University of California, Davis
CLTC
California Lighting Technology Center

Developing and Demonstrating PIER's Load-Shed Ballast

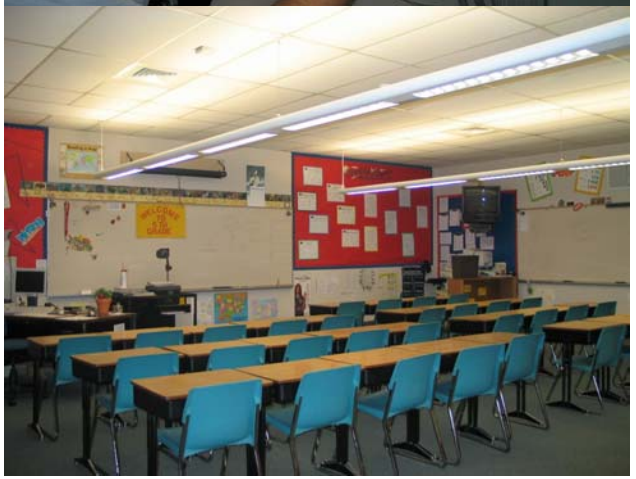
DRETD Meeting
February 13, 2006

Don Aumann, PE
Director of Programs, CLTC

Overview

Background

Current Status



CLTC Established in Early '04

- Partnership between California Energy Commission PIER Program and UC Davis
- Support from NEMA and DOE
- Build on earlier success at LBNL

pier
PUBLIC INTEREST ENERGY RESEARCH
"Research Powers the Future"

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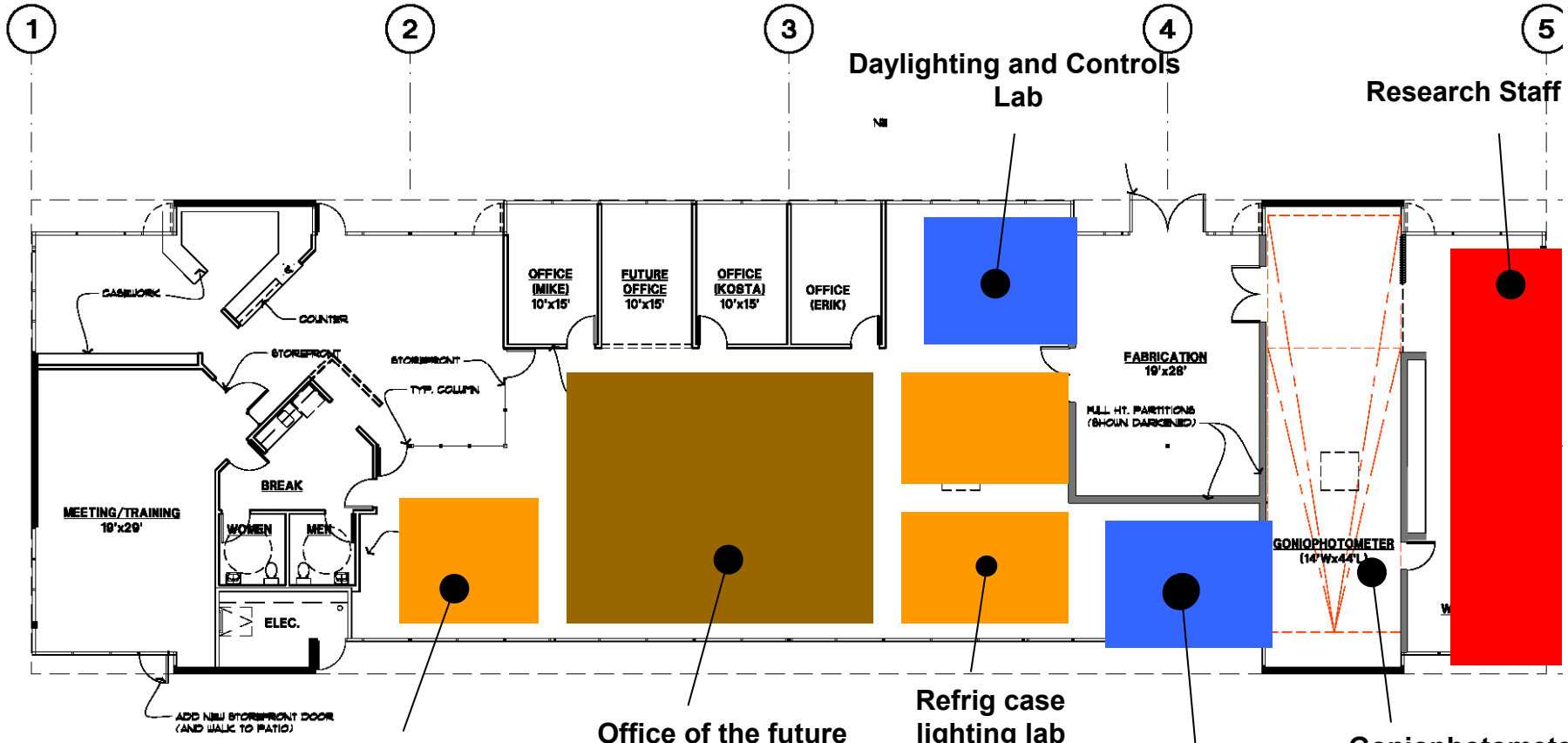
Floor Plan—7000 sq. ft.



