

CECIP

CALTECH ENERGY CONSERVATION INVESTMENT PROGRAM

ANNUAL REPORT 2014



\$17.6M₁

INVESTED TO DATE

ABOUT CECIP

Caltech's green revolving loan fund, CECIP, combines finance, engineering and operations to implement energy conservation measures without negatively impacting research. These projects must have an ROI greater than 15 percent and less than 6 years simple payback.

\$6.7M₂

UTILITY COST AVOIDANCE

ABOUT CALTECH

Caltech is a world-renowned pioneering research and education institution dedicated to advancing science and engineering that transforms our world.

18 GWH₃

TOTAL ENERGY SAVED

Caltech

OVERVIEW

Caltech Facilities

Management supports the development of the newest technology and entrepreneurial spirit at Caltech, while minimizing energy consumption, maximizing return on investment and spearheading organizational efficiency. Consequently, Caltech's green revolving loan fund, the Caltech Energy Conservation Investment Program (CECIP), was created to resolve the unique situation of implementing much-

needed energy efficiency projects in the resource-constrained environment of higher education and non-profits.

In five years, Caltech has invested \$17.6 million and acquired \$3.2 million in utility rebates for CECIP, which has translated into an unprecedented \$6.7 million of avoided utility costs, while simultaneously reducing the

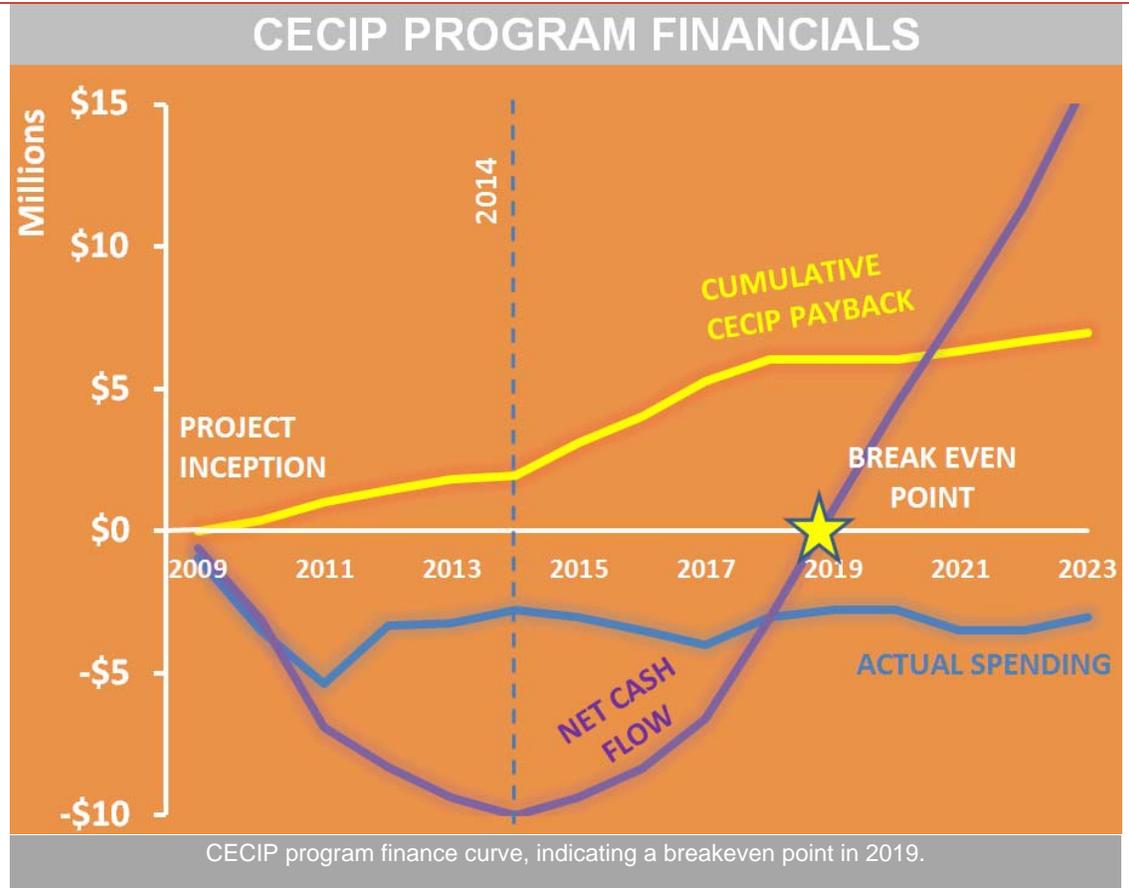
CECIP is intensely rigorous in its measurement of actual building performance, both pre- and post-investment, and in its recalculation of savings based on actual energy prices, not just those that prevailed when the project was approved.

- Dean Currie, VP for Business & Finance, Caltech

environmental footprint. CECIP has reduced Caltech's greenhouse gases by 16,000 MTCO₂e⁴. Without the program, the Institute would consume about 18 more GWH of electricity every year, compared to business as usual.

