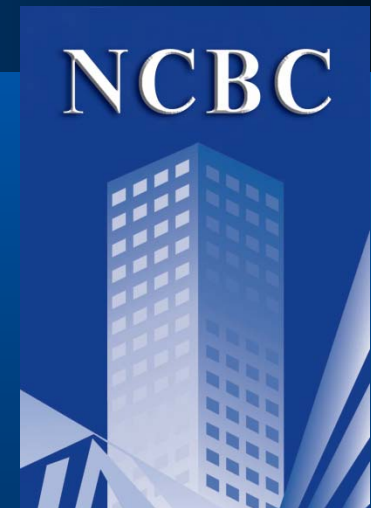


Quantifying Monitoring-Based Commissioning in Campus Buildings: *Utility Partnership Program Results, Lessons Learned, and Future Potential*

2007 National Conference on Building Commissioning
May 2-4, 2007, Chicago, Illinois



Mike Anderson, Ann McCormick
Principals, Newcomb Anderson McCormick

Andrew Meiman

Senior Program Manager, Newcomb Anderson McCormick

Karl Brown

Deputy Director, California Institute for Energy and Environment
University of California Office of the President



UC/CSU/IOU Energy Efficiency Partnership Program

- **Funded by California Investor Owned Utilities under the Auspices of the California Public Utilities Commission**
- **University Systems**
 - **University of California (10 Campuses)**
 - **California State University System (23 Campuses)**
- **Investor Owned Utilities – 2004 First Statewide Partnership**
 - **Pacific Gas and Electric**
 - **Southern California Edison**
 - **Southern California Gas**
 - **San Diego Gas and Electric**
- **Program Management and Overall Coordination**
 - **Newcomb Anderson McCormick**

UC/CSU/IOU Energy Efficiency Partnership Program

- **2004-05 Program**
 - \$15 Million
 - Retrofit Projects
 - Monitoring Based Commissioning (MBCx)
 - Training and Education
- **Continuing in 2006-08**
 - \$30 Million

MBCx Utility Program Overview

- **Submit Project Application**
 - Stipulate reasonable anticipated savings based on site conditions; typically 5-20% of metered use
- **Utility Completes Due Diligence Review**
 - Application and results reviewed at each payment milestone
 - Final measured results are tracked against original application; overall reconciliation is on a portfolio approach
- **Incentive Rates:**
 - \$0.24/kWh and \$1.00/therm annual savings
 - Incentive cost cap at 100% of project cost for 2004-05 and 80% for 2006-08
- **Payment Schedule**
 - 2004-05 Program: 50% acceptance / 40% controls installed / 10% final report
 - 2006-08 Program: 60% acceptance / 40% final report

MBCx Process

- **Select Appropriate Buildings**
 - Benchmark Comparison with Campus Buildings
 - Complex Systems
 - History of Problems
 - Incomplete Commissioning
 - Direct Digital Controls
 - High Air Change Rates
 - Dedicated Facilities Manager
- **Select Team**
 - Mix of In-House Staff and Consultants

MBCx Process

- **Monitoring**
 - **Install Permanent Whole Building Metering for Electricity, Gas, Steam, Hot Water, Chilled Water (or Central System Metering)**
 - **Install System Submeters where Warranted**
 - **Collect Load Profiles in Energy Information System**
 - **Establish Energy Use Baseline**
 - **Trend Points from Energy Management System**

MBCx Process

- **Commissioning with Monitoring**
 - **Functional Testing and Calibration**
 - **Review Sequence of Operations**
 - **Review Energy Use Profiles**
 - **Review EMS Trend Points**
 - **Identify Modifications**
 - **Review with Campus**
 - **Implement Commissioning Changes**

MBCx Process

- **Documentation and Persistence**
 - **Measure New Energy Use and Calculate Savings**
 - **Project Energy Savings to Annual Basis**
 - **Document Process**
 - **Train Staff**
 - **Identify Potential Retrofit Projects**
 - **Set Alarm Points in EIS for Persistence**
 - **Report Results to Partnership Program**

