LBNL User Testbed Facility

LBNL Community Advisory Group
May 9, 2011
Richard Stanton & Steve Selkowitz

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Project Goals and Objectives

- Design and construct the facilities to
  - address key technical challenges for low-energy buildings
  - facilitate R&D on multiple building components and systems concurrently
  - provide extreme flexibility
  - integrate components being tested into building systems: envelope, lighting, HVAC, electrical
  - automate data collection, virtual modeling, and "live" building systems optimization
  - demonstrate facility capabilities, display current data collection, and visualize testing results

Reality vs Simulation

- LBNL has a long history of measuring performance of building systems under realistic conditions
- Some critical performance issues can only be determined with field measurements
- User Test Bed Facility continues this tradition
- Simulation still has a critical role:
    - "All Models are Wrong but Some are Useful"

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MoWiTT: Mobile Window Thermal Test Facility
Reno, NV, 1985-2000

LBNL Façade Testbed Facility

2003-2006
Electrochromic
windows

Industry Advisory Groups:
Manufacturers
Glazing, Shading, Framing, Lighting Controls
Designers
Architects, Engineers Specifiers
Owner/Operators
Public, Private
Utilities

2007-2009
Automated
Shades

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Full-Scale Test Bed in Oakland GSA Federal Building, 1990s

- Side-by-side test offices
- Stage 1: Unshaded large-area electrochromic windows
- Stage 2: Automated interior blinds with "optimal" controls
- **Integrated control between window and lighting system**

Partnering with a Building Owner: NY Times Company Intelligent Lighting and Shade Control

- Automated Shading
  - (Multifunctional)

Occupied 2007

- Dimmable lighting
- Addressable
- Affordable

(1/3 original cost estimate)

  – Multifunctional

Interior: *New York Times* office with dimmable lights and automated shading

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Outcomes and Benefits

- **For Manufacturers**
  - Ability to more rapidly design, prototype and test new energy efficient products and systems. Feedback on system performance that will allow optimization. Performance data that could drive increased investment in new technologies and systems.

- **For Architects and Engineers**
  - Ability to specify new innovative systems with confidence, thereby achieving higher energy performance targets.

- **For Facility Managers**
  - Insights into improved operational practices and more realistic building performance targets.

- **For Code Officials and Utilities**
  - Ability to tighten existing codes or offer new rebates and incentives based on confidence in measured performance data under realistic conditions.

- **For Building Owners**
  - Increased confidence in investing in high efficiency retrofit solutions and new buildings.

- **For Federal, State, Local Efficiency Planners**
  - Ability to more accurately predict EE program impacts.

- **For Researchers**
  - Access to high quality performance data will advance R&D in new technology, allow validation of simulation codes, provide insights into opportunities of new breakthroughs.

Who Are We Working With?

Lighting & Controls

- Adura Technologies
- Dimonoff
- Encelium
- Finelite
- Lunera
- LUMEnergi
- Lutron Electronics
- Philips Research
- Schneider Electric
- Siemens
- Universal Lighting Technologies
- WattStopper
- iControl
- …

Windows & Facade

- Apogee
- Benson Industries
- Corning Palo Alto
- Dow
- Enclos corp.
- Glen Raven, Inc.
- Hunter Douglas
- Liquidia
- MechoShade Systems
- Nysan
- Sage Electrochromics
- Sharp
- Serious Materials
- Soladigm
- Solatube
- VELUX
- …

Building Systems

- Cisco
- Cypress Envirosystems
- Johnson Controls Inc.
- Bosch
- Carrier
- Automated Logic
- Suntulit
- Arch Rock
- Applied Materials
- Autodesk (software)
- Hara (software)
- Honeywell
- IBM Research Center
- National Gypsum
- Palo Alto Research Center
- Siemens
- Epic Metals Corp.
- Trane
- Uponor
- …

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LBNL as the center of national Hub for Building Performance Testing: Potential National Network Partners

Iowa Energy Center
Energy Resource Station
Ankeny, Iowa

Oak Ridge National Laboratory
Building Technologies Research
and Integration Center (BTRIC)
Oak Ridge, Tennessee

University of Maine
Advanced Structures and
Composite Center
Orono, Maine

Pacific Gas and Electric
Pacific Energy Center,
ZNE Test Facility
San Francisco, California

