EMISSIONS REDUCTION PLAN

Updated

December 2009

Executive Summary:

The City of Houston's goal over the past six years has been to make the city the energy efficiency capital of the world. Under the Mayor Bill White's leadership the City of Houston has led by example. Several policies and projects aimed at simultaneously reducing expenses and emissions have been implemented.

In September 2008, the Multi-Pollutant Emissions Reduction Plan (MERP) was released to document the 2005 baseline government greenhouse gas (GHG) emissions and 2010 GHG emission reduction goals by project/strategy. The MERP set forth a list of measures to be adopted by City of Houston departments that reduce emissions through a combination of efficiencies, operational changes, and use of renewable energy. The goal was to have these voluntary measures implemented by 2010.

This document presents a summary of the 14 strategies undertaken by the City under and additional projects that have been developed since the publication of the MERP to reduce emissions and costs. This is an update as to the status of the projects listed in the MERP as of December, 2009. Each of the fourteen strategies is assessed for progress in reaching emission reduction goals. The summary table below gives a quick summary of the GHG reductions and project status.

It is anticipated that the MERP will be regularly updated to keep track of emissions reductions and cost savings as a result of the innovative projects undertaken by each City department.

Strategy	2005 GHG Baseline	2010 GHG Goal	Current Progress	% Complete	Estimated Completion Date
Wind Energy	1024017	824838	824838	100%	Complete
Facility Retrofits	85964	68183	0	0%	2012
LED Traffic Signals	17295	5284	11692	84%	2010
HAS	198404	218334	218334	100%	Complete
Lighting Retrofit	25186	20220	20220	100%	Complete
Vending Misers	750	563	563	100%	Complete
LEED Certification	Emissions Reductions Targets Not Quantified			100%	Complete
CHP at WWTP	Emissions Reductions Targets Not Quantified			0%	Date Unavailable
Fleet Use and Replacement	88522	96761	90864	100%	Complete
Hybrid Initiative	9601	8942	9186	97%	2010
TERP	64-77% reduction in NOx for completed vehicles				Ongoing
Emerging Technologies	Emissions Reductions Targets Not Quantified				Ongoing
City Recycling	Emissions Reductions Targets Not Quantified				Ongoing
Residential Recycling	Emissions Reductions Targets Not Quantified				Ongoing

Strategy #1: Wind Energy

Responsible Department: General Services Department

Status: Goal Achieved

Completion Date: 2009

Source of Update: Gavin Dillingham, GSD

Table:

	Pollutant (tpy)		
	GHG	NOx	VOC
2005 Emissions Inventory	1,024,017	1,703	100
2010 Business As Usual	1,139,464	1,895	111
Wind Energy Purchase	-314,626	-431	-13
2010 Goal	824,838	1,464	98
December 2009 Achieved	824,838	1,464	98

Source: The Energy Division of the General Services Department provided the electricity used in kilowatt-hours. ICLEI's CACP software generated the emissions outputs shown in this Table based on 50 megawatts of wind energy.

The MERP established a goal of purchasing 50 MW of renewable electricity by the year 2010. In 2007, the City negotiated a contract for 30 MW of wind energy. In both 2008 and 2009 the City negotiated an additional 10 MW of wind energy. The contract gives the City the ability to purchase up to 80 MW of renewable power, which represents 50% of the City's annual power usage as of 2005.[1]

Wind energy is a domestic source of power, and is in abundant supply. It is also one of the lowest-priced renewable energy sources available today, costing between four and eight cents per kilowatt-hour. Before the wind energy contract was signed, the City spent approximately 9.1 cents per non-renewable kWh. Under the wind energy contract negotiated under the leadership of Mayor White, the City spends 7.5 cents per renewable kWh. This is a **cost savings** of 1.6 cents per kWh or **$32.85 million** on 50 MW of energy. Thus, not only was this wind energy purchase better for the environment, but reduced expenses for the City of Houston.

