

# Continuous Commissioning<sup>®</sup> of Public Schools

**Gary Napper, CEM**  
**Guanghua Wei, PE**  
**W. Dan Turner, PE, PhD**  
**Juan-Carlos Baltazar-Cervantes, PhD**

**Texas A&M University**

**Dayu Dong, PhD**  
**Li Song, PhD**  
**Ik-Seong Joo, PhD**

**Bes-Tech Inc.**



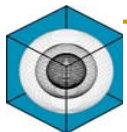
Energy Systems Laboratory



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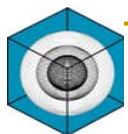
# Introduction

- Austin ISD Capital Improvements Bond Programs
- CC<sup>®</sup> assessment started in June 2004
- Two elementary schools and one high school were selected
- Began CC<sup>®</sup> in April 2004
- Minor retrofits were performed in one school



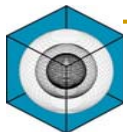
# Pickle Elementary School and St. John's Community Center

- Built in 1999 with 116,000 ft<sup>2</sup> of area
- 10 single-duct VAV units
- 101 terminal boxes
- One 400 ton chiller and one 60 ton chiller
- One dual-cell cooling tower with VFDs
- 18 heating water heaters
- Most of the AHUs operate from 6:00 AM to 7:00 PM, Monday through Friday



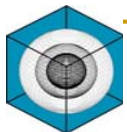
# Galindo Elementary School

- Built in 1986 with 83,000 ft<sup>2</sup> of area
- 8 single-duct VAV units, with a heat recovery unit attached to each AHU at the outside air intake
- 80 terminal boxes
- Two 250 ton chillers
- One cooling tower with VFDs
- One 3.5 MBtu/hr boiler
- Most of the AHUs operate from 6:00 AM to 4:00 PM, Monday through Friday



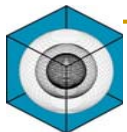
# Akins High School

- Built in 2000 with 300,000 ft<sup>2</sup> of area
- 12 single-zone constant volume AHUs
- 30 RTUs
- 8 HRUs that provide 100% fresh air to classrooms
- Two 300 ton chillers
- Two 3.0 MBtu/hr boilers
- CW pumps are equipped with VFDs
- Most of the AHUs operate from 7:00 AM to 8:00 PM, Monday through Friday



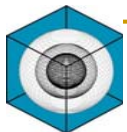
# Problems Identified

- Some key sensors were found to be in error
  - ❑ The outside air relative humidity sensor reading at Pickle ES was constantly fluctuating between 1% and 99%
  - ❑ A failed space relative humidity sensor caused the AHU and the chiller plant to be constantly energized
  - ❑ One AHU duct static pressure sensor failed and was showing -0.2 inch of static pressure
  - ❑ Many CO<sub>2</sub> sensors were reading higher than actual



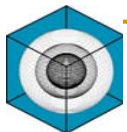
# Problems Identified (cont'd)

- Time schedules for many units can be improved
- Excessive heating in the terminal boxes was observed at Galindo ES during the cooling season
- Outdoor air and relief air flow rates were almost twice as much as the amount required at Galindo ES and Akins HS
- Relief air fans released more air than the supply air fans supplied at Akins HS



# Problems Identified (cont'd)

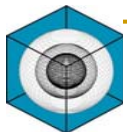
- The chillers at Galindo ES were always enabled
- Constant and extremely high hot water loop  $\Delta P$  setpoint was causing simultaneously heating and cooling at Akins HS
- The existing outside air temperature enable setpoints at Pickle ES for the hot water system ranged from 75°F to 115°F





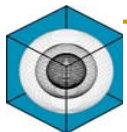
# CC<sup>®</sup> Measures Implemented

- Calibrated/replaced sensors
- Adjusted time schedules to eliminate unnecessary runtimes
- Optimized the economizer cycle operation
- Disabled the heat wheel of the HRU during economizer mode
- Adjusted minimum OA intakes
- Reset AHU DAT setpoints based on outside air temperature and fan speed



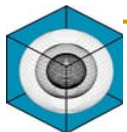
# CC<sup>®</sup> Measures Implemented

- Reset AHU static pressure setpoints
- Terminal box minimum airflow settings were adjusted lower based on actual space needs
- Optimized chiller start/stop sequence
- Reset CHW loop  $\Delta P$  setpoint based on outside air temperature or maximum chilled water valve position
- Reset CW temperature setpoint based on ambient wet-bulb temperature



