



# Secondary Educational Facility

## Work Scope

EMAT completed an ASHRAE Level 2 energy audit of a high school in Houston, Texas.

## Facility Description

The building was constructed in 1905 and totaled 252,000 square feet. The building consists mainly of classrooms, offices, a gymnasium, and a kitchen. Lighting was observed to be mainly compact and linear fluorescent. Most restroom faucets still had their original high flow aerators.

The building was conditioned by variable air volume (VAV) air handlers, located in mechanical rooms throughout the building and on the roof. Some of the air handlers were multi-zone, constant volume units but the vast majority are VAV. The air handlers were ducted to allow in outdoor air. Outdoor air intake utilized airside economizing. Space cooling was provided by two air-cooled chillers.

Chilled water was supplied to the air handlers via a primary and a secondary loop. Both the primary and secondary loop were variable volume. Space heating was provided by two condensing boilers. Hot water, similar to chilled water, was supplied to the air handlers via a primary (constant volume) and secondary loop (variable volume). The building was controlled locally by a building automation system (BAS).

## Summary of Recommendations

The overall energy consumption of the building was average, receiving an ENERGY STAR® Score of 50. The first savings measure to be recommended was lighting retrofitting. Most of the building was still utilizing fluorescent lighting, so EMAT recommended upgrading to LED. Another straightforward ECM was to install low-flow faucet (0.5 GPM) aerators.

Although the building was setting back temperatures at night, the set points were very conservative. EMAT recommended the following: implement an optimal start strategy to determine morning warmup based off outside air and internal air temperatures, lower unoccupied heating set point to 50 °F, turn off all non-essential cooling equipment during unoccupied hours, and implement an optimal stop strategy to determine an acceptable time to shut HVAC equipment down before the end of occupancy. Other control strategies that were recommended included chilled water reset and hot water resets. The chillers were currently supplying a constant leaving water temperature; raising the leaving water temperature during part load conditions increases the efficiency of the chillers.

While the building has condensing boilers, they were not recognizing any of the benefits, as they were locked to supply 180 F water. Condensing boilers can recover heat from the waste exhaust as the returning water gets colder. Resetting the water temperature based on outdoor air temperature will allow the boiler efficiency to rise from around 80% to over 95%.

EMAT also recommended replacing the domestic hot water heaters with instantaneous units, as well as installing a rooftop PV system.



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### Potential Savings Identified

- Seven (7) Energy Conservation Measures (ECMs)
- Total annual savings of over 1.5 million kWh, 5,500 therms, and \$123,000 in cost savings
- Overall payback of less than 6 years