UCDAVIS PROGRAM FOR INTERNATIONAL ENERGY TECHNOLOGIES

UCDAVIS FACILITIES MANAGEMENT
Energy Conservation Office

MGP 440
IMPACT Project

Investment Proposal for UC Davis Steam-to-Hot Water Conversion Project

June 2017

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UCDAVIS GRADUATE SCHOOL OF MANAGEMENT

Final Presentation Overview

Agenda Item	Desired Outcome
Introductions	Introduce project sponsors, stakeholders, and GSM Impact Team
Restatement of Project Opportunity and Scope	Reiterate current state of the Steam-to-Hot Water Project and GSM Impact Team focus.
Engagement Approach and Work Completed	Outline of work process, research methodology and decisions made.
Investment Proposal	Detail findings and analysis used to develop the final investment proposal.
Insights and Implications	Identify key learnings in developing an infrastructure investment proposal.
Conclusion	Present final project recommendations.

UC Davis Steam-to-Hot Water Project

Steam-to-Hot Water project is poised to be the leading UC Davis anchor project supporting the **Climate Neutrality Initiative**, with a goal of bringing the campus to **net-zero greenhouse gas emissions by 2025**.

Currently: Scheduled to be completed in three phases **over 10 years.**

- Project de-prioritization.
- Increasing material and labor costs.
- Budgets for each phase are dependent on previous phase savings.

- On course with current plan.
- Does not require year over year returns to an outside investor.
- All savings are returned to UC Davis.

Opportunity: Convert the campus' existing water heating system to be fully operational **within 5 years** through private investing.

- UC Davis is obligated to a specific rate of return.
- Majority of savings will be sent to investor group.

- Increased reduction in GHG emissions.
- Higher projected savings.
- Opportunity to implement hot-water compatible systems, further increasing carbon reductions.
- Locking in lower interest rates today.

Review of Work Process

IMPACT Group Focus

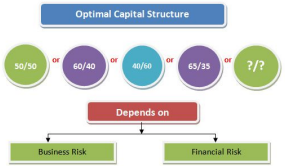
Create an attractive investment proposal to be presented to Aligned Intermediary or any other investor with an interest in long-term, climate infrastructure projects.

IMPACT Group Goal

Develop a win-win financing situation for UC Davis and investor, such as UCOP.

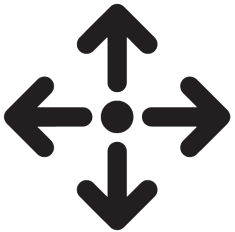
Pro-forma Financial Modeling

- Capital requirements
- Assumptions
- Project value
- Returns on investment



Identified Financial Structure

- Evaluated financing options
- Incorporated risks



Outlined Project Risks

- Identified risks across design, planning and construction phases.
- Offered risk management recommendations.

Interim Presentation

- Presented findings and insights to project sponsors and stakeholders.
- Incorporated feedback into final investment proposal.

Research Methodology

Project Information Research

- University of California, Davis
  - Hot Water Conversion White Paper
  - ZNE Steam-to-Hot Water Financing Report
  - BMcD & FVB Campus Heating & Cooling Systems Energy Report
  - UC Davis CEED Dashboard
- University of British Columbia
- Stanford University





Stakeholder Interviews/Correspondence

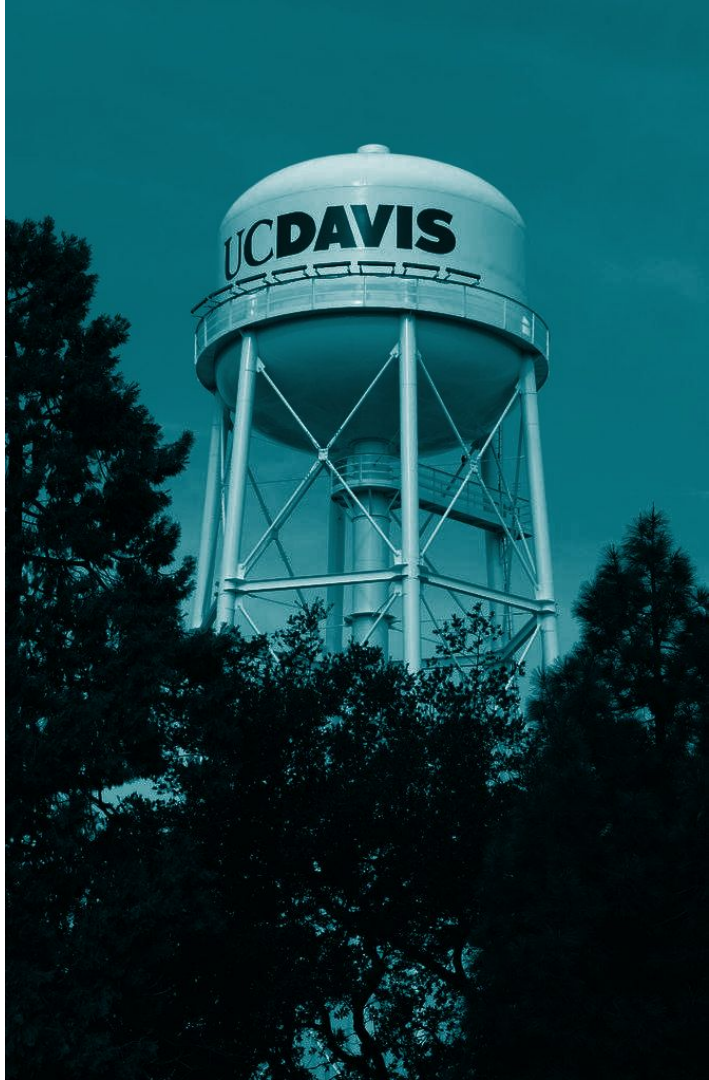
- **David Phillips**
  Associate Vice President of Energy and Sustainability | UCOP
- **Amy Jaffe**
  Senior Advisor to Chief Investment Officer | UCOP
- **Kelly Ratliff**
  Interim Leader, Finance, Operations & Administration | UC Davis
- **Joshua Morejohn**
  Manager, Energy Conservation Office | UC Davis
- **Camille Kirk**
  Assistant Director of Sustainability | UC Davis