Northeastern University
Infrastructure Assessment and
Renewable Laboratory
Boston, Massachusetts

University of California
Center for the Built
Environment
Berkeley, California

Syracuse University
The Building Energy and
Environmental Systems Laboratory
(BEESL)
Syracuse, New York

National Renewable Energy Laboratory
Thermal Test Facility
Golden, Colorado

Carnegie Mellon University
Robert L. Preger Intelligent
Workplace (IW)
Pittsburgh, Pennsylvania

University of Texas
Thermal Lab
Austin, Texas

**American Society of Heating,
Refrigeration, and Air Conditioning
Engineers**
ASHRAE Headquarters
Atlanta, Georgia

Florida Solar Energy Center
Building Science Laboratory
Orlando, Florida

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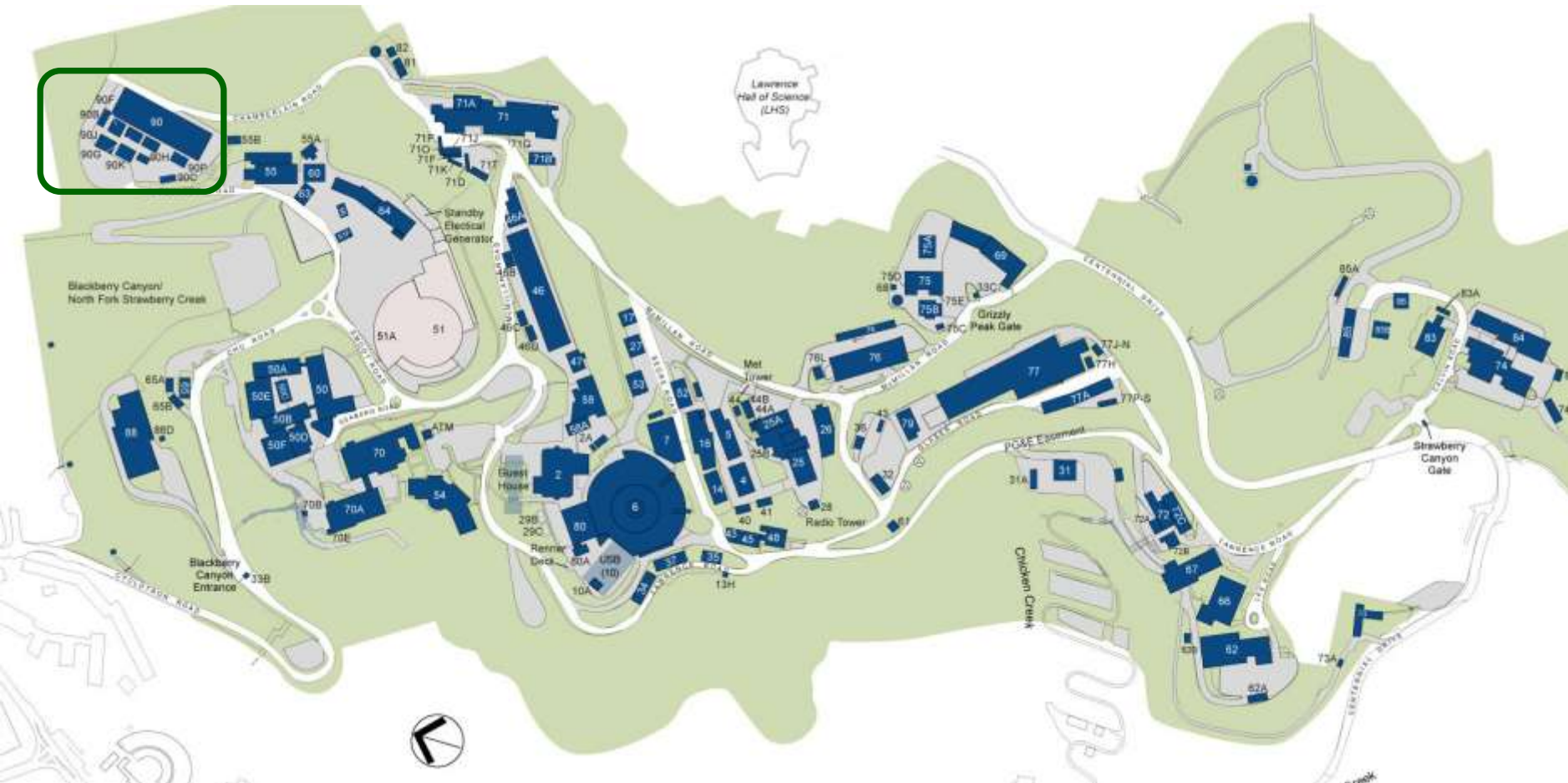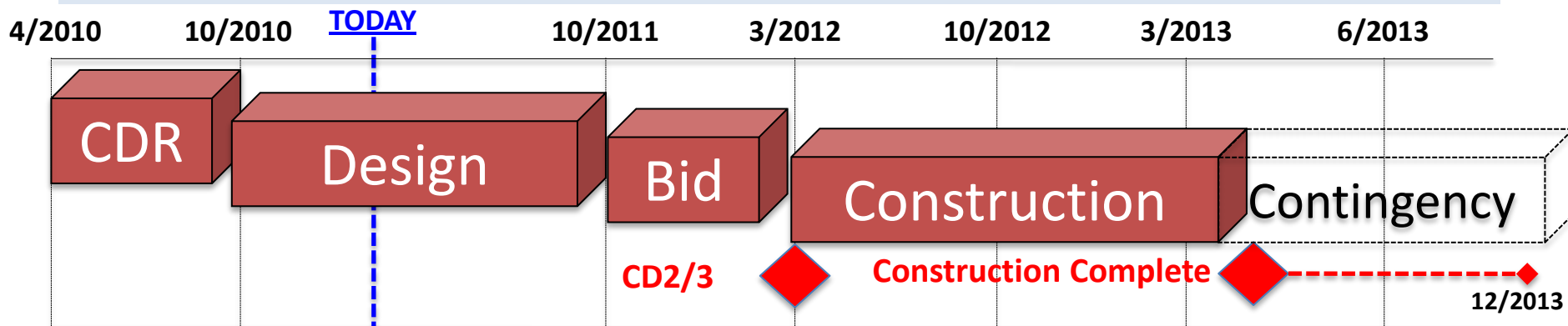
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Project Scope