Caltech's CECIP program is unique due to its comprehensive approach to energy efficiency, CECIP aims to have four types of impact: financial, environmental, operational and social. CECIP grants the Institute the ability to have best in

class facilities without impairing the bottom-line, which translates into the recruitment and retention of the best faculty, students and staff.



CECIP PROJECT HIGHLIGHTS



Since CECIP's inception in 2009, the program has graduated from lighting retrofits to the implementation of more complex projects including full building automation controls and mechanical system upgrades within the Institute's most critical facilities where operational control is a high priority.

CECIP Projects Include

- › Lighting Upgrades
- › RCx
- › Controls Optimization
- › Demand Ventilation
- › Fume Hood Controls
- › Exhaust Stack Optimization
- › Data Center Containment
- › Pressure Independent Control Valves (PICVs)

› Retrocommissioning

Retrocommissioning (RCx) is an ongoing strategic and risk-management process that is part of Caltech's Active Energy Management program. RCx optimizes building systems by routinely inspecting and servicing equipment enabling to obtain modeled energy savings by identifying sources of "drift" (such as leaky valves, unoccupied spaces and improper hardware installation) and steering those systems back to expected performance standards, if not exceeding them. This includes continuously reviewing building controls and consistently analyzing detailed mechanical systems so that obsolete equipment can be replaced or updated. Half of Caltech's buildings have undergone RCx.

50%

of major campus buildings have been part of the CECIP program

Average savings (\$/GSF/yr)
Lab: \$3; Office: \$1

› Smart Commissioning

Smart commissioning is an **automated whole building diagnostics tool** that is a top-down approach to diagnostics to detect excess energy consumption of the whole building and its major systems (ASHRAE). Caltech has deployed smart commissioning within two pilot projects – the Beckman Institute & the Thomas Lab renovation project.



› Controls Optimization



Caltech Facilities Building Services Operator, Paul Ayala (Photo: Bob Patz)

The Controls Optimization program involves regularly scheduled reviews of the controls sequences that operate the mechanical equipment responsible for a building's heating, cooling and chilled water systems. This ensures that critical systems are frequently standardized and updated so that energy is saved and the building is performing at peak design standards for optimal occupant comfort. Controls optimization also reduces operational costs, and extends equipment life. Currently **27 buildings** at Caltech are in the Controls Optimization program.

