

Energy Efficiency Building Retrofit Case Study: City of Houston Retrofit Program, Tranche 2 Results

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.

INITIAL 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 on an interim basis by issuing tax-exempt commercial paper; it will later refinance the paper with a general obligation bond.

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 revenue¹ 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 and 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. and Siemens 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 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.

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 Siemens' and Schneider Electric's Tranche 2 retrofits.

Siemens – Solid Waste

ESCO: Siemens

Project Size: 119,502 square feet/5 buildings

Project Cost: \$1,103,822

Annual Energy Savings:

Electricity: 24% reduction (886,469 kWh)

Natural Gas: -1% reduction (-24 MMBtu)

Water: 0% reduction

Annual Energy & Maintenance Cost Savings: 23% (\$122,918)

Annual Emissions Reductions: 289 tons

Simple Payback: 9 years

Construction Duration: 8 months

Siemens: Solid Waste Energy Conservation Measures AND CONTRIBUTION TO TOTAL SAVINGS

1.	HVAC Efficiency Improvements & Energy Management System Installation Replace packaged rooftop units, split systems, chillers, chilled water pumps, boilers, and air handling units with high efficiency units in several facilities. Install and/or upgrade building automation systems in several buildings and implement schedules based on occupancy.	61%
2.	Lighting Improvements Retrofitted all T12 lamps and magnetic ballasts with T8 & T5 lamps with electronic ballasts. Installed occupancy sensors and controls as appropriate.	39%

Siemens – Health & Human Services Department

ESCO: Siemens

Project Size: 939,141 square feet/24 buildings

Project Cost: \$6,951,686

Annual Energy Savings:

Electricity: 23% reduction (5,717,344 kWh)

Natural Gas: 4% reduction (602 MMBtu)

Water: 9,689 kgal reduction

Annual Energy & Maintenance Cost Savings: 22% (\$852,995)

Annual Emissions Reductions: 1,903 tons

Simple Payback: 8.1 years

Construction Duration: 12 months

Siemens: HHSD Energy Conservation Measures AND CONTRIBUTION TO TOTAL SAVINGS

1.	HVAC Efficiency Improvements & Energy Management System Installation Replace packaged rooftop units, split systems, chillers, chilled water pumps, boilers, and air handling units with high efficiency units in several facilities. Install and/or upgrade building automation systems in several buildings and implement schedules based on occupancy.	64%
2.	Lighting Improvements Retrofitted all T12 lamps and magnetic ballasts with T8 & T5 lamps with electronic ballasts. Installed occupancy sensors and controls as appropriate.	16%
3.	Plumbing Fixture Upgrades Replace toilets, urinals, and aerators with new low flow fixtures in several facilities.	10%
4.	Holcombe Lab – New EMCS & LCS Install new energy management system and laboratory control system at the newly constructed Holcombe Laboratory.	7%
5.	Solar Window Film Install reflective solar window film at (2) facilities.	4%

Siemens – Parks & Recreation Department

ESCO: Siemens

Project Size: 209,750 square feet/2,966 acres/34 locations

Project Cost: \$12,273,431

Annual Energy Savings:

Electricity: 12% reduction (2,130,512 kWh)

Natural Gas: -3% reduction (-113 MMBtu)

Water: 35% reduction (46,593 kgal)

Annual Energy & Maintenance Cost Savings: 19% (\$1,081,138)

Annual Emissions Reductions: 703 tons

Simple Payback: 11.4 years

Construction Duration: 16 months

Siemens: PARD Energy Conservation Measures AND CONTRIBUTION TO TOTAL SAVINGS

1. Sports Lighting Upgrades	39%
Replace old sports lighting systems with new, Musco Sports lighting systems equipped with web based controls.	
2. Irrigation Upgrades	35%
Replace irrigation controllers with ET-based controllers and upgrade irrigation distribution system in several City Parks	
3. HVAC Efficiency Improvements & Energy Management System Installation	14%
Replace packaged rooftop units, split systems, chillers, chilled water pumps, boilers, and air handling units with high efficiency units in several facilities. Install and/or upgrade building automation systems in several buildings and implement schedules based on occupancy.	
4. Lighting Improvements	11%
Retrofitted all T12 lamps and magnetic ballasts with T8 & T5 lamps with electronic ballasts. Installed occupancy sensors and controls as appropriate.	

Schneider Electric – Tranche 2: Police Stations & General Governmental Buildings

ESCO: Schneider Electric

Project Size: 1,934,035 square feet/15 buildings

Project Cost: \$23,148,472

Annual Energy Savings:

Electricity: 36% reduction (11,566,294 kWh)

Natural Gas: 41% reduction (73,169 Therms)

Water: 14% reduction

Annual Energy & Maintenance Cost Savings: 31% (\$1,964,842)

Annual Emissions Reductions: 7,218 tons

Simple Payback: 11.8 years

Construction Duration: 20 months

Schneider Electric: Tranche 2: Police Station and General Governmental Buildings Energy Conservation Measures AND CONTRIBUTION TO TOTAL SAVINGS

1.	Lighting Improvements Retrofitted all T12 lamps and magnetic ballasts with T8 & T5 lamps with electronic ballasts. Installed occupancy sensors and controls.	29%
2.	Water Retrofits Replace toilets, urinals, and aerators with new low flow fixtures in several facilities.	6%
3.	HVAC Efficiency Improvements & Energy Management System Installation Replace packaged rooftop units, split systems, direct replacement air cooled chillers, boilers, and air handling units with high efficiency units in several facilities.	9%
4.	Central Plant Redesign & Replacement Complete redesign and replacement of chillers and pumps in 7 central plants. Some central plants also received upgraded cooling towers. Redesign included conversion of constant flow pumping to variable flow and implementation of latest technology magnetic bearing chillers.	34%
5.	Building Automation Control Upgrades 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.	22%

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