Micro to Macro: Campus Sustainability From the Ground Up

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University of California, Merced
Youngest campus in the UC system

University of California, Berkeley
First Graduating Class, 1873

University of California, Merced
First Graduating Class, 2009
UC Merced
Located in California’s fastest growing region

Source: Demographic Research Unit, California Department of Finance. State and County Population Projections by County, by Race/Ethnicity and by Major Age Groups, 2010-2060.
Photos:
Structures of Utility
David Starck Wilson
Campus Construction (2002)
Campus is a greenfield site on city edge

Sources: Google Maps, County of Merced, California High Speed Rail Authority
UC Merced’s Approach to Sustainability

Integrate land use and cultural context to create memorable places

Design buildings that reduce energy demand

Incorporate energy infrastructure into plans and buildings

Foster involvement from campus community in operations
UC Merced has grown to 104 acres
1.4 million gross square feet, 2,000 beds
UC Merced Today
Diverse and growing

- 6,700 Students
- 60% low income
- 62% are from families where neither parent holds a four-year degree
- More than half majoring in STEM fields

Source: UC Merced Institutional Research and Decision Support, Fall 2013 and Fall 2014. [http://ipa.ucmerced.edu/docs/campus%20enrollment/Class%20Level.pdf](http://ipa.ucmerced.edu/docs/campus%20enrollment/Class%20Level.pdf); [http://www.ucmerced.edu/fast-facts](http://www.ucmerced.edu/fast-facts) - Does not equal 100% due to rounding.
UC Merced has a distinct design vocabulary inspired by its place and time

Glass, concrete, stucco and steel

Inspired by simple forms derived from the region’s architecturally underappreciated buildings
Familiar, Simple Forms

- 60% of roof is solar ready
- Operable hangar doors connect art studios to outdoor work areas
- Daylight brought deep into interior
- Unconditioned arcades and stairs
- Structural system shades NW facade
The campus is networked for efficiency

- Roof space dedicated to solar research
- Facade treatments according to orientation provide shade and daylighting to reduce loads
- Energy absorbed by solar panels sent to Central Plant
- LEED Gold Central Plant distributes and controls campuswide energy and cooling
- Low water use fixtures
- Shaded Arcade
- Low water use fixtures
- Brise Soleil made of solar panels
- Nonpotable or reclaimed water will be used for irrigation and as a key tool to achieve water neutrality.
- Low water bioswales slow and retain stormwater
Central Plant
Building Maintenance through data
Campus Building Energy Performance Platform

- **Today**: Campus has extensive effort to capture and collect building data

- **Goal**: To quantify portion of building performance and return on investment attributable to maintenance, verify performance and aid troubleshooting

Nurturing a Data Gathering Culture
Pushing conservation through behavior

Blending Data Gathering with the Academy

Thermovote – Crowd sourced climate control

Source:

“Thermovote: Participatory Sensing for Efficient Building HVAC Conditioning”

http://www.andes.ucmerced.edu/papers/Erickson12a.pdf
The 2020 Project
Planning for a campus of 10,000 students

- Add physical capacity to grow to 10,000 students
- Compact Development Footprint
- Mixed-use, long term approach to design and sustainable buildings
- Academic, Student Life, Infrastructure

Construction scheduled for 2016, Completion by 2020
Our challenge
Ensuring lifecycle costs are predictable over the long term

UC Merced’s buildings are brand new, sustainable and state of the art...

... but UC Merced needs a long term strategy to avoid accumulating a backlog of deferred maintenance

Every building at UC Merced is LEED Gold or Platinum

Deferred Maintenance has historically been a challenge on UC campuses
How the 2020 Project will work

UC and a Developer jointly finance the design and construction of multiple facilities at UC Merced.

The Developer maintains major building systems for 35 years in exchange for availability payments subject to performance.

At the end of the contract, the developer turns over maintenance of the well-maintained buildings to UC Merced.
Strategy bundles all project elements into a single, coordinated delivery

- **Creates link** between design and construction of facilities and long-term maintenance
- **Holds the Developer accountable for performance** over life of the asset
- **Incorporates life-cycle financial plan** within affordability constraints established by the University
- **Addresses future obligations** for capital maintenance
- **Creates competition** for all Project elements
- **Manages certain risk elements** to enable campus to focus on core teaching, research and public service missions

Finance, operations and maintenance risks are shared by University and Developer
How the payment mechanism works

1. UC makes **progress payments**
   When Developer meets construction targets

2. UC makes **availability payments**
   subject to performance

3. Developer’s **reserve releases**
   in final years

4. Buildings turned over to UC
   in good condition at end of term

Design and Construction

Occupancy of 2020 Project Facilities under Project Agreement

Year One
Signed Contract

University owns the buildings and land at all stages

Duration of Project Agreement

Year 39
Contract Ends

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The campus will enter into a Project Agreement with a “concessionaire” comprised of the equity members of the team (the “Developer”)

- Concessionaire/Equity Investors ("Developer")
- Lenders
- Design Contractor and Subcontractors
- Construction Contractor and Subcontractors
- Operations and Maintenance Contractor and Subcontractors for Major Building Systems
“The Project Agreement” is the performance based tool we are using to deliver the project

Key Terms

- Developer’s obligation to design, build, finance, operate and maintain major building systems for a term of 39 years
- LEED Gold Minimums
- Energy usage
- Water Budgets
- Daylighting requirements
- Groundwater reduction targets
- Delivery dates for all facilities
- Detailed campus review of design and construction to ensure compliance with the contract terms
- Penalties for performance failure and a “non-compliance” points scheme that lead to progressive remedies up to and including default and termination
- Energy Incentives
- Handback conditions and reserves
Traditional Procurement vs. 2020 Project

UC Merced is using a long-term, performance based framework for every element of the campus.

**Inputs in a Traditional Procurement**

“Cooling to the building must be provided by Carrier Model “XYZ” heat pump with a cooling capacity of “ZZ” tons.”

![Carrier Model “XYZ”](image)

**Outputs in a Public-Private Partnership Procurement**

“The temperature of the occupied portions of the building shall not be lower than 68 degrees Fahrenheit and not higher than 72 degrees Fahrenheit, 97% of the time that the building is open to occupants.”

![Temperature Range](image)
Proposed Phasing of the 2020 Project

- **2016**: Campus selects Developer
  - Developer prepares a comprehensive plan for the entire site.

- **2018**: First delivery of facilities
  - Developer delivers the first set of buildings by June 2018.

- **2019**: Second delivery of facilities
  - Developer delivers the next set of buildings by June 2019.

- **2020**: Substantial Completion
  - Developer delivers final set of buildings by June 2020.

- **2020-2055**: Long-term operations and maintenance of major building systems by Developer
  - Approximately 1.2 million GSF
  - Approximately $1 billion budget
Lessons Learned

• **Set clear**, achievable design and operations **goals**

• **Acting holistically** about long-range financial condition can help set priorities

• **Make sustainability a key element** of the competitive process

• Better suited for **large scale projects** that can capture economies of scale for infrastructure