Finding and Analysis

Investment Proposal

UC Davis Steam-to-Hot Water Conversion Project

June 2017

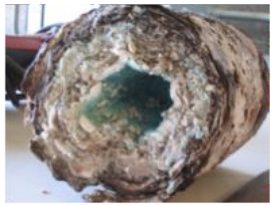


The Opportunity

Opportunity to invest in a UC Davis project converting the campus heating system from steam to hot water, which would **decrease greenhouse gas emissions, lower utility costs** and **generate a 7-10% return on investment.**

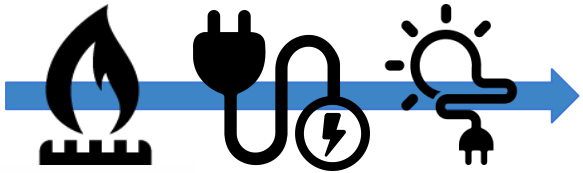
UC Davis Commitment

The President of the University of California announced the Carbon Neutrality Initiative in November 2013, committing UC to emitting **net zero greenhouse gases by 2025.**

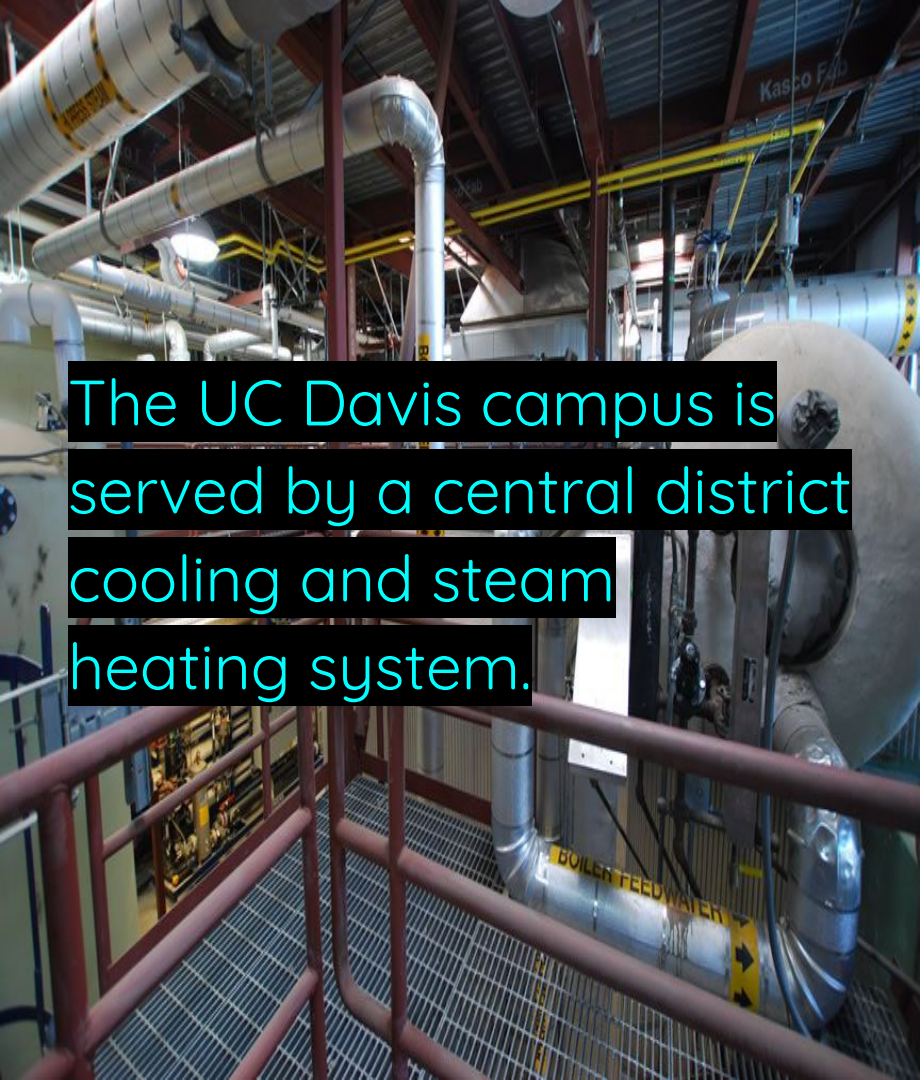


Cost savings through lowered utility costs and heat loss. Avoided capital expenditures and maintenance to replace an outdated system.

UC Davis is driving towards a predominantly electric system.



By far, the largest UC Davis project supporting the Carbon Neutrality Initiative.

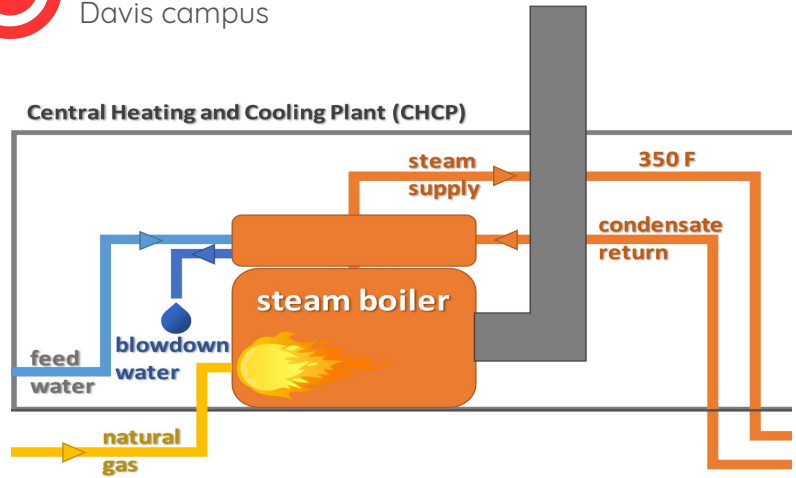


The UC Davis campus is served by a central district cooling and steam heating system.

The Current State

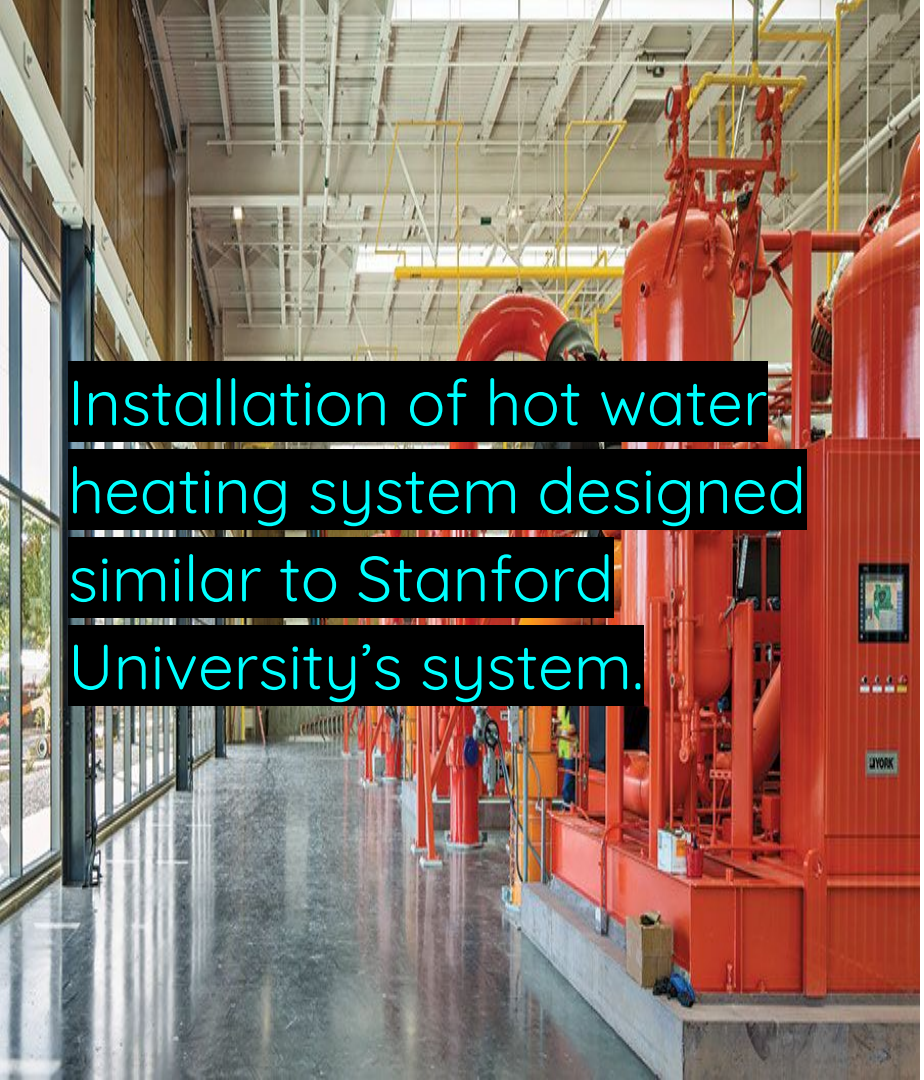
System runs at 350°F to create steam to distribute heat across UC Davis campus

