

**California State University –  
Cx on the Path to Net Zero**  
Thursday October 13, 2011



---

Create Tomorrow Together

## Overview

- Motivation
  - Scope
  - Achievements
  - Lessons Learned
  - Evolution
- 
- 500,000 people
  - 87million GSF
  - \$150million - Utility Bill



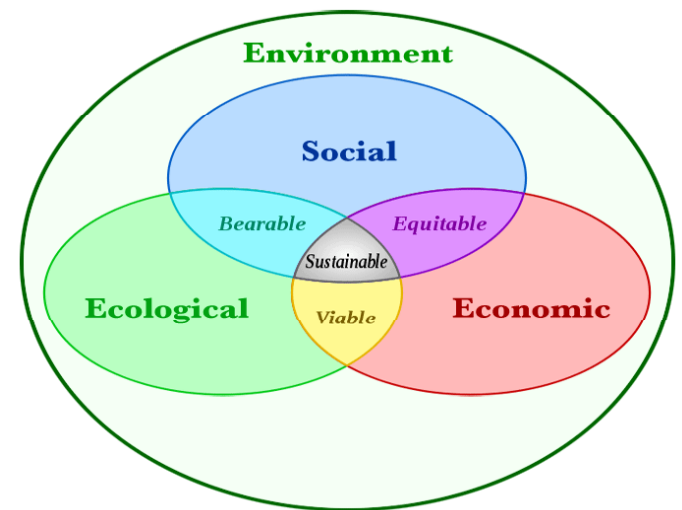
## Overview

- EnerNOC
  - Tom Riley
  - Charlotte Wagner
  - Sean Layerle
- Quest
  - David Jump
- Nexant
  - Jim Reese
  - Pranesh Vrenugopal