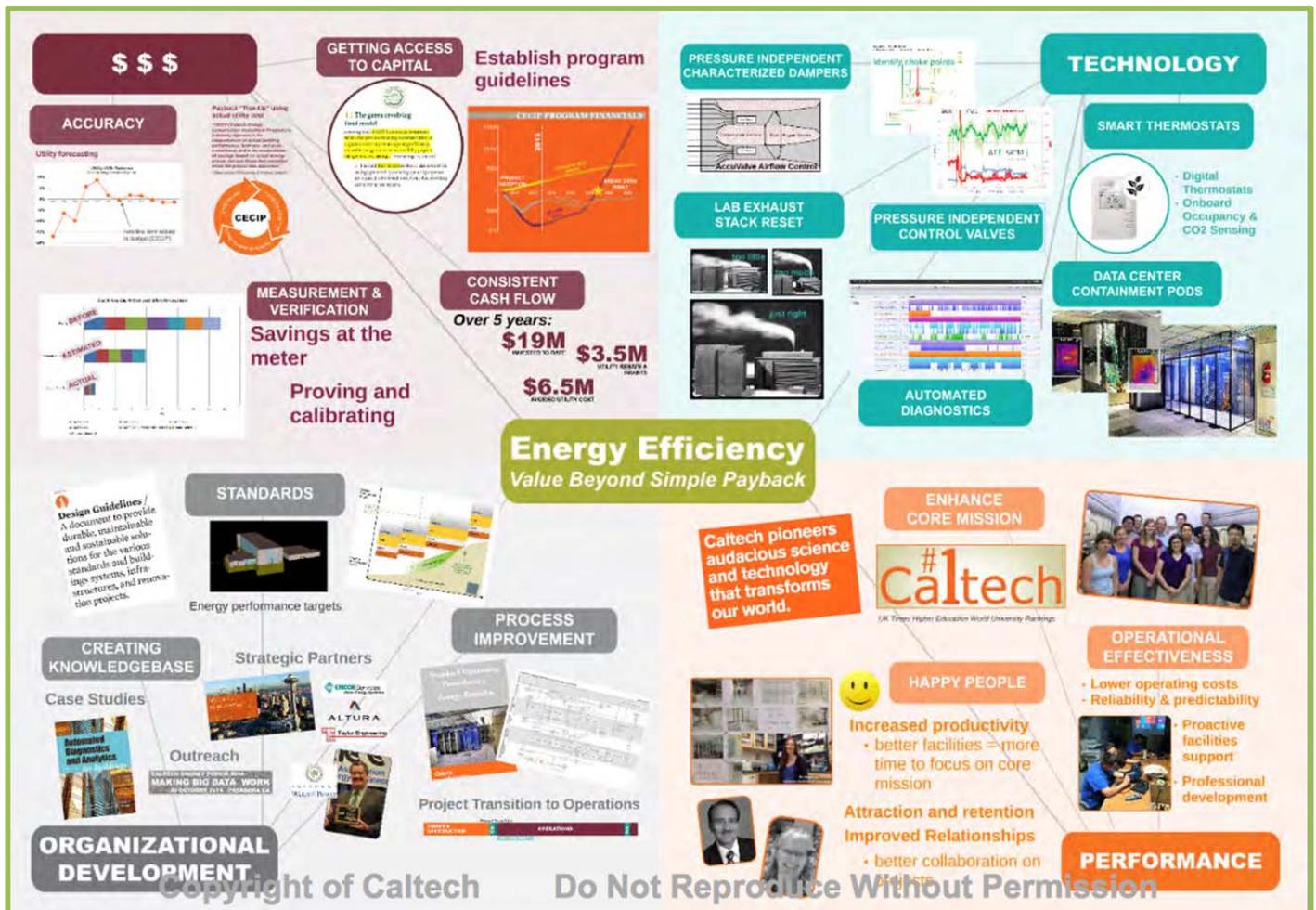
CONTROLS OPTIMIZATION

- › Reduces lifecycle costs
- › Decreases energy usage
- › Improves occupant comfort

CALTECH ENERGY FORUM 2014

Created in 2010, the annual Caltech Energy Forum is a unique opportunity to collaborate & share best practices across multiple markets in support of the efficient operation of best-in-class facilities. The Energy Forum connects industry leaders, and proves the value of integrating energy management throughout all aspects of the building lifecycle. The 4th Energy Forum, held on October 30th 2014, was our most successful yet with the theme "MAKING BIG DATA WORK."

An all-day event, hosted at the Athenaeum at Caltech, featured 6 sessions and an interactive "Speed DATA'ing" lunch session. Attendees came to learn from how Caltech manages our own big building data and to learn key success strategies from the five year history of CECIP. Caltech has invested \$17.6M in CECIP to date, and has achieved an overall 26% ROI from the program.



During the talk on "Value Beyond Simple Payback" (excerpt above) attendees learned key success strategies from the five year history of CECIP from Director, Energy Services & Maintenance Management, **Matthew Berbée**, who also explained **Caltech's 5Ps of Energy Efficiency** – People, Possibilities, Projections, Priorities & Proof (below, far right).

Presenters **Mark Jewell**, EFG, (middle left) and **Darrell Smith**, Microsoft, (middle right) delivered the Forum keynote addresses; Associate Vice President for Caltech Facilities, **Jim Cowell** (far left) opened the day.





Associate Vice President for Caltech Facilities, Jim Cowell & Director of Maintenance Management & Energy Services, Matthew Berbée, receive the 2014 NACUBO Innovation Award

› AWARDS

- › **Innovation Award**, National Association of College and University Business Officers (NACUBO), 2014
- › **Sustainability Champion**, California Higher Education Sustainability Conference, 2013
- › **Energy Project of the Year**, Association of Energy Engineers Southern California, 2012
- › **Energy Engineer of the Year**, Association of Energy Engineers Southern California, 2011
- › **Association of Energy Engineers Corporate Management Award**, Active Energy Management Program, 2011
- › **Go Beyond Award**, CECIP and Lab Retro-Commissioning, Department of Energy / EPA LABS21,
- › **Clean Air Award** Model Community Achievement, South Coast AQMD, 2011
- › **Go Beyond Award**, U.S. Department of Energy / Labs for the 21st Century, 2011
- › **Clean Air Award**, South Coast Air Quality Management District, 2011
- › **National Corporate Energy Management Award**, Association of Energy Engineers, 2010

› PRESENTATIONS 2014

- › **California Municipal Utilities Association**, 2014
- › **California Commissioning Collaborative**, 2014
- › **Association of Energy Engineering**, Presentation & Tour, 2014
- › **Construction Owners Association of America**, 2014
- › **Society for College and University Planning**, Integrated Facilities Planning – Capital Program, Sustainability, Maintainability and Operations, March 2014
- › **Society of Women Engineering**, The Successful implementation of green revolving loan funds, March 2014

Clarifications

1. \$20.6M total investment cumulative total over five fiscal years, \$17.6M net after rebates of approx. \$3M
2. Cumulative total recorded paybacks of \$6.7M; \$4.2M paid back to fund
3. Annual energy reduction as of FY14, years end.
4. Assumption is that the avoided 18 GWH would come from PWP, which emits ~ 0.9MTCO₂e/MWH, which leads to Caltech avoiding approximately 16,000 MTCO₂e in emissions.