40% of UC Davis carbon emissions are generated by steam heating



30-50% of heating energy is wasted in distribution

Steam system maintenance is projected to be $98.5M over the next 10 years



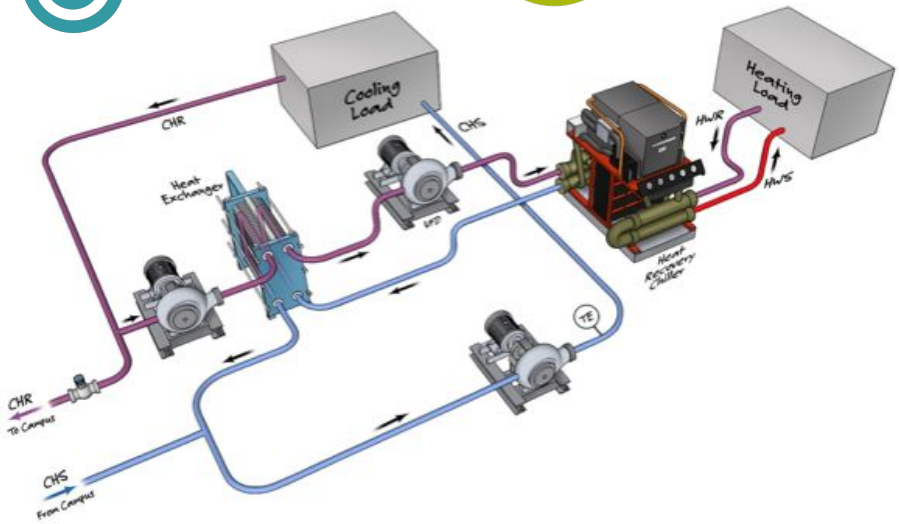
Installation of hot water heating system designed similar to Stanford University's system.

The Future State

Low-temperature system heats water to 150°F

CO_2

Reduces UC Davis carbon emissions by **30%**



Uses electric power and natural gas
<10% heat loss in distribution

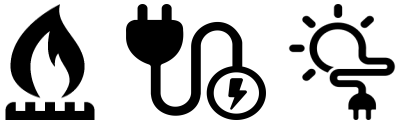
42% decrease in O&M costs from steam to hot water systems