The City's move to wind power comes as the nation recognizes Texas as one of the top producers of wind power, and as regulators forecast a substantial increase in the demand and use of wind energy over the next twenty-five years. Currently, the City of Houston is the number one municipal purchaser of renewable energy and ranks sixth nationally (ahead of the U.S. Air Force and only behind Fortune 500 companies Intel, PepsiCo, Whole Foods, Kohl's, and Dell).[2]

Strategy #2: Facility Retrofits with Energy Savings Company Financing

Responsible Department: General Services Department

Status: Projected to achieve 58% of the 2010 goal by 2012

[1] 80 MW is equivalent to 700,800,000 kWh and 503,402 tpy of GHG emissions savings.
[2] http://www.epa.gov/grnpower/toplists/top50.htm

Project Update in Brief:
The goal in the MERP was to retrofit 271 City of Houston facilities, totaling 11 million square feet, based upon recommendations from the ESCOs. The guaranteed energy savings would pay for the retrofits. In 2008 the Convention and Entertainment Facilities (CEF) department withdrew nine buildings from the retrofit program. These buildings included the George R. Brown Convention Center, Jones Hall, and the Wortham Theater. Together these buildings represent 3.9 million square feet of building space. Without the inclusion of these buildings, the original goal will not be achieved.

The modified project aims to retrofit 7.1 million square feet of City building space, which includes 262 facilities. Currently, there are two ESCOs working on the project – TAC and Siemens. Both companies follow the same process for completion - an assessment audit and then the implementation. Currently, both companies are either in the audit or implementation stage for Phase I and II; however, Phase III for both companies is still being formulated. The progress and estimated completion dates are provided in the table below. Current kWh saved and therefore emissions reduced are not yet available as the projects are still in progress; however, based on the plans underway, we expect to achieve the full 30% reduction for the 7.1 million square feet of retrofitted space. Upon each phase completion, the emissions saved will be reported by GSD. Phase I includes several police stations and 611 Walker; Phase II, includes Fire Station 50 and the Metropolitan Multi-Service Center. Phase III includes City Hall, City Hall Annex, 1200 Travis, and additional police stations. Phase IV includes Parks and Recreation, Solid Waste and City Health Facilities.

Estimated Completion Date/Progress:

Phase	Contractor	Current Stage	Square Feet Anticipated	Square Feet Completed	Estimated Completion Date
1	TAC	Audit complete, 90% of construction complete	1.2 million	1.08 million	1st quarter 2010
2	Siemens	30% of audit complete	38,000	0	1st quarter 2010
3	TAC	Audit complete, passed Council 12/2009, kickoff planned in January 2009	1.8 million	0	600 days after January 2010
4	Siemens	90% of audit complete	1.2 million	0	Beyond 2010

Source of Update: Gavin Dillingham, GSD

Table: The emissions reduction table is not available for current progress because none of the phases have been completed. However, by approximately 2012, it is expected that the emissions reductions will be in line with the emissions reductions presented in the table below. It is important to note that the emissions reductions estimated in the MERP assumed 11 million square feet would be retrofitted for a savings of 34,369,963 kWh over the life of the project. However, the contract was reduced to 7.1 million square feet (and may increase as more departments become involved). Therefore, assuming that approximately 3.12 kWh/square foot would be saved from the original plan, by 2012, the 7.1 million square feet of space can achieve a 22,184,249 kWh savings. The corresponding emissions reductions are recorded below.

GOAL TABLE	Pollutant (tpy)		
	GHG	NOx	VOC
2005 Emissions Inventory	85,964	136	3
2010 Business As Usual	95,656	151	3
2010 Estimated Reduction	-27,472	-38	-1
2010 Goal	68,183	114	2
2012 Revised Reduction	-15,935	-22	-1
2012 Revised Emissions	79,721	129	2

Sources: The Energy Division of the General Services Department and the Mayor's Office of Environmental Programming provided the energy used in kilowatt-hours of electricity. ICLEI's CACP software generated the emissions outputs. 2010 Business as Usual emissions and emissions reduced are extrapolated using the projected population growth rate (11.3%). 2012 Revised Reduction used a kWh savings of 22,184,249 kWh (calculated by estimating that 3.12kWh/square foot are reduced from 2010 goal = 34,369,963/11,000,000). 2012 Goal calculated by subtracting 2012 Revised Reduction from 2010 Business as Usual.

