Energy Efficiency Building Retrofit Case Study: City of Houston Retrofit Program

OVERVIEW

With the support of the C40 and Clinton Climate Initiative (CCI), the Houston mayor's office developed and implemented a large-scale energy efficiency retrofit program to address all city buildings using C40/CCI's best practices energy performance contracting methodology. The city government has set a goal of reducing its energy demand from buildings by at least 25 percent through the program.

INTIAL C40/CCI ENGAGEMENT

As the implementation partner of the C40 organization, an association of large cities committed to taking action on climate change, C40/CCI has worked with the Houston mayor's office since May 2007, when the mayor became a founding member of C40/CCI's flagship Energy Efficiency Building Retrofit Program (EEBRP). Before deciding to participate in the retrofit program, the city government had an infrastructure upgrade program that planned and scheduled facilities improvements over a multi-year period. However, difficulties in financing upgrades from the capital improvement budget and in securing contract bids for comparatively small-scale improvements ($350,000-$750,000) meant that the city was falling behind on its planned upgrade schedule. As a result of participating in the EEBRP, the mayor's office asked C40/CCI to support the development of a holistic, multi-building financeable building retrofit program. In working with C40/CCI, the city government decided to pursue an energy services performance contracting (EPC) model, which allowed the city government to undertake a multi-building retrofit project that fully exploited energy and cost savings opportunities without large capital budget outlays. This program became a keystone of former Mayor Bill White's commitment to transform Houston from "energy capital" of the world to the "energy conservation capital" of the world and a foundation element in the current Mayor Annise Parker's initiatives.

ESCO SELECTION

The city government moved swiftly after initial engagement. In June 2007 the city issued a request for qualifications (RFQ) for the retrofit of 271 buildings totaling 11 million square feet. As a public entity, the city of Houston was subject to the Texas Government Code, which establishes procedures for procuring professional services. Under this code, a government entity must choose a service provider on the basis of qualifications only, with no consideration of price or scope of work in the selection process. Price is negotiated only after the city selects the intended contractor(s), and the contract performance must be verified by an independent third party. We worked with the city government to identify energy service companies (ESCOs) that could implement the retrofit project. Five interested firms responded to the RFQ, four of which were invited to the request for proposal (RFP) stage of the process. Here respondents were given the opportunity to demonstrate their creativity and innovation by proposing uncosted energy conservation measures for the same three representative buildings. An evaluation team verified references and vetted the energy conservation measures proposed by the respondents.

The city ultimately chose to award its contract to two ESCOs, Schneider Electric/T.A.C. and Siemens, based on the firms' experiences working with particular building typologies similar to Houston's building stock. Both Schneider Electric/T.A.C. and Siemens showed a proven track record in successful large-scale energy performance contracts and demonstrated great flexibility in adapting timelines to fit the requirements of occupied administrative buildings. In accordance with our best practices, Schneider Electric/T.A.C. and Siemens agreed to guarantee the energy savings resulting from the project over a period of up to 20 years; they also agreed to monitor savings in accordance with the International Performance Measurement and Verification Protocol (IPMVP). In mid-2008, the parties initiated the auditing and project definition process for the first tranche, or sub-projects, of approximately 1.5 million square feet of buildings.

FINANCING SOLUTION

C40/CCI helped the city government understand and consider the available financing alternatives. The city ruled out many options, including a bond election, which would have incurred delays and extra costs. Ultimately the city decided to finance the project utilizing Qualified Energy Conservation Bonds (QECBs). In doing so, the City became the first municipality in the State of Texas to take advantage of this funding option. QECBs are bonds that provide lower rates through tax credits which are transferred to the private sector bond purchasers after the projects meeting established energy reductions.

KEYS TO SUCCESS

The city's innovative approach to the project makes the city a prime example of building retrofit best practices.

- The city government committed all of its non-enterprise revenue[1] buildings to the initiative – 271 buildings, comprising 11 million square feet. By making this large-scale commitment up front, the city attracted many best-in-class firms who brought innovative and competitive solutions to the table early in the service procurement phase of the project. Moreover, by going through the procurement process just once, the city streamlined the selection of firms and accelerated project implementation – thereby expediting the delivery of energy and cost savings in the buildings as well.
- By grouping similar building types into discrete tranches, the city increased the program's odds of success. This tactic not only streamlined project management and finance but also took advantage of economies of scale and blended payback available only with multiple-building projects.
- The city defined its program goals (such as a minimum percentage of energy savings) as well as specific aspects of the buildings (such as envelope) that the ESCOs had to address, which gave the respondents guidance and pushed them to maximize innovation.
- The city was willing to take a long-term, lifecycle cost perspective on the program benefits (to the maximum allowed under Texas law), allowing a blended payback of up to 20 years.
- The city took a creative, open-minded approach to finding a set of financing solutions that would allow the projects to move *forward.*
- The city maintains quality control and minimizes project management demands by authorizing the work in each tranche on a schedule that is aggressive but that also allows for adaptation by building occupants and the ESCOs.

[1] These are buildings whose construction and operation are funded through general taxpayer monies rather than dedicated user fees. In this initiative, the City excluded airports, sporting event venues, and visitors and convention bureau facilities in which user fees provide ongoing revenue.

PROJECT CHALLENGES

Because the buildings under retrofit were occupied by city employees and in active use by the public, the project required a high degree of schedule coordination between the building occupants, the city, and the ESCOs. Schneider Electric/T.A.C. has made a concerted effort to avoid construction during peak hours of public demand. For instance, lighting retrofits were done at night, and major plant upgrades were made over weekends or holidays to avoid interruption of service to taxpayers.