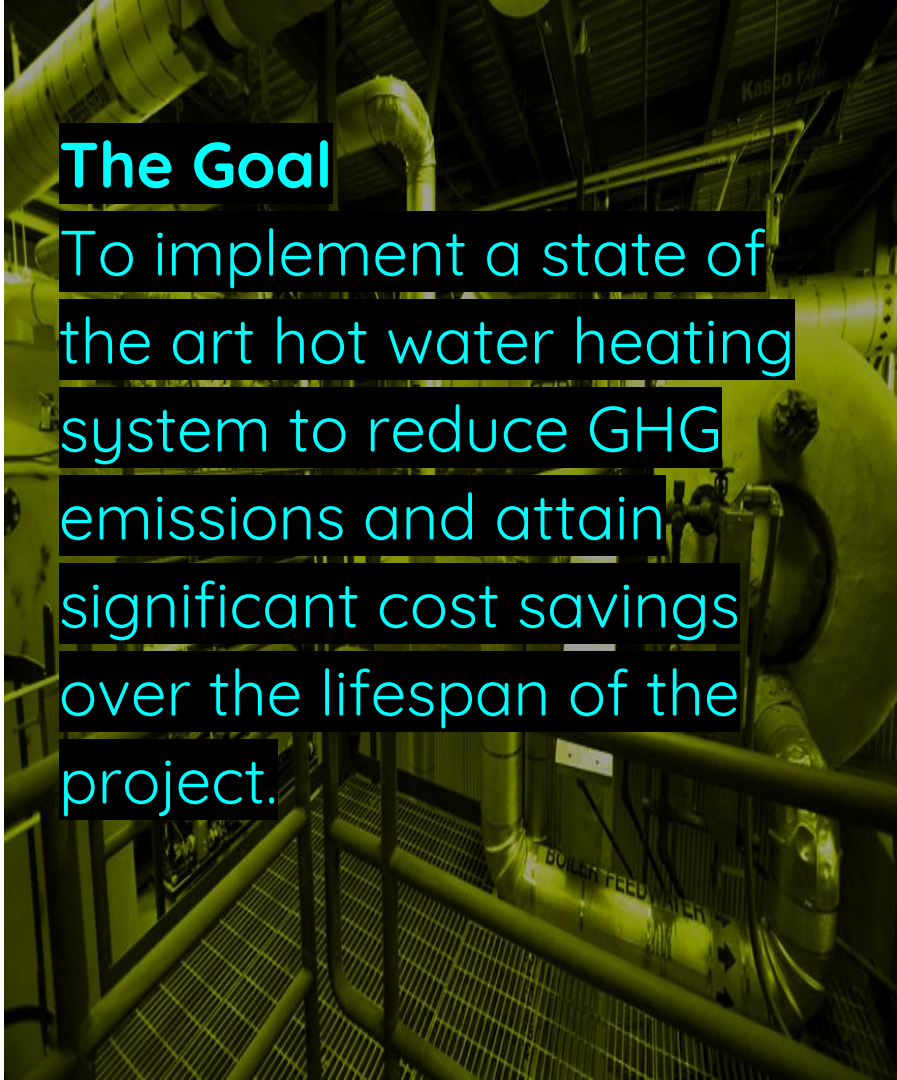
The Change

Steam System	Hot Water System
+/- 40% Heat Loss	**< 10% Heat Loss**
$10.50 per Pipe Foot $4.5M Annual O&M	**$1.10 per Pipe Foot** **$2.6M Annual O&M**
$3.5M in annual natural gas costs	**29% decrease in natural gas costs, shifting towards a predominantly electric system**

STATE of the ART

Technology can be continuously improved through design enhancements, like incorporating heat recovery chillers.





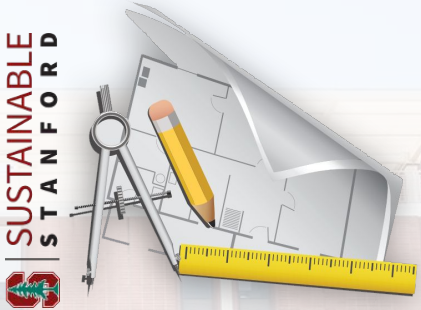
The Goal

To implement a state of the art hot water heating system to reduce GHG emissions and attain significant cost savings over the lifespan of the project.

Project Landscape

Investment in a highly reputable, well-established institution.

$250M
Debt Capacity



A similar project has been implemented at **Stanford University.**

Major risks/expenses were for building retrofit.
UC Davis buildings will not need these retrofits.

Project is in UC Davis' Roadmap

Currently being implemented with **10 year horizon,** but GHG reduction and costs savings are positively impacted by acceleration.

UC Davis is willing to guarantee a return on investment.

Construction contingency costs are estimated at 5%
based on mitigation factors learned from Stanford's implementation.

Model is built to ensure that investor's fiduciary responsibilities are realized.

Cash Flow & Waterfall

Cash Flow

Calculated as the **NET SAVINGS** between the **current steam system operating cost** and the **new hot water system projected operating cost.**

Distribution of Returns

Pay investor's preferred return

Pay back capital investment

Allocation to UC Davis and investor per participation %s

Investment Opportunity Overview

Projected IRR (Gross)

7.5%

9.7% for Investor
6.5% for UC Davis

Cash On Cash Return

2.6x

Over 20 Years

In the first 10 years:
$174.45M for Investor
$15.7M for UC Davis

Projected Net Savings

$158M

Over 20 Year Period

Key Model Features:

$37M

3% Annual Growth

Base Year Cost

~26%

Steam Heat Loss @ 30%
New System loss @ 4%

Operating Cost Reduction

10 Years

Break Even Point

Key Assumptions

UC Davis will lock in their willingness to pay for campus heating at a rate equivalent to the current steam system operating cost; plus a **growth rate which reflects utility price cost increases.**

Model assumes that the new system will use a combination of **natural gas and electric power*.**

*Distribution of power sources will depend on final design.

Costs associated with greenhouse gas emissions currently are not included as UC Davis has sufficient cap-and-trade allowances until 2020.

Proposed Investment Structure

UC Davis
40% Contribution

$68.8M
Over 5 Years

Investor
60% Contribution

$103.2M
Over 5 Years

Contributed Capital
$172.2M

UCD buyout option exercisable by year 10.
1.5x Net Savings (Cash Flow)