Industry Link—Advisory Council

Co-founding Institutions

- California Energy Commission
- UC Davis

Utilities

- Sacramento Municipal Utility District
- Southern California Edison
- Pacific Gas & Electric Company
- Southern California Gas Company

Industry

- NEMA
- Acuity Lighting Group, Inc.
- Osram Sylvania
- The Watt Stopper
- Building Industry Research Alliance

Government

- California Energy Commission
- U.S. Department of Energy

Public Interest

- Natural Resources Defense Council

Load-Shed Ballast—Opportunity

Commercial building lighting is a large load

… ~35% of all commercial building electricity use

Commercial building lighting is a big on-peak contributor

… ~11% of CA peak demand

… plus associated cooling

Load-Shed Ballast—Opportunity

Stepped dimming lighting is a “confident” load shed resource

Stepped-dimming maintains “lights on” appearance

Stepped-dimming load-shed savings are easily repeated

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Load-Shed Ballast—Opportunity

Lighting Research Center (LRC) study shows limited dimming is acceptable

… 20-30% drop ok

… slow dimming not noticed by most

PIER Research Project

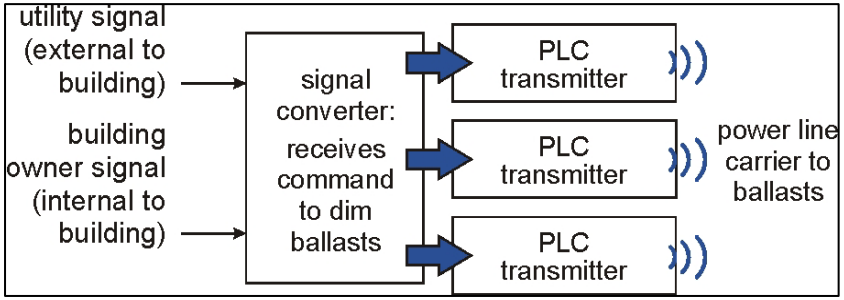
- Timeline ~2003-2004
- Target = instant-start T8 fluorescent
  … new construction version
  … retrofit version
- Initial goal = slow dimming ramp
- Project leader = LRC
- Ballast industry partner = Osram Sylvania
- PLC controls industry partner = Intech 21

Project Results

- Early analysis
  … retrofit version too expensive w/expected rates
  … focus on new construction version
- Early results
  … ramped dimming is too expensive
  … use 33% step dimming
- Final result = prototype unit
  … includes built-in PLC receiver
  … appearance/installation same as “standard” unit

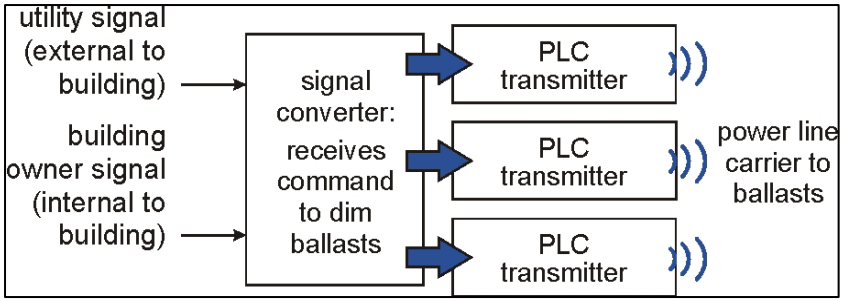
Prototype Performance

- 4.8% efficiency loss in load-shed mode
- >98% power factor
- <10% THD
- Limited dimming does not reduce lamp life



Prototype Performance

- Full output mode
  - … 0.88 ballast factor
  - … 83.3 Watts
  - … 105 ballast efficacy factor (BEF)
- Load shed mode
  - … 0.57 ballast factor
  - … 57 Watts
  - … 100 BEF



Project Economics/Impact

- ~$9 total additional cost (vs. ~$10-$15)
- ~3 year simple payback
  … 100 hr/yr load-shed condition
  … new construction/renovation applications
  … utility CPP and TOU rates

- ~7% building-wide load reduction (com'l sector)
- 100 MW load shed potential for California

Post-Project Activities

- Osram Sylvania produced ~500 pre-production units in 2005
- NYSERDA field test
  … expected completion mid/late 2005
  … extensive problems w/PLC signal generator
  … installation February 2006
- PIER field test
  … UC Santa Barbara
  … installation expected late March 2006
  … UCSB participated in SCE's demand bidding

Commercialization Potential

- Osram Sylvania interested
  … others too
- Manufacturers need confidence of
  … utility rates
  … communication interface

Too much uncertainty
for manufacturers to
commit at this time

Additional Information

- PIER research results
  www.archenergy.com/lrp

- Post PIER project activities
  www.cltc.ucdavis.edu

Summary

- Tremendous opportunity
  … lighting is a great DR load
- Groundwork is set
- Manufacturers need confidence before committing