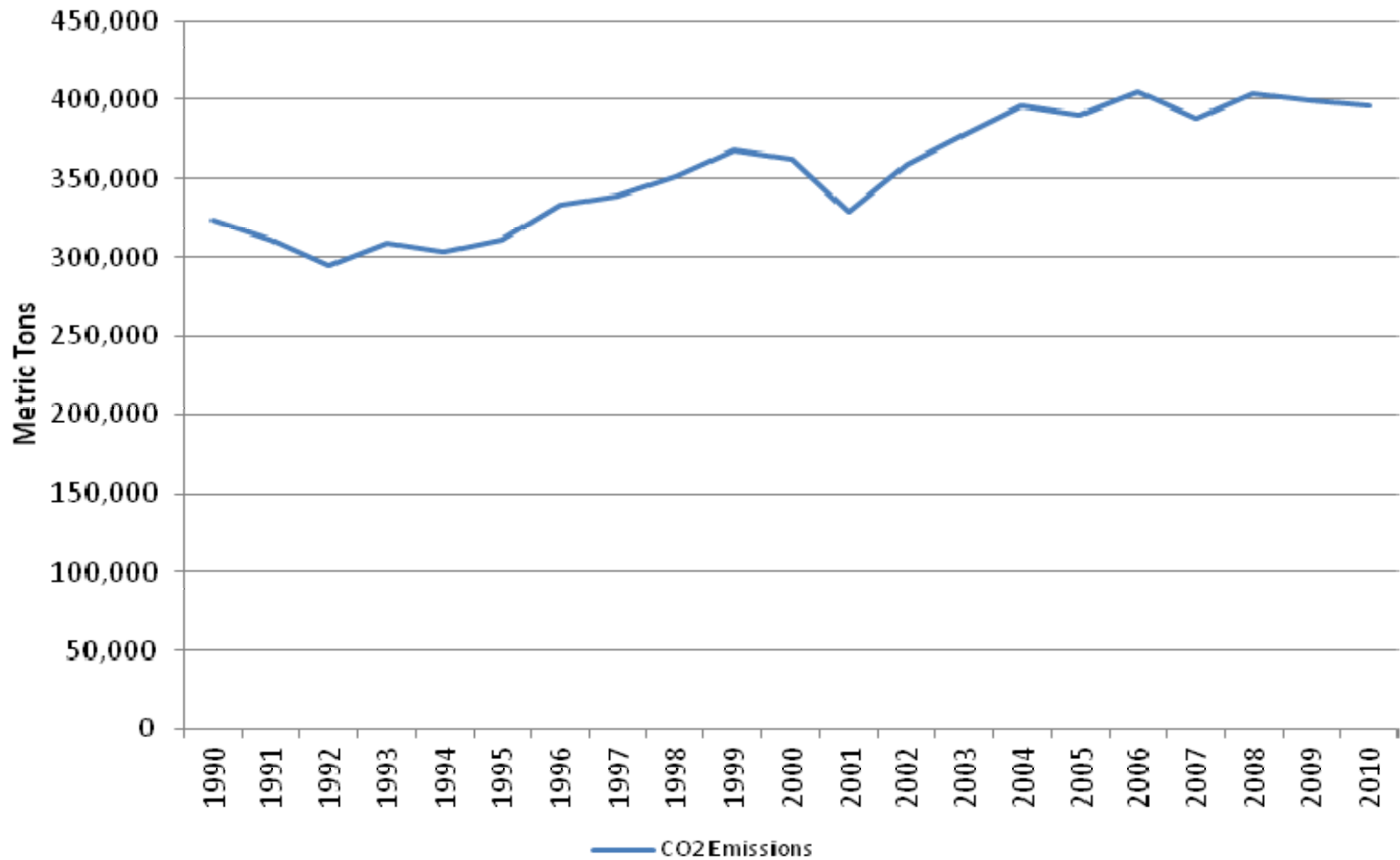
## Motivation

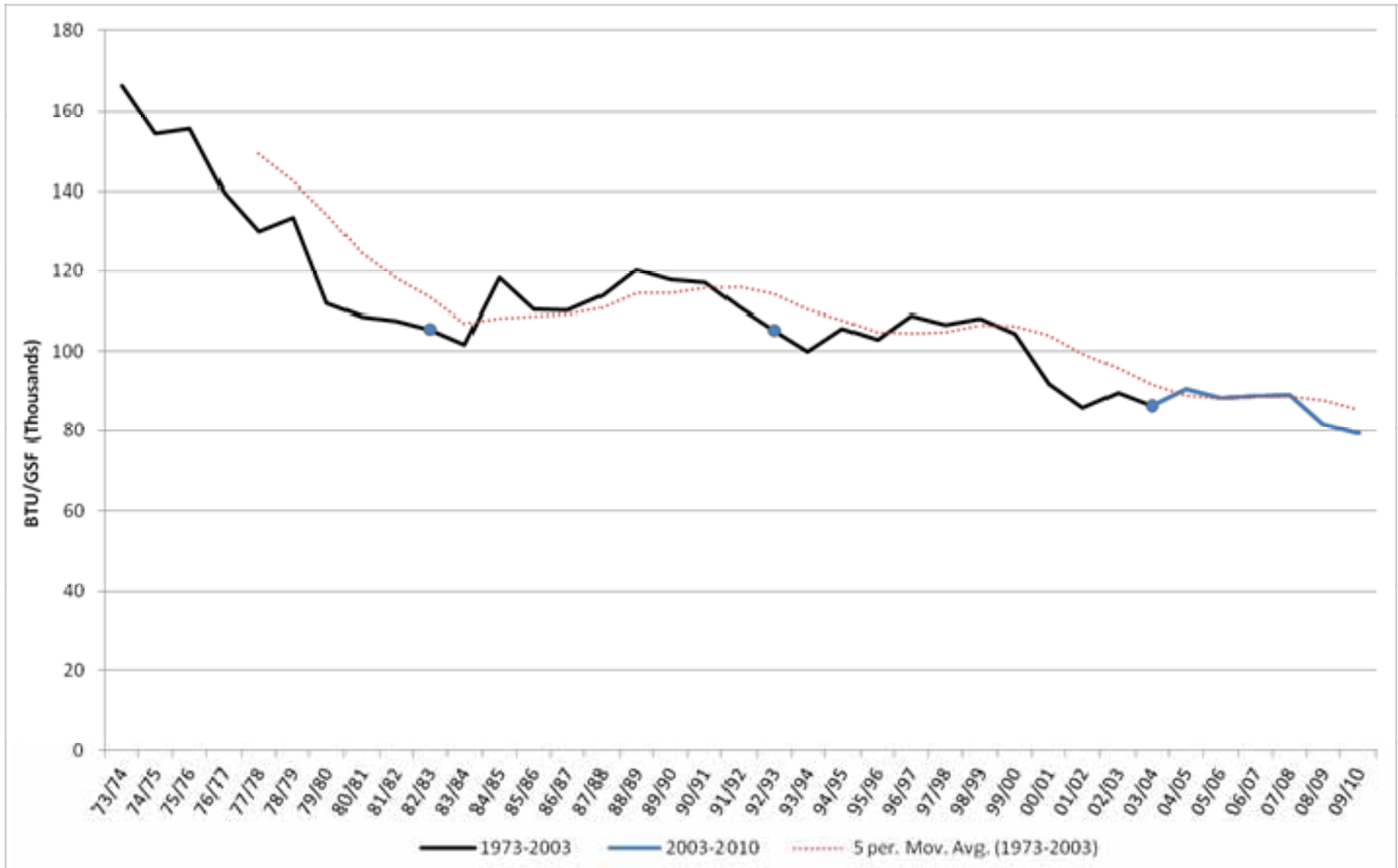
- CSU Sustainability Policy
  - Sustainability Goals (Climate and Energy)
    - Energy Efficiency: 15% reduction BTU/GSF by 2015
    - Cogeneration: 30 MW increase by 2020
    - Renewables On-site: 20 MW increase by 2020
    - Climate Impact Mitigation
    - Robust GHG Reporting/Tracking
- ZNE as part of Sustainability Prog.
  - Definition: No annual net grid use on a campus basis