Total Project Cost
$172.2M

Investor Preferred Return

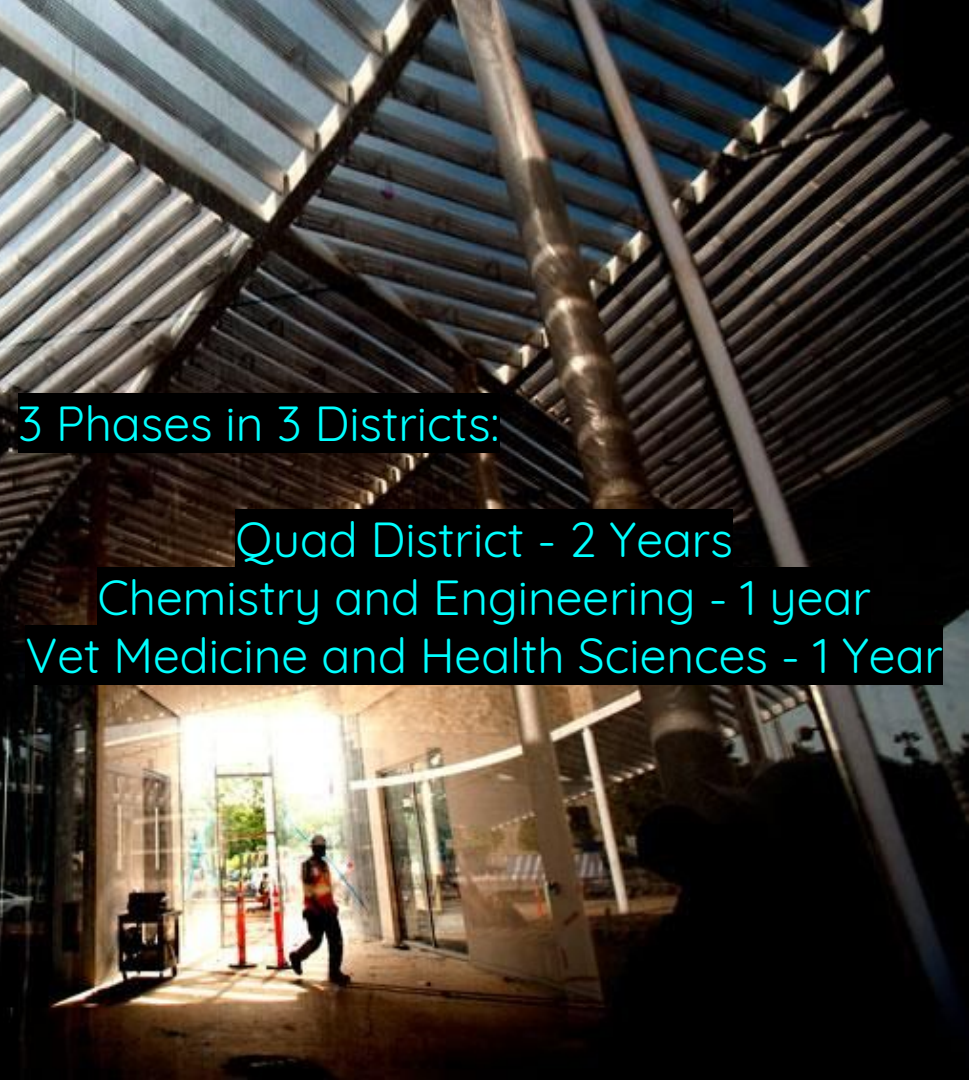
7%

- 7% on contributed capital.
- Unpaid balances will accrue for purposes of calculating preferred return.

Investor Participation

20%

- Investor receives 20% of net savings after return of capital and preferred return.



Use of Proceeds

$172M

3 phases over 4 years

$80M
Distribution and building conversion

$14M
New hot water boiler

$40M
Distribution and building conversion

$32M
Distribution and building conversion

$8.2M
5% Construction contingency

Financial Summary

Energy Savings Performance Contract	2018	2019	2020	2021	2022 - 2031	2032 - 2036	Terminal Value*
	Phase 1		Phase 2	Phase 3	Yr 1 - 10	Yr 11 - 20	TV
Implementation Site	QUAD	QUAD	CHEM & ENG	VET & HS			
Investor Investment	$59.4M	-	$25.2M	$18.6M			
UC Davis Investment	$39.6M	-	$16.8M	$12.4M			
Preferred Return Paydown		$4.2M	$4.2M	$5.9M			
Gross Contribution	$99.0M	$4.2M	$46.2M	$36.9M			
	Savings/Cash Flow						
Total Savings/Net Cash Flow	-$99.0M	-	-$42.0M	-$31.0M	$190.1M**	$139.9M	$114.2M
Net Cash Flow to Investor	-$59.4M	$4.2M	-$21.0M	-$12.7M	$142.9M	-	-
Net Cash Flow to UCD	-$39.9M	-$4.2M	-$21.0M	-$18.3M	$47.4M	$139.9M	$114.2M

*Terminal Value calculated is based upon year 20 savings, with a 3% growth rate at an 18% discount rate.
**Calculation includes all preferred returns and payback during the period.