The need to adhere to the public procurement requirements of the Texas Government Code posed another challenge to the city by restricting its ESCO selection criteria to respondents team qualifications only. The city was therefore unable to assess the relative cost of the proposals put forward by the ESCOs at the RFP stage. Moreover, the cost savings projected by the ESCOs after the audit must be reviewed by an independent third-party licensed professional engineer, adding another bureaucratic step to the process. The process of choosing a partner based on qualifications, not cost, was new to many stakeholders in the city and required significant education and demonstration before the procurement could proceed. In retrospect the city is convinced that selection by qualifications is by far preferable to selection by price. The City also is a firm believer in the value added by the independent third party review of the scope and cost of the identified energy conservation measures.

C40/CCI ROLE

C40/CCI supported the city government throughout the project development process, including:

- Introducing the concept of energy services performance contracting (EPC) as a mechanism for implementing large-scale energy efficiency retrofits without large capital expenses;
- Helping design a procurement process that utilized best practices in performance contracting and encouraged innovation;
- Drafting the RFQ and RFP for the city's review, approval, and processing;
- Identifying ESCOs that could support the best practices terms, and
- Providing and securing external financing advice for the project.

PROJECT AT A GLANCE

The City of Houston's retrofit program covers a portfolio of 271 city buildings encompassing 11 million square feet. Similar buildings are grouped into sub-projects, or tranches, and retrofit together; the implementation of each tranche is phased over time. The following provides an overview of the Schneider Electric's Tranche 3 retrofits.

Tranche 3: Libraries and General Government Buildings

ESCO: Schneider Electric
Project Size: 965,215 square feet/20 buildings
Project Cost: $8,234,709
Annual Energy Savings:
Electricity: 23% reduction (5,420,003 kWh)
Natural Gas: 46% reduction (70,477 Therms)
Water: 63% reduction
Annual Energy & Maintenance Cost Savings: 26% ($548,121)
Annual Emissions Reductions: 2,452 tons
Simple Payback: 14.6 years
Construction Duration: 12 months

In addition to saving energy and reduction of green house gas emissions these projects provide tangible upgrades of equipment that may otherwise be difficult for the client to address. The following are two examples of problems this phase was able to fix:

Alief Library

The library was previously built in two phases and served by two small air cooled chillers. The chillers were initially going to be included in the Phase 3 project, but one of them failed during the installation of Phase 2. The replacement of the failed chiller was added to our Phase 2 scope of work. We designed and specified the chiller to be large enough to serve the entire building. As part of the Phase 3 project, we removed the second chiller and installed chilled water piping and pumps to connect the entire building to the larger chiller we installed in Phase 2. The building is now served by only one chiller which greatly reduces their energy consumption and O&M costs.

HEC- Houston Emergency Center

The HEC is the city's 24hr emergency center. The building was served by three cooling towers that had reached the end of their useful life. The towers were in very bad shape and the city was aware that they could fail at any time. Potential major equipment failure at this facility put the City's ability to respond to the public in an emergency at risk. Schneider Electric included the replacement of the towers in our Phase 3 scope of work. The challenge that was encountered is that the building could not be shut down for any period of time. The HVAC equipment for their server rooms were served by the cooling towers. We were able to modify the piping in the building to allow us to connect temporary cooling towers to the central plant. Temporary cooling towers were brought onsite and Schneider Electric was then able to replace the failing cooling towers without any interruption to the operation of the central plant. During the installation, additional piping and the necessary isolation valves were added to allow the city to isolate each tower independently for cleaning, repair, or replacement. This proactive approach to the retrofit means that in the future the city will not face the same shut-down problems should they need to work on one of the towers.

1.	Lighting Improvements 19% Retrofitted T12 lamps and magnetic ballasts with T8 & T5 lamps with electronic ballasts. Installed occupancy sensors and controls. Replaced metal halide fixtures with T5 high bay technology. Upgraded exit lights to long-life LED lamps.
2.	Water Retrofits 3% Replace toilets, urinals, and aerators with new low flow fixtures in several facilities.
3.	HVAC Efficiency Improvements & Energy Management System Installation 4% Variable air volume retrofits, replace packaged rooftop units, split systems and air handling units with high efficiency units in several facilities. Upgrade boilers to high efficiency technology, direct replacement of air cooled chillers, and central plant re-piping.
4.	Central Plant Redesign & Replacement and Cooling Tower Redesign & Replacement 14% Complete redesign and replacement of chillers, boilers and pumps in 12 facilities Complete redesign and replacement of cooling towers at the Houston Emergency Center. Redesign included conversion of constant speed fans to variable fans and installation of isolation valves and piping for future maintenance operations..
5.	Building Commissioning & Automation Control Upgrades 60% Install and/or upgrade building automation systems in several buildings and implement schedules based on occupancy. Consolidation and upgrade of the City's control system servers for future expansion. Commissioning of the building systems operating parameters. Verification of the control system operations and sequences.

KEY CONTACTS

C40
Brian Yeoman
byeoman@C40.org
HTTP://www.C40.org

City of Houston
Lisa Lin
Sustainability Manager – Mayor's Office
Lisa.lin@houstontx.gov
901 Bagby, Houston, TX 77020

Schneider Electric/T.A.C.
Roger Flud
Sales Team Leader, Energy Solutions
roger.flud@schneider-electric.com