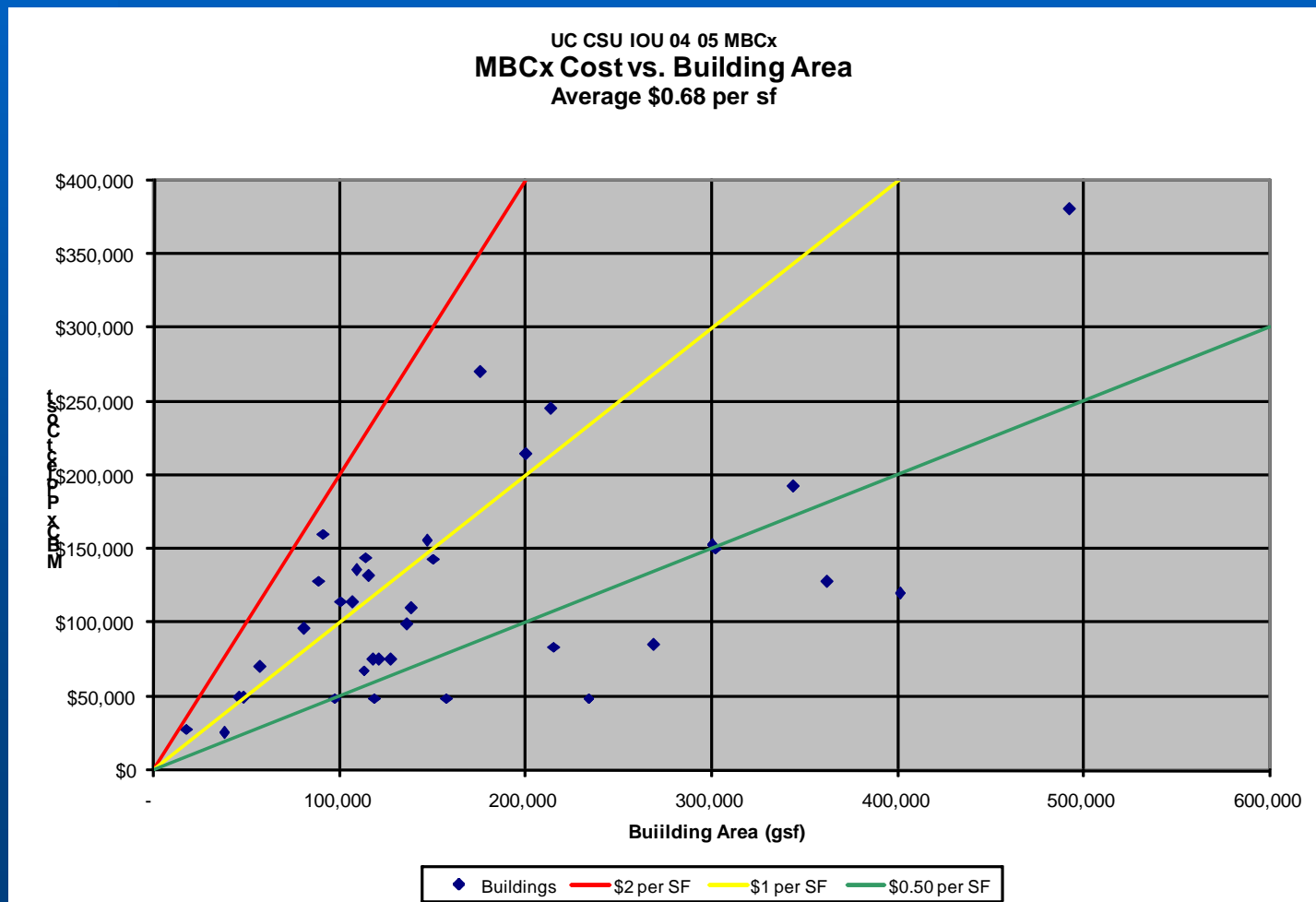
MBCx vs. RCx

- Whole Building Metering
- Energy Information System
- Continuous Monitoring and Optimization
- Long Term Trending
- Alarming