Distribution Summary

	Phase 1		Phase 2	Phase 3	Yr 1 - 10	Yr 11 - 20	TV
Cash Available for Distribution	-$99.0M	-$4.2M	-$42.0M	-$31.0M	$190.1M	$139.9M	$114.2M
Investor (LP)							
Distributions (Invested Capital)	-$59.4M	-	-$25.2M	-$18.6M	$109.8M	-	-
Preferred Return	-	$4.2M	$4.2M	$5.9M	$33.1M	-	-
Buyout Income	-	-	-	-	$31.6M	-	-
Total Investor Distributions	-$59.4M	$4.2M	-$21.0M	-$12.7M	$174.5M	-	-
UC Davis (GP)							
Distributions (Invested Capital)	-$39.6M	-	-$16.8M	-$12.4M	$47.3M	$140.0M	-
Preferred Paydown During Construction	-	$-4.2M	$-4.2M	-$5.9M	-	-	-
Terminal Value	-	-	-	-	-	-	$114.2M
Buyout Expense	-	-	-	-	-$31.6M	-	-
Total Investor Distributions	-$59.4M	$-4.2M	-$21.0M	-$18.3M	$15.7M	$139.9M	$114.2M
Total Distributions	-$99.0M	$0	-$42.0M	-$31.0M	$190.1M	$139.9M	$114.2M

Returns Analysis Summary

UCDAVIS

UC Davis (GP) 20 Years

Contributed Capital	$68,880,000
Net Distributions	$269,844,269
20 Year IRR*	**6.50%**
20 Year CoC Return	**1.9x**

*Assumes TV in year 20

Terminal Value in year 20 @ 3% growth with an 18% discount

UC Davis
40% Contribution

Investor (LP) 10 Years

Contributed Capital	$103,200,000
Net Distributions	$188,684,558
10 Year IRR*	**9.70%**
10 Year CoC Return	**2.0x**

*Assumes buyout in year 10

Investor
60% Contribution

Sensitivity Analyses

Construction and Implementation

Advancing Technology

Energy Sources

Implementation of large-scale projects commonly face challenges and overrun costs.

Outlined are some of the most significant risks related to the hot water project and the effect on the overall return on investment.

Many risks running across many infrastructure projects can be mitigated, managed or avoided with a comprehensive risk management plan.

Sensitivity in Implementation/Project Delays

Development Costs	Construction Contingency				
	0.00%	2.50%	5.00%	10.00%	20.00%
$111,000,000	12.80%	12.60%	12.50%	12.10%	11.50%
$121,000,000	12.20%	12.00%	11.80%	11.50%	10.80%
$164,000,000	10.00%	9.80%	**9.70%**	9.40%	8.90%
$175,000,000	9.60%	9.40%	9.30%	9.10%	8.10%
$200,000,000	8.90%	8.60%	8.10%	7.10%	**7.00%**

Project delays may occur, but could be greatly mitigated by proper training.

SUSTAINABLE STANFORD

Interviews with Stanford University stated that with proper training, there were very few failed welds

Using a 5% construction contingency and $164M development cost lead to a 9.7% return for the investor.

Sensitivity to Technology

Heat Loss \ Energy Efficiency	5.00%	15.00%	25.00%	35.00%	45.00%
1.00%	8.40%	9.30%	9.90%	10.50%	11.10%
2.00%	8.10%	9.20%	9.80%	10.40%	11.00%
4.00%	7.40%	9.10%	**9.70%**	10.30%	10.90%
8.00%	7.00%	8.80%	9.40%	10.10%	10.70%
10.00%	7.00%	8.20%	9.30%	10.00%	10.60%

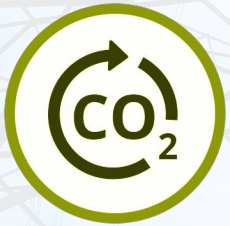
Proven Efficiency:
Stanford's hot water system has documented **only 1-2% heat loss** over the last 2 years.

Adaptive System:
Even if a more efficient heat pump was invented, **replacement would be a simple installation** if the economics are justified.

Anticipating a hot water system efficiency loss of 4% and a 25% increase in energy efficiency (decreased utility costs) moving from steam to hot water, leads to a 9.7% investor return.

Sensitivity to Carbon and Electricity Costs

Electricity Costs ($) \ Carbon Costs ($)	0	500,000.00	1,000,000.00	1,500,000.00	2,000,000.00
16,500,000.00	10.50%	10.30%	10.20%	10.00%	9.90%
19,000,000.00	9.50%	9.40%	9.30%	9.10%	8.60%
21,500,000.00	7.10%	7.00%	**7.00%**	7.00%	7.00%
24,000,000.00	7.00%	7.00%	7.00%	7.00%	7.00%
26,500,000.00	4.90%	4.20%	3.50%	2.80%	1.90%



Assuming the cap and trade were to continue after 2020 and UC Davis purchases allowances we expect the carbon cost to be $1M annually.

If the system moves off natural gas to 100% electric we forecast the electricity cost to be $21.5M.

Conversion: 1 therm = 29.3kwh

Diverting UC Davis' solar energy to this project would help decrease electricity costs.