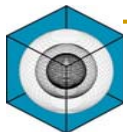
# CC<sup>®</sup> Measures Implemented

- Optimized hot water heater start/stop setpoints
- Reset hot water loop  $\Delta P$  setpoint based on outside air temperature
- Reset hot water loop supply temperature setpoint based on outside air temperature



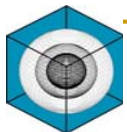
# Minor Retrofits Performed

- VFDs were installed on several large constant volume AHUs at Akins HS
- Adjusted the fan pulleys to balanced HRUs supply and exhaust air flows

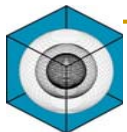
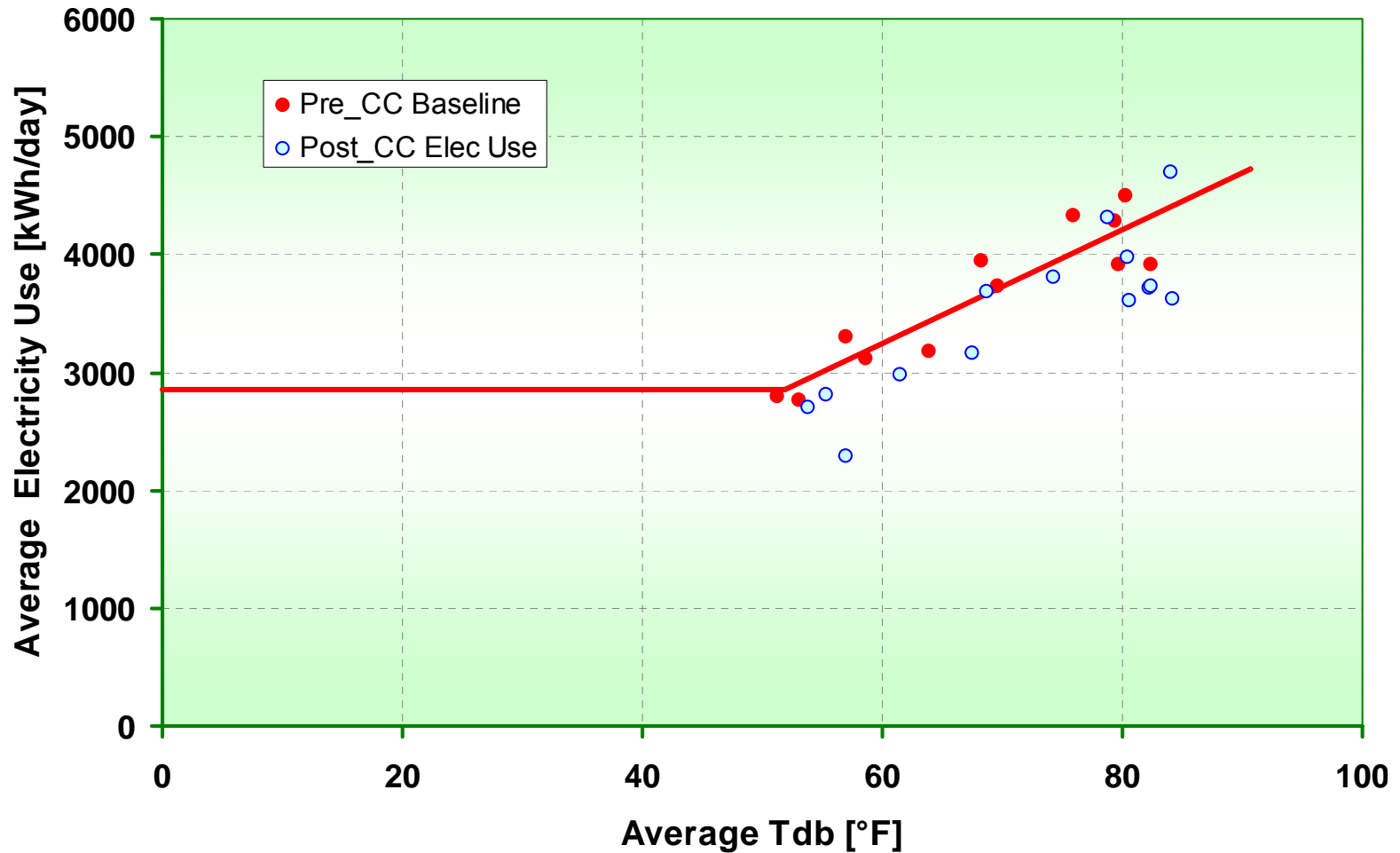