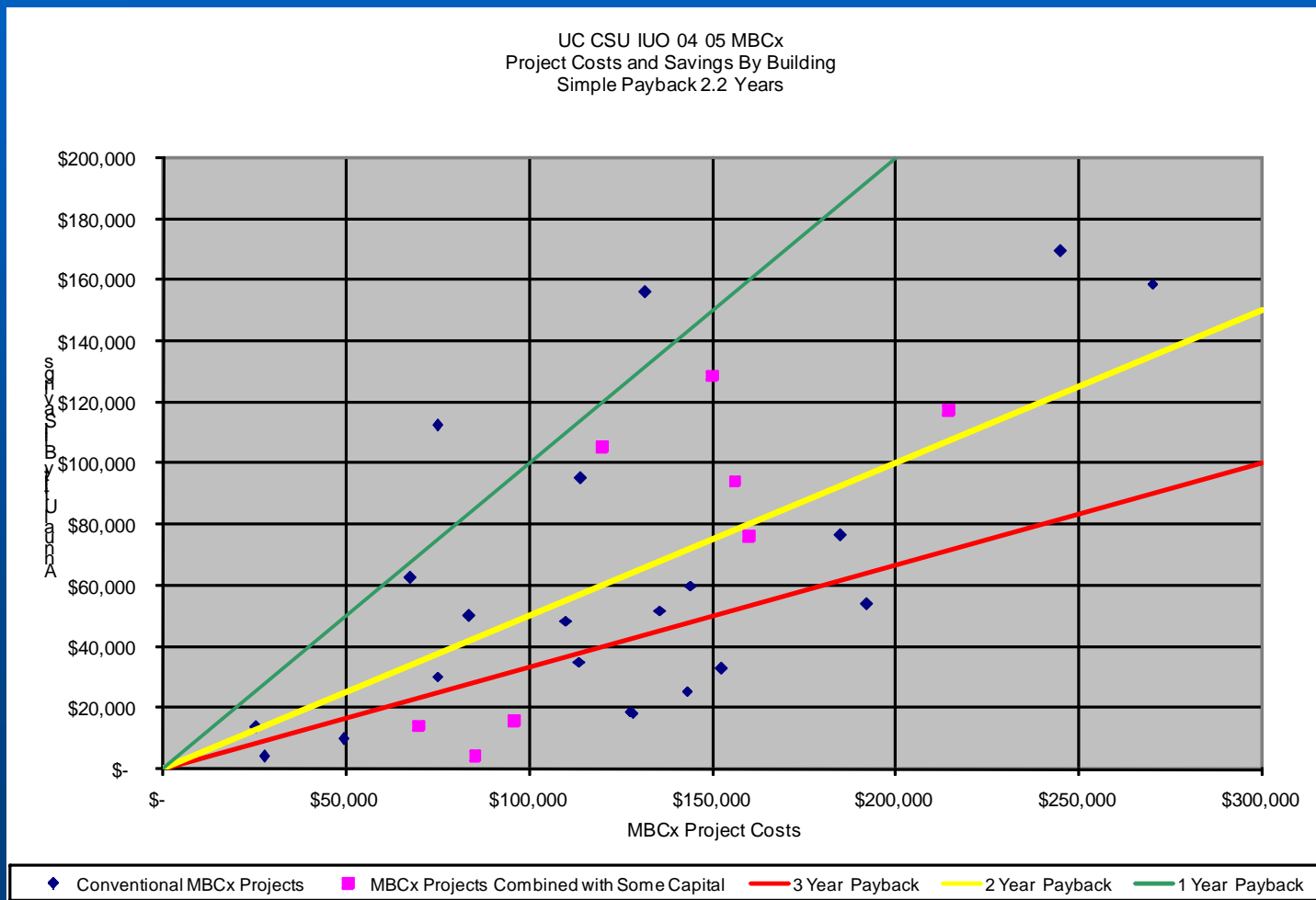
2004-05 MBCx Projects

- **Projects on 25 Campuses**
- **37 Building Projects**
- **9 Plant Projects**
- **Reports from all but one campus**