Strategy #3: LED Traffic Signals

Responsible Department: Public Works and Engineering & General Services Department

Status: In Progress—84% complete in 2009 –will be 100% complete in 2010

Project Update in Brief: The MERP estimated that 2,450 signalized intersections would be replaced with LED traffic signals by 2010 producing a 2.7 million kWh electricity savings annually. Currently, there are 2,028 LED traffic signals that have been completed and 398 left to be replaced – there are a total of 2,426 signalized intersections in the City to date and a decrease of 24 signalized intersections. 1,413 were completed by Siemens and the remaining lights were completed as a result of Hurricane Ike (accelerated replacement rate due to Hurricane Ike). Therefore, the table below illustrates the emissions reductions as planned in the MERP, currently, and expected (upon completion). As the table indicates, due to the LED conversion and decrease in the number of intersections, the City is 84% toward the 2010 revised goal. The City is expected to reach the revised 2010 goal by late 2010.

Estimated Completion Date: Late 2010

Source of Update: Jeff Weatherford, PWE

Table:

	Pollutant (tpy)		
	GHG	NOx	VOC
2005 Emissions Inventory*	17,295	27	1
2010 Business As Usual*	19,245	30	1
2010 Estimated Reduction*	-13,960	-19	-1
2010 Goal*	5,284	11	0
2009 Current Reduction**	-11,692	-14	0

*The Energy Division of the General Services Department provided the electricity used in kilowatt-hours. ICLEI's CACP software generated the emissions outputs shown here, based on 75% efficiency gained from LEDs. 2010 Business as Usual emissions are extrapolated using the projected population growth rate (11.3%).

**The 2009 Current Reduction was calculated by estimating the average kWh reduction per intersection and multiplying the current number of intersections complete (2028) by this estimate (19,434,000/2,450 = 7,932); resulting in a 16,276,966 kWh current electricity reduction.

Strategy #4: Houston Airport System's Environmental Initiatives

Responsible Department: Houston Airport System

Status: Complete

Source of Update: James Parise, HAS

Project Update in Brief: The energy reduction measures originally identified by HAS (such as installing motion detectors for lighting specific interior areas, installing control measures such as photo cells, clocks and/or timers on all outside lighting, cutting the energy supply to unoccupied retail space, and requiring lights in electrical closets be turned off when not in use) mostly have been implemented. These energy reduction strategies resulted in 11,126,996.06 kWh per year of energy savings. To address the shortfall, HAS identified additional energy reduction strategies to supplement the original measures.
Additional measures targeted HVAC systems of the HAS Administration Building and the Technical Services Buildings. HVAC systems are now shut off when the buildings are not in use. Energy reduction numbers were provided by the Airport System. As the table indicates, the HAS achieved the goal established in the MERP. It is important to note that the Houston Airport System is experiencing a period of accelerated growth. This needs to be monitored to ensure that the progress achieved to date is not negated by expected growth.

Energy Reduction Strategies	kWh Reduced
HAS Admin Building HVAC	1,506,738
HAS Technical Services Building	629,627
Reductions from original MERP list	916,289
Total Energy Reductions	3,052,655
2010 Goal	3,050,190

Table: Below is the emissions table that HAS expected to achieve by 2010 on an annual basis and the last row presents the current emissions increase from 2005. It is important to note that travel patterns and air traffic impact these numbers significantly and must be taken into consideration when judging these numbers.

Table:

For Houston Airport System	Pollutant (tpy)		
	GHG	NOx	VOC
2005 Emissions Inventory	198,404	308	9
2010 Business As Usual	220,772	343	10
2010 Expected Reductions	-2,438	-3	0
2010 Goal	218,334	339	10

Sources: The Houston Airport System provided the energy savings. ICLEI's CACP software generated the emissions outputs. 2010 Business as Usual emissions and emissions reduced are extrapolated using the projected population growth rate (11.3%).