UC Davis Steam-to-Hot Water Executive Committee

UCDAVIS PROGRAM FOR INTERNATIONAL ENERGY TECHNOLOGIES

Dr. Kurt Kornbluth
Founder and Director
UC Davis Program for International Energy Technologies

UCDAVIS FACILITIES MANAGEMENT
Energy Conservation Office

Joshua Morejohn
Director
UC Davis Facilities Management, Energy Conservation Office

UCDAVIS FINANCE, OPERATIONS AND ADMINISTRATION

Kelly Ratliff
Associate Vice Chancellor,
Budget and Institutional Analysis,
UC Davis Office of the Vice Chancellor

Investment Proposal Key Objectives

Opportunity Overview

Determine the value proposition of the project for potential investors.

Financial Model

- Identify and verify critical assumptions.
- Create a win-win financing structure for both project and investor.

Risk Assessment

Create a forward-looking risk management plan to address common infrastructure project overruns.

Investment Highlights

Pinpoint key drivers supporting investment return.

Investment Proposal Next Steps

1. **Complete consultant review/analysis and finalize expected costs for the new hot water system.**
   - Currently in progress by AEI Consultants.
2. **Update project costs in the GSM IMPACT financial model to determine feasibility to attract private capital investment.**
   - Pending consultant review.
3. **Identify mitigation and management strategies to address various project specific risks.**
   - Pending finalized assessment of technology. Risk assessment template provided.
4. **Form Executive Committee to drive investment proposal and solidify investor term sheet.**
5. **Approach Aligned Intermediary or other investor with final investment proposal.**
   - Seek Amy Jaffe's advice on preliminary introductions.

Closing Comments/Recommendations

With a 9.7% unlevered LP IRR, the steam-to-hot water conversion project is an ideal investment for a public-private joint venture. This project not only sets the standard for campus clean energy projects and climate infrastructure investment, but the investment proposal provides a framework for future joint venture projects

Explore Alternative Financing Options

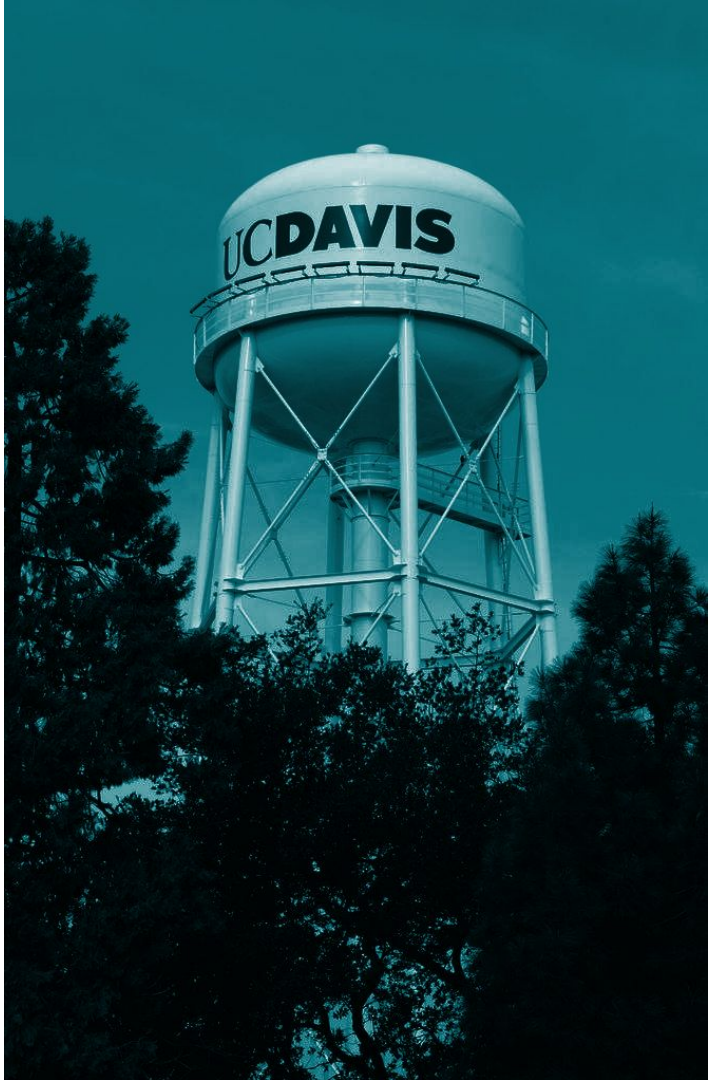
UC Regents Bond Financing

- Project return is greater than the 6% required by underwriters, making it a good candidate for bond financing
- Post underwriting, cost of capital typically closer to 4.5 - 5%

Government and Philanthropic Grant Funding

- DOE Energy Efficiency and Conservation Block Grant Financing Program
- Hewlett Foundation Environment Program, Climate and Energy Grants

Questions?



Appendix

1. Financial Model
2. Risk Assessment Template