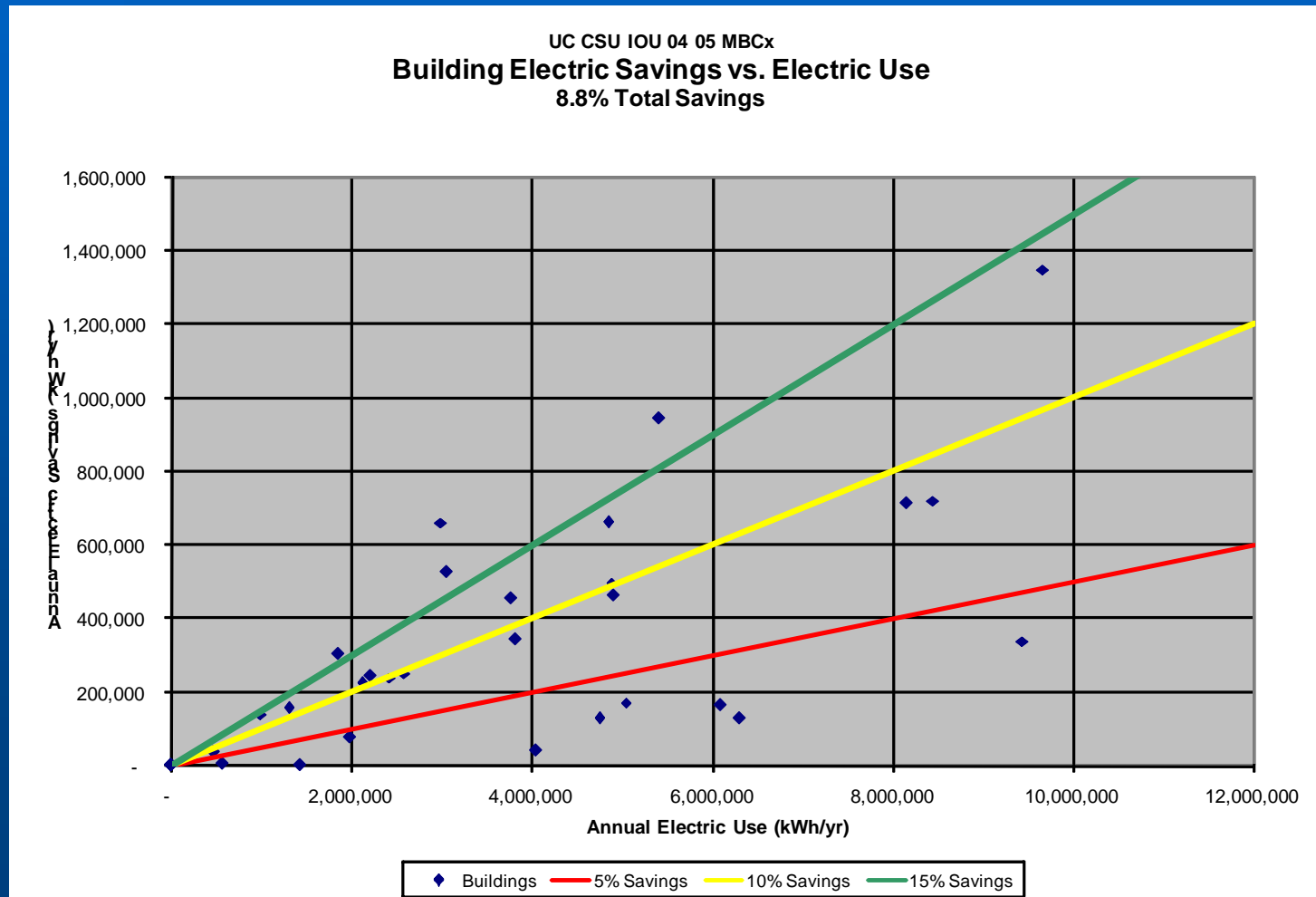
MBCx Cost vs. Building Area



Project Cost and Savings by Building