Strategy #5: Citywide Lighting Retrofit Project

Responsible Department: General Services Department

Status: Goal Achieved

Completion Date: 2007

Source of Update: Felix Johnson, GSD

Project Update in Brief: The General Services Department instituted a supply-side energy management program in 2006. The program includes the implementation of a citywide lighting retrofit and replacement project. The project involved replacing 8,000 tubular 1½" (T12) fluorescent lamps and magnetic ballasts with energy-efficient tubular 1" (T8) twenty-eight watt lamps, electronic ballasts, and compact fluorescent lights. The City upgraded the lighting at several city facilities, including the administrative building of the Houston Fire Department and the Central Police Station Complex. This project was completed in 2007. The 9.8 million kWh savings are achieved annually since the completion of the project.

Table:

	Pollutant (tpy)		
	GHG	NOx	VOC
2005 Emissions Inventory	25,186	40	1
2010 Business As Usual	28,025	45	1
Lighting Retrofits	-7,806	-11	0
2007 Achieved	20,220	33	1

Sources: The Energy Division of the General Services Department provided the energy savings in kilowatt-hours of electricity. ICLEI's CACP software generated the emissions outputs. 2010 Business as Usual emissions and emissions reduced are extrapolated using the projected population growth rate (11.3%).

Strategy #6: Energy Efficient Vending Machines and Vending Misers

Responsible Department: General Services Department

Status: Goal Achieved

Source of Update: Brian Yeoman, CCI

Project Update in Brief: The City purchased 186 energy misers, energy saving devices, for cold beverage vending machines in City facilities. Dr. Pepper Co., the City's vending machine franchisee, installed the misers at no cost. This low cost energy saving measure saves 265,303 kWh/year. The City also requested that FreshBrew, the City's snack machine vendor, remove the light bulbs in all snack machines. At current usage rates, this cost-free energy saving measure saved the City 74,285 kWh/year.

Estimated Completion Date: 2007

Table:

	Pollutant (tpy)		
	GHG	NOx	VOC
2005 Emissions Inventory	750	1	0
2010 Business As Usual	835	1	0
Vending Miser and Energy Efficient Vending Machines	-272	0	0
Achieved	563	1	0

Sources: The Energy Division of the General Services Department provided the energy used in kilowatt-hours of electricity. ICLEI's CACP software generated the emissions outputs. 2010 Business as Usual emissions and emissions reduced are extrapolated using the projected population growth rate (11.3%).

Strategy #7: LEED Certification for Construction of City Buildings

Responsible Department: General Services Department

Status: Goal Achieved

Source of Update: Gavin Dillingham, GSD

Project Update in Brief: The City adopted the LEED certification standards for new construction of City-owned facilities and large retrofits in 2004. To date, 1 City building has achieved LEED certification – Looscan Neighborhood Library. The City is pursuing LEED certification for another 31 facilities, which include neighborhood and branch libraries, several fire stations, a multi-service center, the Parks Department headquarters, a fleet maintenance facility, among other facilities. By the end of January 2010, 13 of these facilities will have achieved substantial completion . In addition, the City has designed and built 6 facilities that comply with LEED.

We will update this Plan to include the emissions reductions attributable to energy savings obtained through LEED certification as reliable data becomes available.

Strategy #8: Combined Heat and Power System at Wastewater Treatment Facilities

Responsible Department: Public Works Department

Status: In Progress

Source of Update: Karl Pepple, MYR

Estimated Completion Date: Not Available.

Project Update in Brief:
A feasibility study already completed indicates that a CHP system could be introduced into the sludge drying process, by incorporating a natural-gas turbine generator and hot oil recovery system, which could reduce electricity use by 74% or 10,800,000 kWh. Although natural gas use will increase by 39% or 104,000 MMBtu, the emissions reductions are still expected to be 1095 tpy of CO2e due to the great reductions in electricity use. At a low electricity cost of 7.5 cents per kWh, this reduction in electricity use will result in a cost savings of at least $810,000 per year.