### CSU Greenhouse Gas Emissions 1990-2010





## UC/CSU/IOU Energy Efficiency Partnership 2010-2012

### CSU ENERGY PROGRAM DASHBOARD

Data as of: 10/10/2011

Achieved - Annual Totals and Values to Date	2010-2012	2006-2009	2004-2005	Total Since 2004
<b>Annual Totals</b>				
kW Reduction	3,303	4,868	2,866	11,037
kWh Savings	23,971,216	26,696,641	19,731,369	70,399,226
Electrical Cost Savings	\$ 2,756,690	\$ 3,070,114	\$ 2,269,107	\$ 8,095,911
Therm Savings	1,020,837	893,489	485,087	2,399,413
Gas Cost Savings	\$ 867,711	\$ 759,466	\$ 412,324	\$ 2,039,501
<b>Cumulative to Date</b>				
Incentive Funding	\$ 5,060,967	\$ 7,105,218	\$ 7,061,312	\$ 19,227,497
Funds Invested	\$ 22,139,280	\$ 43,558,263	\$ 6,892,082	\$ 72,589,625
Quantity of Projects	99	54	43	196

# Motivation

- Why MBCx Express?
  - Protracted Data Collection Duration
  - Data Loggers vs. Utility and System Metering
  - Connectivity, Telemetry Limitations
  - Lack of Common Platform and Interoperability
  - Need for Automated Deliverables and Updates
  - Continuous and Persistent Commissioning
  - Metering, Dashboards, Reporting – Sustainability Goals

## Scope

- Solicit Campus Interest in Pilot
- RFP
  - Metering & Telemetry Partner – EnerNOC
    - Metering & Implementation Cost – Campus
  - Manage Program at Enterprise Level
  - Coordinate with Cx Agents at Campus Level
    - Cogent, Quest, Nexant
  - Reporting to Chancellor’s Office (CO)
  - CO Contracted & Managed EnerNOC and Cx Agents
    - Streamlined Contracting
    - Convenient Campus Resource - Cx Agent MEA

## Scope

- 6 Campuses, 26 Buildings
  - 2.5million GSF
  - Pre-MBCx Express
    - 30million kWh/yr
    - 700,000 thm/yr
    - Pneumatic HVAC
    - Varying Metering Capabilities
    - Old Sequence of Operations
    - Various EMS/BMS: Yamas, JCI, Honeywell, etc.



- Scoping
  - Plan, Scan, Plan
- Pre-Investigation
  - Evaluate, Calibrate, Contemplate, Populate
- Investigation
  - Collect, Inspect, Reflect
- Implementation
  - Supply, Apply, Verify
- Verification
  - Collect, Inspect, Reflect
- Hand Off and Training



## Achievements

- Increased User Comfort
- Varying Vintage – Better Metering
  - Electric, Gas, CHW, HHW
  - AHU, VAV Box, Lighting Circuits
- Infrastructure for Persistent Cx (Beef Up EMS/BMS)
- Demand Response Integration
- Cooperative Product Development with EnerNOC
- Price Point Metric
  - \$0.75-\$1.15/GSF
  - \$0.15-\$0.40/GSF



Show up to 3 locations  
 Show up to 10 locations

Locations	Key
California State University	<input type="checkbox"/>
CSU Bakersfield	<input type="checkbox"/>
CSU Chancellor's Office	<input type="checkbox"/>
CSU Chico	<input type="checkbox"/>
CSU Dominguez Hills	<input type="checkbox"/>
CSU Fresno	<input type="checkbox"/>
CSU Fullerton	<input type="checkbox"/>
CSU Long Beach	<input checked="" type="checkbox"/>
CSU Monterey Bay	<input type="checkbox"/>
CSU Pomona	<input checked="" type="checkbox"/>
CSU San Bernardino	<input type="checkbox"/>
CSU San Marcos	<input type="checkbox"/>
California Polytechnic State	<input type="checkbox"/>
Humboldt State University	<input type="checkbox"/>
San Francisco State University	<input type="checkbox"/>
San Jose State University	<input type="checkbox"/>



1 **California State University > CSU Long Beach**  Compare To Past

- Electricity DemandSMART Electricity Baseline (kW) [Change](#) [Remove](#)
- Electricity Electricity Demand (kW) [Change](#) [Remove](#)