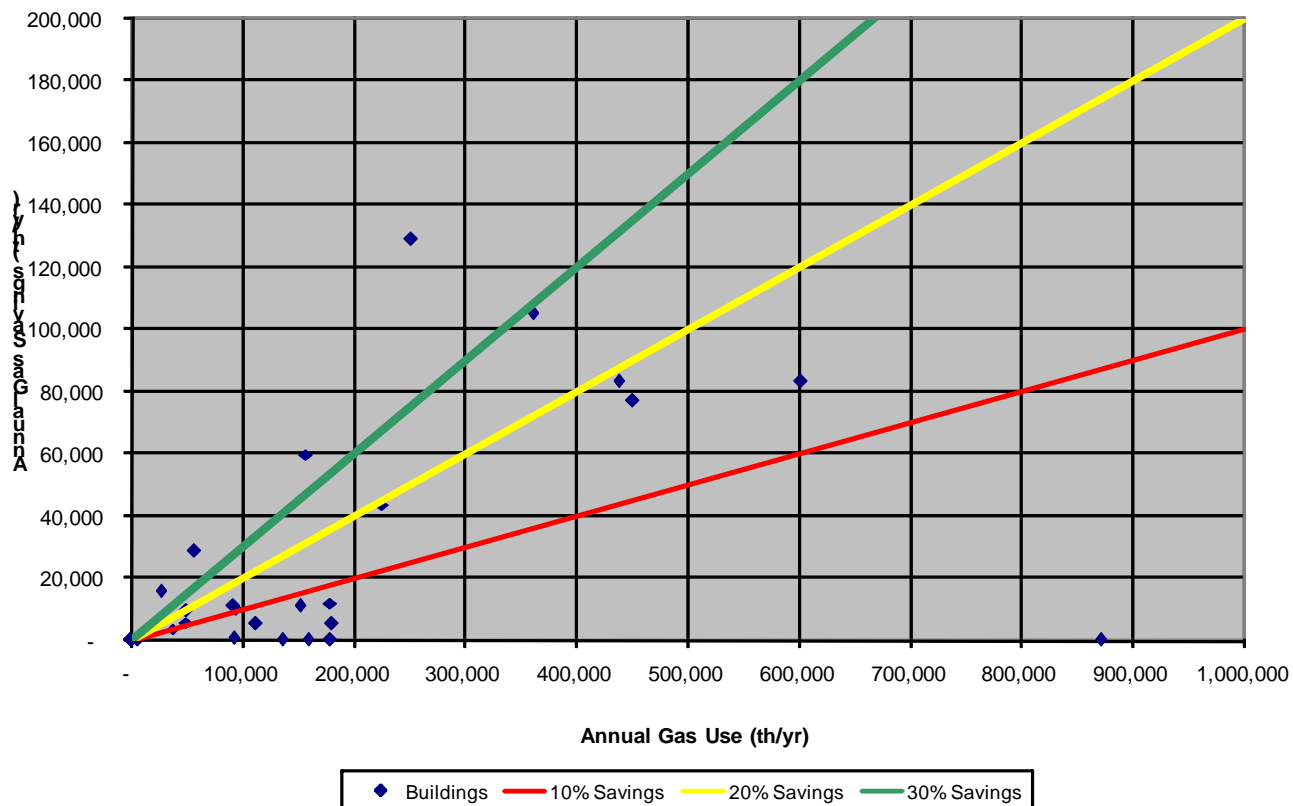


Building Electric Savings vs. Electric Use