Grants are being sought to implement a CHP facility at Almeda Sims. Additionally, the PWE department has taken initiative to pursue a comprehensive energy efficiency program at the wastewater treatment plants. As part of this

program, CHP systems could be considered at several facilities. No additional details are available at the drafting of this document.

Strategy #9: Fleet Use and Replacement

Responsible Department: Finance

Source of Update: Bruce Haupt, FIN

Status: Goal Achieved

Project Update in Brief: The City of Houston is replacing older, high mileage equipment in order to reduce current and future maintenance costs, increase vehicle reliability, and decrease emissions. In February 2007, the City engaged Mercury Associates, Inc. to develop a long-term fleet replacement plan and make the business case for accelerated fleet replacement. One of the key findings in Mercury's report is that fleet renewal, or accelerated replacement, minimizes the total cost of ownership.[3] Replacing equipment on a regular schedule is more cost-effective than making marginal investments in the maintenance and upkeep of older equipment. Not only is fleet renewal more cost effective, but also by simply replacing older equipment, which tends to have fewer emission controls, the City will reduce its emissions.

Currently, the City is engaging in three specific measures to achieve this goal of Fleet Use and Replacement – Reduce fleet size, Rejuvenate the current fleet, and Better track/monitor fleet. In order to reduce the fleet size, the City is implementing a "motorpool" system to better consolidate the current fleet. Fleet rejuvenation is taking place by working with specific departments to replace the oldest vehicles in order to receive the greatest emissions reductions. Also, the City has applied for several grants to replace the aging fleet; in particular the City was recently awarded a $2.4 million competitive Clean Diesel Grant by Region 6 of the EPA under the 2009 American Recovery and Reinvestment Act (ARRA). This funding will be used to purchase 34 new diesel or diesel/electric vehicles, including the acceleration of the purchase of the aforementioned HLA systems. Once this program and funding is fully implemented, the GHG and cost savings will be recorded and reported to the EPA. Finally, better monitoring and tracking of the fleet can take place with the newly installed Asset Works – M5 Fleet Focus software. This software allows for more precise and accurate tracking and monitoring than the older software. This will enable reporting and fleet replacement analysis to take place more frequently and with greater accuracy.

Table: The City of Houston's mobile emissions goals have been reached through the above-mentioned measures as indicated in the inventory of the City's entire fleet below.

Mobile Emissions Overall	Pollutant (tpy)		
	GHG	NOx	VOC
2005 Emissions Inventory	88,522	225	206
2010 Business As Usual	98,502	250	229
2010 Estimated Reductions	-1,741	-13	-17
2010 Goal	96,761	237	212
2009 Current Inventory (as of 11/17/09)	90,864	449	198
% Below 2010 Goal	-6%	89%	-7%
% Below 2010 BAU	-8%	80%	-14%

Source: The Finance Department provided the gallons of fuel consumed. ICLEI's CACP software generated the emissions outputs shown here.

[3] Report on Fleet Renewal, Right Sizing, and Cost Reduction Opportunities for the General Services Department. Mercury Associates, Inc. (August 2007)

Strategy #10: The Mayor's Hybrid Initiative

Responsible Department: Finance

Status: In Progress—80% of goal achieved in 2009

Source of Update: Bruce Haupt, FIN

Estimated Completion Date: 2010

Project Update in Brief: In 2005, the City implemented the Mayor's Hybrid Initiative. Under this program, 50% of the City's non-specialty, light-duty fleet[4] of approximately 1,600 vehicles will be replaced with their gasoline/electric hybrid equivalents[5] by the year 2010. Initially, only compact and mid-size sedans were scheduled for replacement with a hybrid equivalent. As other models of hybrids have become available, the City has expanded its hybrid program. In 2006, we began replacing gasoline-only 4 x 4 compact sport utility vehicles with Ford Escape Hybrids. As of November 2009, the City has 691 hybrid vehicles in its fleet or 43% of the non-specialty fleet. The major challenge the City faced in achieving the goal of 50% of non-specialty fleet was (1) vehicle availability and (2) funding challenges. It is important to note that in the same time frame as the Mayor's Hybrid Initiative, the Toyota Prius (the City's major hybrid purchase) had a sharp increase in demand, and Toyota slowed the sale of the Toyota Pruis at the lower government rate to Houston and increase sales to the public (since profit margins were higher). Thus, the City was forced to slow the growth of the hybrid fleet. Despite this challenge, the program has returned to the intensity and purchasing power it began with.