# Savings From CC<sup>®</sup>

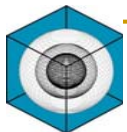
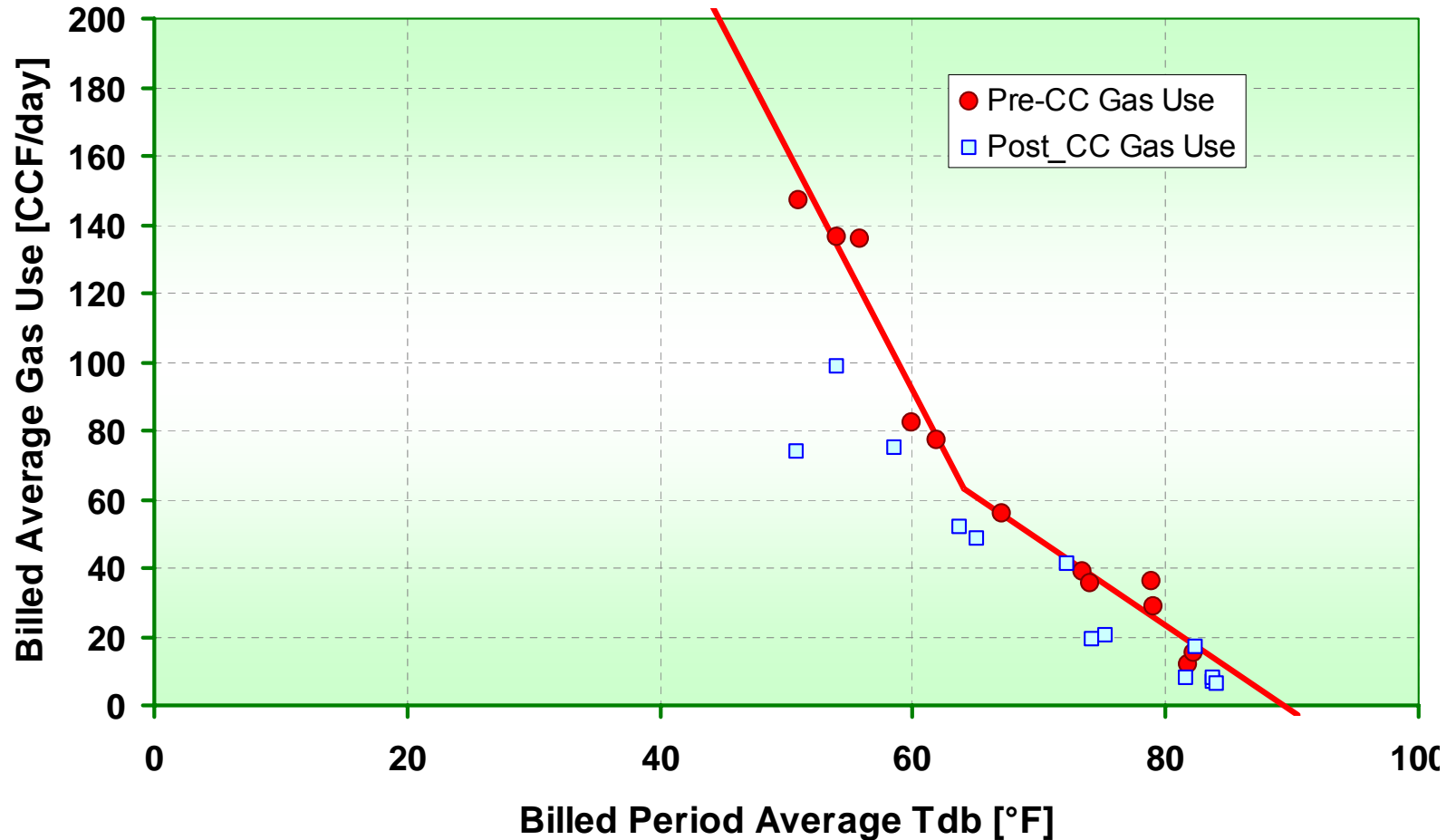
- Developed a baseline model
  - Based on utility bills and outside air temperature
- Savings determination
  - Difference between baseline estimate and actual utility bills
  - Utility rates of \$0.054 - \$0.081/kWh, \$5.68-7.95/kW, and \$5.82 - \$13.0/Mcf
  - Savings were determined from June 2005 Through October 2006