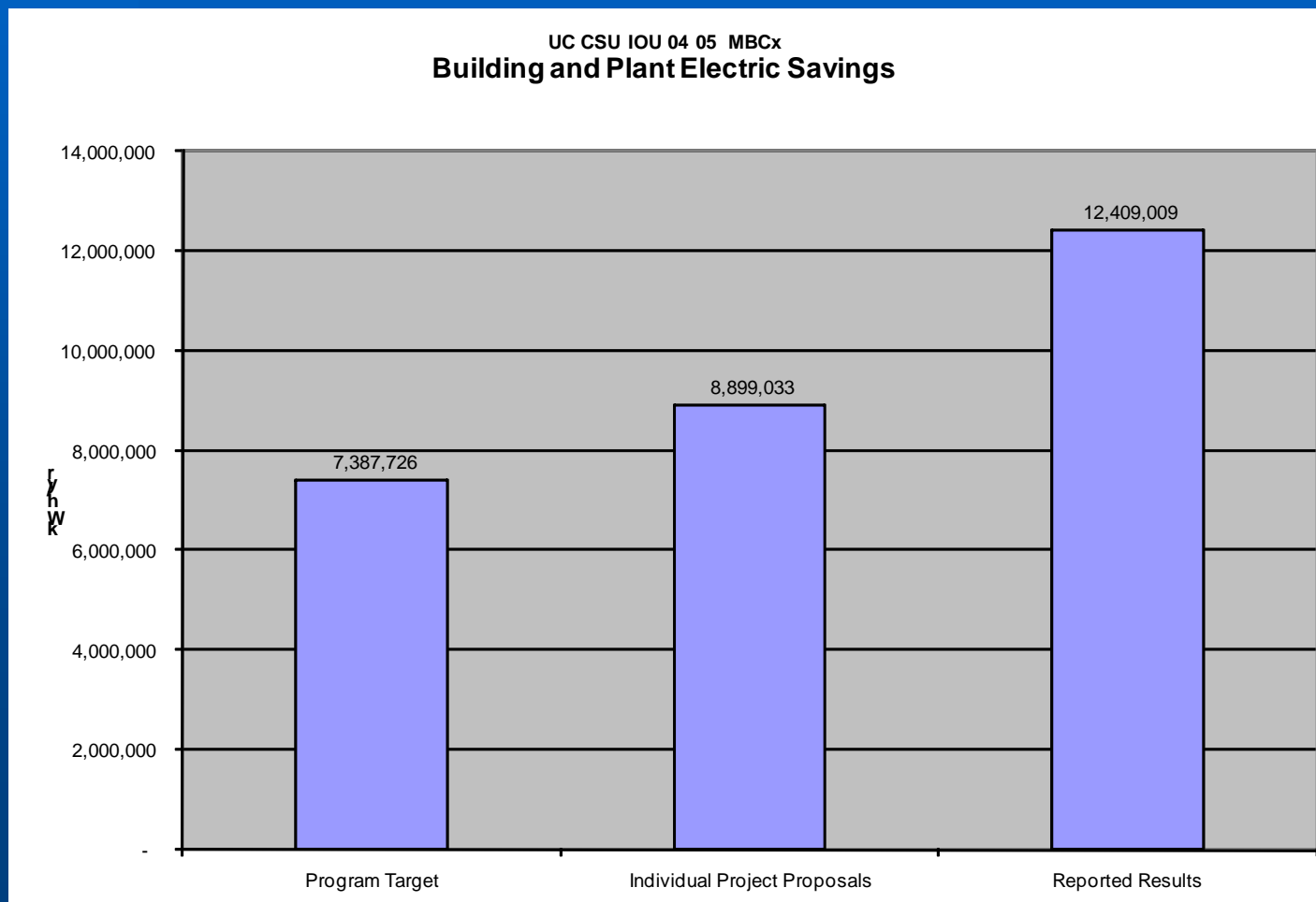


Building Gas Savings vs. Gas Use

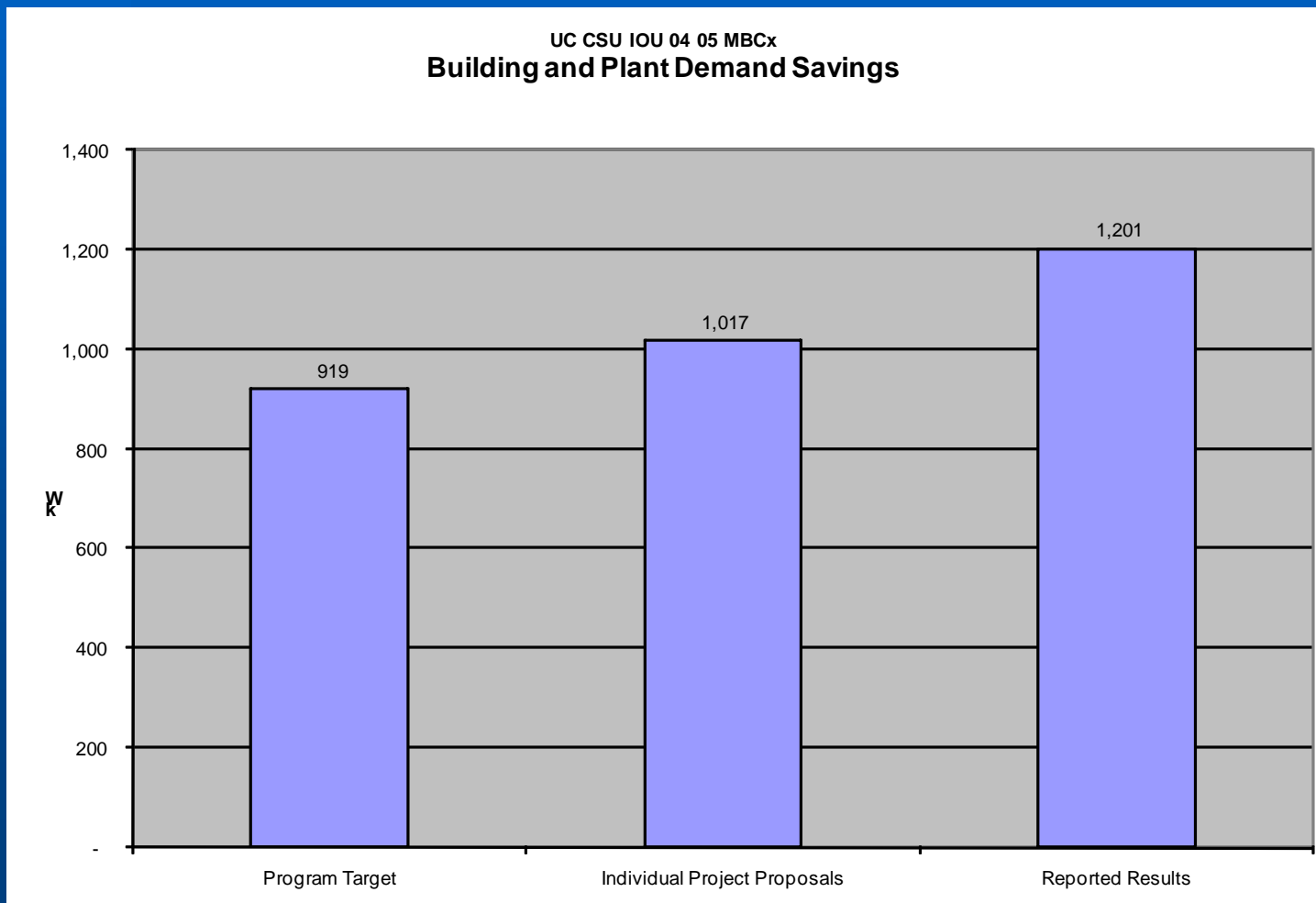
UC CSU IOU 04 05 MBCx
Building Gas Savings vs. Gas Use
14.1% Total Savings