Mayor's Hybrid Initiative Quick Facts

Total Vehicles	12,069
Total Light Duty Vehicles	7,728
Total Hybrids (excluding golf carts)	691
Total Hybrids (including golf carts)	750
Total Priuses	498

Table: Although the City of Houston has not yet reached its goal, the City is 86% toward the goal of 50% of the non-specialty fleet. Using this ratio, the table below indicates the current status of this initiative.

Hybrid Emissions As of November 2009	Pollutant (tpy)		
	GHG	NOx	VOC
Light Duty Fleet 2005 Emissions	9,601	24	28
2010 Business as Usual	10,683	27	31
2010 Estimated Reduction	-1,741	-13	-17
2010 Goal	8,942	14	14
Current 2009 Reduction	-1497.3	-11	-14.6
Current 2009 Emissions	9,186	16	16
Remaining Emissions Reductions To Achieve 2010 Goal	244	2	2

Sources: The General Services Department provided the gallons of fuel consumed and hybrid purchase frequency data. ICLEI's CACP Software generated the emissions outputs shown here. 2010 Business as Usual emissions and emissions reduced are extrapolated using the projected population growth rate (11.3%). 2009 Reduction estimates calculated by multiplying 2010 estimated reduction

[4] Light Duty Fleet includes 1,600 non-specialty, non-emergency, light-duty sedans and sport utility vehicles.

[5] Hybrid equivalents are gasoline/electric hybrid substitutes for traditional gasoline-only vehicles that provide significant improvements to fuel economy (i.e. 25-50% higher miles per gallon than the average for the vehicle class).

by 86% (the ratio toward goal COH has achieved). 2009 Emissions is 2010 BAU minus 2009 Reduction. Remaining emissions is 2010 Goal minus 2009 emissions.

Strategy #11: Texas Emissions Reduction Plan

Responsible Department: Finance

Status: In Progress

Source of Update: Bruce Haupt, FIN

Estimated Completion Date: NA

Project Update in Brief: The State of Texas appropriated approximately $150 million in Texas Emission Reduction Plan (TERP) funds to subsidize local and private efforts to reduce NOx emissions and improve air quality in ozone non-attainment regions including Houston.[6] In October 2007, the City of Houston and five other local entities organized the TERP Working Group.[7] Since the Houston-Galveston-Brazoria non-attainment region still faces considerable challenges to reaching attainment of the EPA's ozone standard, the TERP Working Group intends to secure substantial funding from the TERP allocation through a third party contract between the Houston-Galveston Area Council of Governments (H-GAC) and the Texas Commission on Environmental Quality (TCEQ). These grant funds will be used to accelerate fleet replacement as described above. We have identified approximately 200 pieces of diesel equipment that may qualify for TERP funding. Just $2 million in grant funds can reduce NOx emissions by more than 200 tpy. The City has already filed applications with the TCEQ for Emission Reduction Rebate Grants for the replacement of six fire pumper trucks that are between 12 and 16 years old. These replacements will emit 404 pounds per year (or 35%) less NOx. To date the City has received 8 new vehicles under this program, with funds of approximately $186,953.60. Specific reductions for each vehicle are unavailable, but the technologies installed all reduce NOx by 64-77%.

Strategy #12: Emerging Technology

Responsible Department: General Services Department

Status: In Progress

Source of Update: Bruce Haupt, FIN

Estimated Completion Date: NA

Project Update in Brief: The City is taking advantage of opportunities to utilize emerging clean emissions technology; four strategies are outlined below.