- Up to ten new test beds

- Eight test beds in front of Building 90

- Two test beds inside Building 90

- Demolition of existing trailer buildings in front of Building 90

- Rearrange parking stalls at south side of Building 90

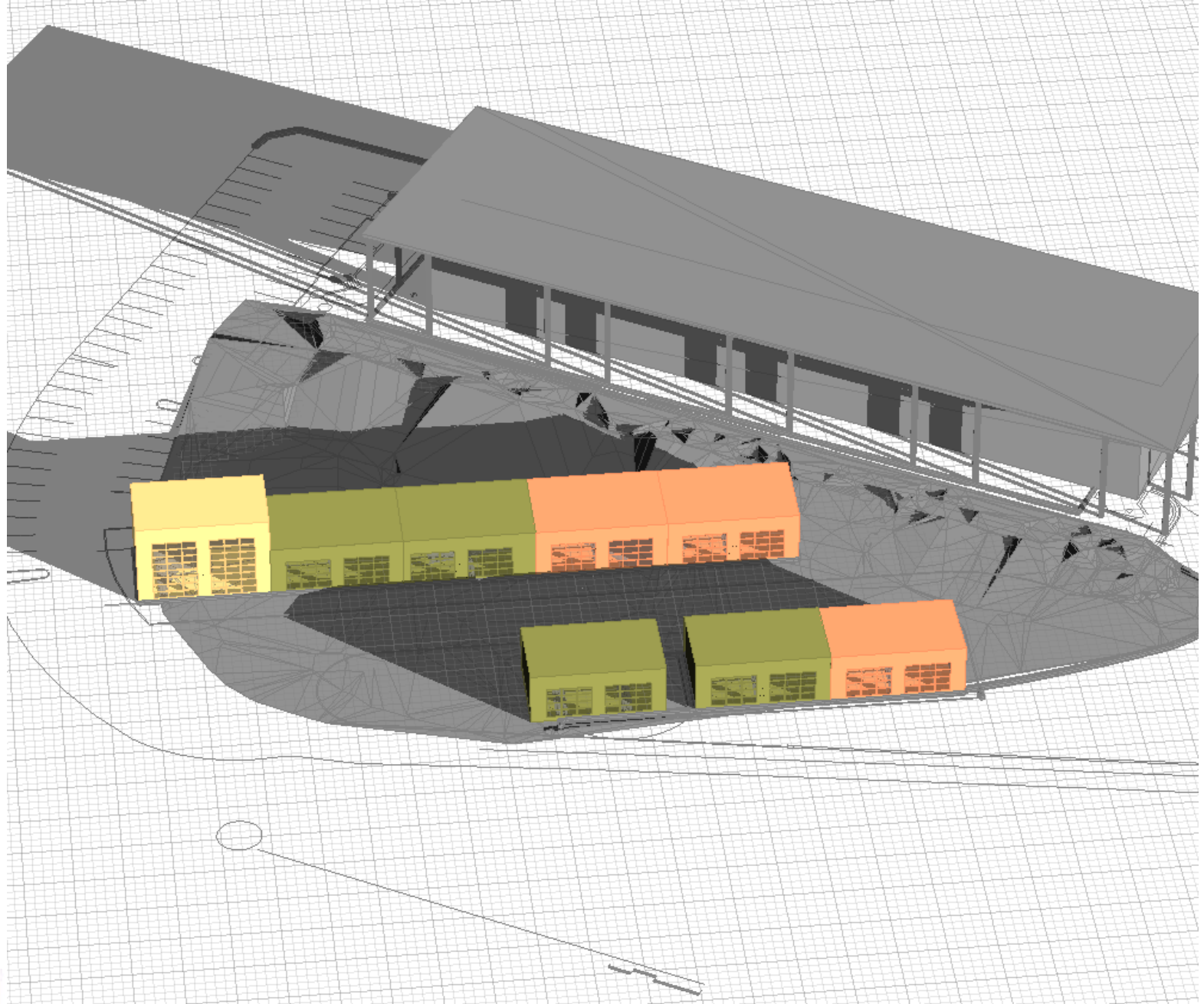- Low water use landscaping

LBNL Site Plan

Project Overview

- Preliminary Design Underway
- Completed site analysis and selection
- Design completion scheduled Fall 2011
- Construction start scheduled Spring 2012
- Construction completion Spring 2013
- $15.7M ARRA Funds

Demolish Building 90 Trailers

- Trailers contain 17,138 gsf of offices
- Installed over 30 years ago
- Past their expected life

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Dec. 21, 2011 – 8:30am

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EXTERIOR MATERIALS

- Test Bed exterior – Vertical corrugated metal panel
- Test Bed signage – Flat metal panel w/ bright white supergraphic text, Test bed doors similar
- Test Bed entries – Hazard yellow entry pad w/ white arrow
- Hazard yellow bollards
- Mechanical Equipment – Painted to match the building

HAZARD YELLOW ENTRY PADS

METAL PANEL +MECH. EQUIP.

ALUM PANEL w WHITE TEXT
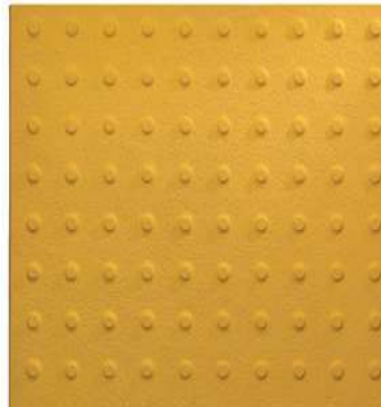
Building Features

- Interchangeable façade elements, shading, glazing, skylights
- Two cells in each testbed for comparative studies
- Flexible interior space
- Flexible HVAC systems
- Interchangeable lighting
- Sensors and instrumentation

Building Systems

- Integration studies in low-energy building solutions
  - Dynamic envelope control, lighting, daylighting
  - Studies on comfort factors including glare, thermal distribution, operative temperature
- Low-energy systems to be studied include:
  - Airflow distribution
  - Natural ventilation and displacement ventilation
  - Night-time purge/slab cooling
  - Indirect evaporative cooling
  - Ceiling fans
  - Chilled beams
  - In-slab radiant cooling and heating

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Questions?