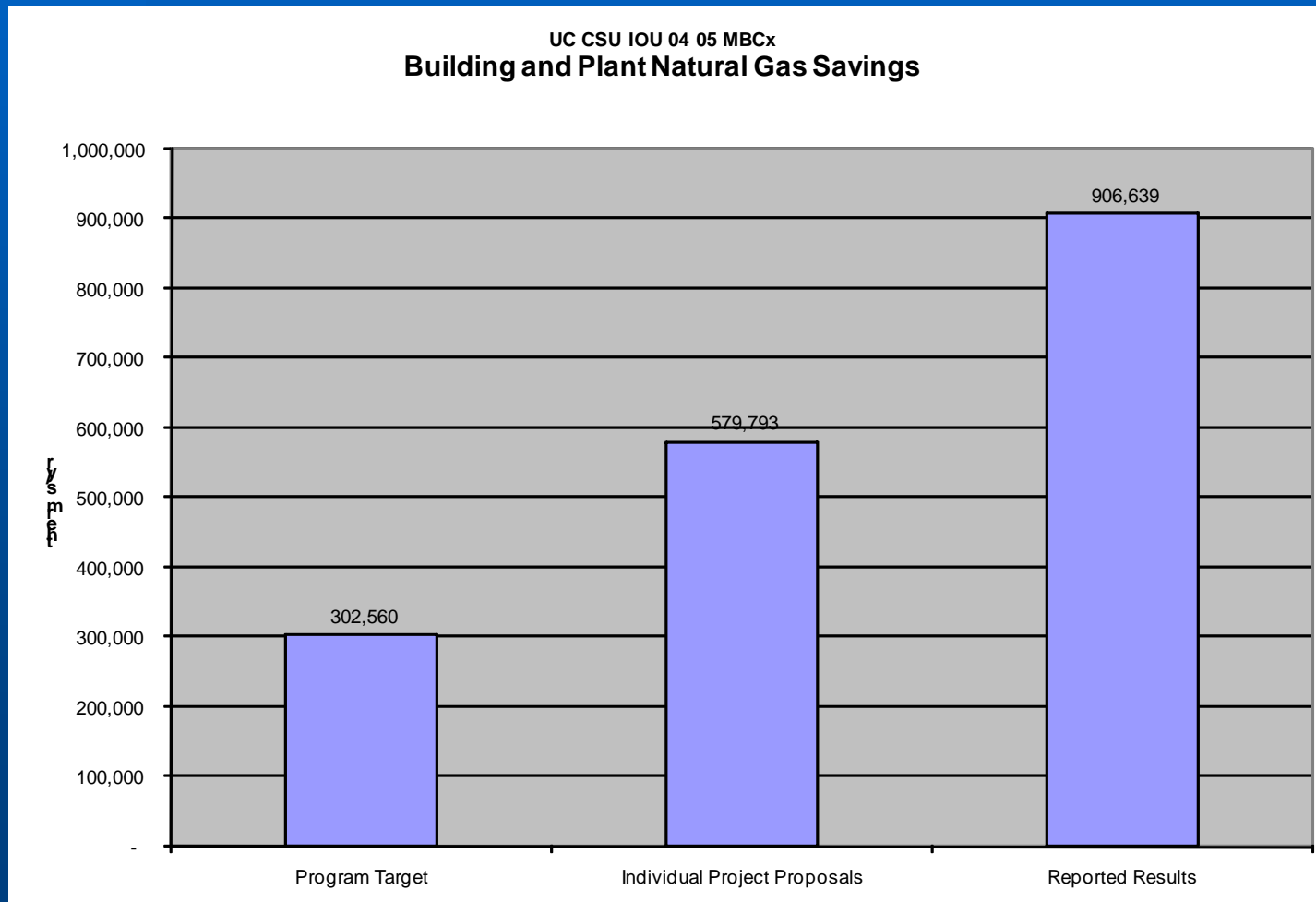
MBCx Annual Electric Savings



MBCx Demand Savings



MBCx Annual Gas Savings



Lessons Learned

- **Initial Screening**
 - **Benchmarking for All Campus Buildings**
 - **Direct Digital Controls**
- **Extended Monitoring Periods (Months vs. Weeks)**
- **Campus Manpower and Training Commitment**
- **Experienced Commissioning Agent**
- **60/40 Payment Schedule**
- **Significant Benefit Beyond Traditional RCx Programs**

Next MBCx Steps

- **2006-08 UC/CSU/IOU Partnership Program**
- **2006-08 California Community College IOU Partnership Program (Pilot program serving 112 campuses)**
- **Planning for 2009, 10, 11 Statewide Utility Partnerships**

MBCx UC/CSU/IOU Energy Efficiency Partnership

- **Mike Anderson**
 - Mike_Anderson@newcomb.cc
- **Ann McCormick**
 - Ann_McCormick@newcomb.cc
- **Karl Brown**
 - Karl.Brown@ucop.edu
- <http://www.uccsuiouee.org>
- <http://ciece.ucop.edu>