+ Add Plot

---

2 **California State University > CSU Pomona**  Compare To Past

- Electricity Electricity Demand (kW) [Change](#) [Remove](#)
- Electricity DemandSMART Electricity Baseline (kW) [Change](#) [Remove](#)

+ Add Plot

+ Add Location

Details

Summary Notes

California State Uni... > CSU Long Be

DemandSMART Electricity Baseline (k

- Max 8,391.36 Oct 06, 2011 12:0
- Min 5,259.84 Oct 12, 2011 3:00
- Average 6,824.95

Electricity Demand (kW)

- Max 10,078.20 Oct 12, 2011 12:0
- Min 3,591.40 Oct 09, 2011 8:0
- Average 6,196.88
- Load Factor 0.61

California State Uni...r...ity > CSU Pom

Electricity Demand (kW)

- Max 6,896.00 Oct 10, 2011 10:0
- Min 2,880.00 Oct 09, 2011 10:0
- Average 4,849.67
- Load Factor 0.70

DemandSMART Electricity Baseline (k

- Max 6,844.80 Oct 06, 2011 10:0
- Min 4,696.00 Oct 12, 2011 5:00
- Average 5,529.81

## Achievements

Campuses Complete	Project Cost	Annual Avoided Cost	Incentives Recovered	Payback (w/ incentives)	Payback (w/o incentives)	Avoided Cost as % of Building Total
San Marcos	\$ 466,407	\$ 84,379	\$ 185,141	3.3	5.5	8.5%
San Jose	\$ 242,589	\$ 103,165	\$ 152,235	0.9	2.4	5.9%
Monterey Bay*	\$ 103,669	\$ 8,118	\$ 11,518	11.4	12.8	2.0%
Chico	\$ 365,519	\$ 190,354	\$ 256,386	0.6	1.9	15.8%
<b>Subtotal Completed</b>	<b>\$ 1,178,184</b>	<b>\$ 386,015</b>	<b>\$ 605,280</b>	<b>1.5</b>	<b>3.1</b>	<b>8.1%</b>
Campuses Completing 2012	Project Cost	Annual Avoided Cost	Incentives Recovered	Payback (w/ incentives)	Payback (w/o incentives)	Avoided Cost as % of Building Total
Dominguez Hills	\$ 300,715	\$ 18,765	\$ 28,092	14.5	16.0	5.6%
SFSU	\$ 320,986	\$ 79,466	\$ 140,054	2.3	4.0	7.2%
Subtotal Pending	\$ 621,701	\$ 98,231	\$ 168,146	4.6	6.3	6.4%
<b>Grand Total</b>	<b>\$ 1,799,885</b>	<b>\$ 484,246</b>	<b>\$ 773,426</b>	<b>2.1</b>	<b>3.7</b>	<b>7.5%</b>

# Influence

Campuses Completing 2012-13	Project Cost	Annual Avoided Cost	Incentives Expected	Payback (w/ incentives)	Payback (w/o incentives)	Avoided Cost as % of Building Total
Long Beach	\$ 329,898	\$ 567,262	\$ 156,480	0.3	0.6	7.9%
Pomona	\$ 285,614	\$ 344,298	\$ 106,849	0.5	0.8	11.0%
San Bernardino	\$ 345,098	\$ 349,489	\$ 121,708	0.6	1.0	6.8%
San Jose	\$ 210,846	\$ 191,568	\$ 98,884	0.6	1.1	6.1%
San Luis Obispo	\$ 531,576	\$ 260,260	\$ 83,089	1.7	2.0	8.5%
San Marcos	\$ 263,828	\$ 300,964	\$ 98,642	0.5	0.9	7.1%
Sonoma	\$ 541,405	\$ 438,317	\$ 140,380	0.9	1.2	5.9%
<b>Grand Total</b>	<b>\$ 1,719,589</b>	<b>\$ 824,332</b>	<b>\$ 745,660</b>	<b>1.2</b>	<b>2.1</b>	<b>7.6%</b>

## Lessons Learned

- Expectations Setting
- Project funding and Projected Savings
- PM coordination
  - Campus Communication & Coordination
  - Project Support and Tracking
  - Measure implementation
  - Building use changes
- Telemetry/Metering Integration
  - Automated Alarms, Notifications
  - Connectivity and Data Quality

## Lessons Learned

- Utility Partnership
  - Regular Interface – Easy Approval
  - Comparative Energy Models and Metrics
  - Review & Approval: No Site Visits – Saves Time
  - Added Metering Support and Funding - AutoDR

## Evolution

- Energy Information System (EIS) & Smart Grid
- GHG Emissions Tracking
- Can't Manage What You Don't Measure....On the Path to Zero Net Energy
- Expanded Integration with New Construction
- Raising Visibility of Use and Need for Management...to THE Management!!!
- 10million done...70million to go



## Q&A