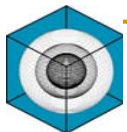
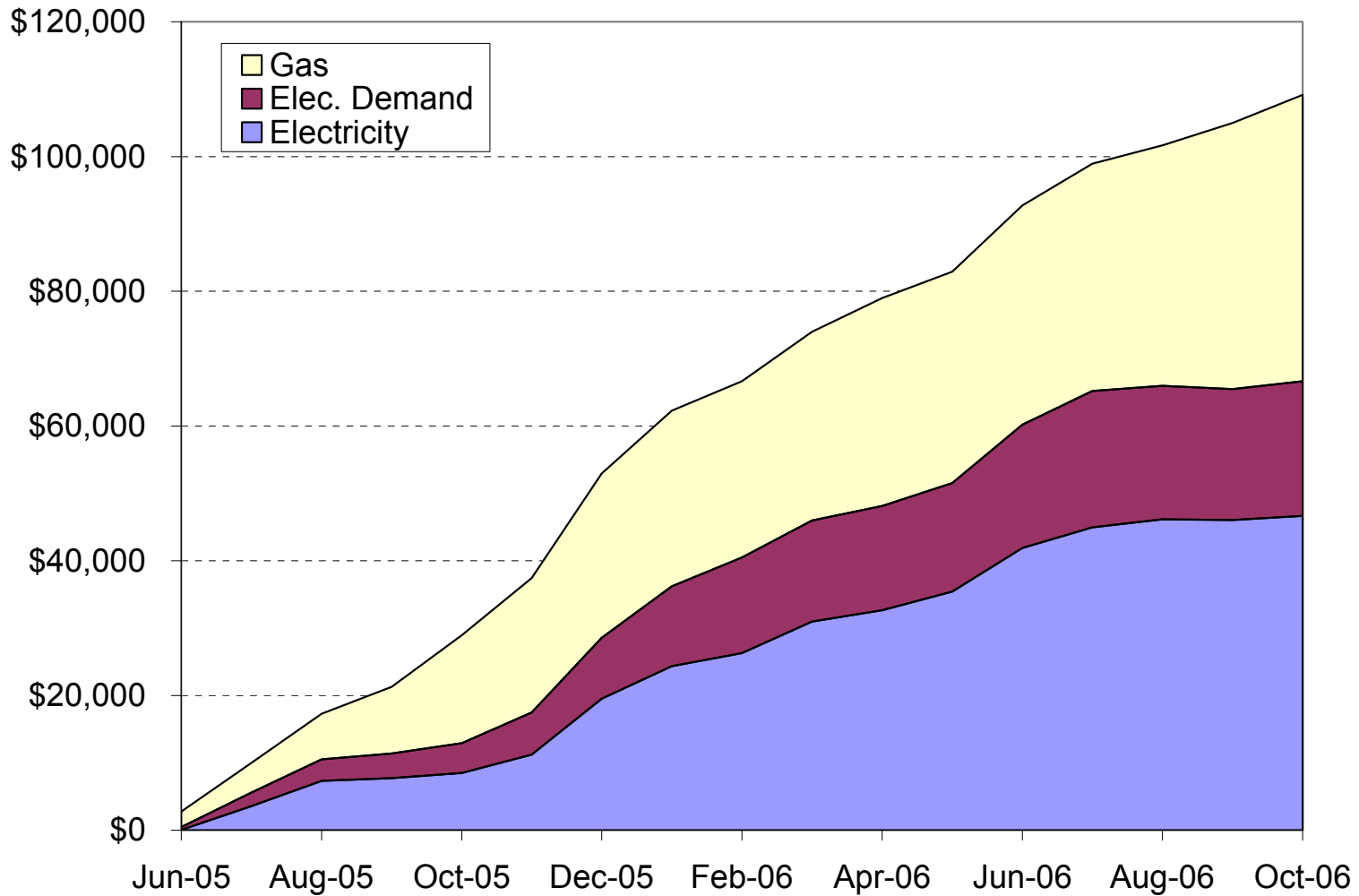
# Savings From CC<sup>®</sup>



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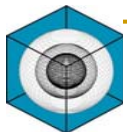
# Savings From CC<sup>®</sup>





# Savings From CC<sup>®</sup>

- Savings of 10-14% of total utility bills are achieved
- \$110,000 in energy savings were achieved in 16 months, based on actual utility bills and price



# Questions?