- In the past, the City collaborated with the University of Houston's College of Engineering to help reduce emissions from the City's fleet of nearly 2,800 diesel-powered units. Together, the City and the University,

[6] The Houston-Galveston-Brazoria non-attainment region includes Montgomery, Waller, Harris, Fort Bend, Liberty, Chambers, Galveston, and Brazoria counties. The EPA designated the HGB region as non-attainment because air pollution levels consistently exceed the national ambient air quality standards for 8-hour ozone. Additional information can be found at the EPA's website: http://www.epa.gov/oar/oaqps/greenbk/index.html.

[7] TERP Working Group members include the City, Harris County, the Port of Houston Authority, the Metropolitan Transit Authority, the Greater Houston Partnership, and the East Harris County Manufacturers Association.

created a local diesel emissions testing laboratory, which will apply for emissions verification certification from the EPA. In addition, the City was an early adopter of TexLED, and used it exclusively well before it was mandated.

- In 2008, the City took delivery of two (2) first generation, Peterbilt diesel/electric hybrid dump trucks. The Public Works and Engineering Department will utilize the five cubic yard trucks to transport right of way repair and construction materials. The incremental cost of the hybrid technology was covered by discounts from the manufacturer and dealer. More recently, the City is working with the New Technology Research and Development Program to purchase and evaluate Eaton HLA hybrid garbage collection trucks. The Eaton system is a parallel hybrid hydraulic regenerative braking (HLA) system. It converts energy normally lost during braking and stores it in the form of high-pressure hydraulic fluid. This fluid is then used to provide a positive torque to the driveline in a subsequent acceleration event. The HLA system has demonstrated 20-30% better fuel economy in refuse collection applications. Hybrid drive trains have shown the ability to simultaneously reduce fuel consumption and pollutant emissions. In the heavy-duty refuse trucks on which this project will be focused, the hybrid hydraulic system is anticipated to reduce NOx, particulate matter, hydrocarbons, and carbon monoxide emissions by 25% or more. Under the program, the City of Houston would purchase new Peterbilt chassis, refuse compaction bodies, and other equipment normally on their refuse trucks. The incremental cost of hybridization would be paid for under the program funding. In other words, the City gets a hybrid truck for the cost of a standard truck. The City will evaluate this technology for one-year, with the option to return the truck to its non-hybrid configuration or have a production HLA system installed.

- In addition, the City was recently awarded a $2.4 million competitive Clean Diesel Grant by Region 6 of the EPA under the 2009 American Recovery and Reinvestment Act (ARRA). This funding will be used to purchase 34 new diesel or diesel/electric vehicles, including the acceleration of the purchase of the aforementioned HLA systems. Once this program and funding is fully implemented, the GHG and cost savings will be recorded and reported to the EPA.

- In addition the City recently launched the Plug-In Hybrid Electric Vehicle (PHEV) Pilot Project with Reliant Energy. This project allows the City to purchase 15 PHEVs and install 15 charging stations (for public and private use) around the City. This project along with the City's aforementioned other emissions reduction strategies are reducing the City's mobile emissions.

Strategy #13: Recycling Program for All City Facilities

Responsible Department: Solid Waste Department

Status: In Progress

Source of Update: Sarah Mason, MYR

Estimated Completion Date: 2010

Project Update in Brief: This program will systematize recycling across all City facilities. Internal and external contract issues delayed the rollout of the program to late fall 2009. However, as of December 1, 2009 all phase one facilities received new recycling bins. This new recycling program expanded the recycling opportunities at City building and facilities to include plastics # 1- 7 (except Styrofoam and film bags); aluminum and bi-metal cans; glass and cardboard in addition to all types of paper. The program will be administered by the Solid Waste Management Department and the

vendor, AbitibiBowater, Inc. Key components of the contract include monthly data collection of the amount of material generated at each City location. As the program develops, we believe that this streamlined approach will reduce costs associated with waste disposal, divert material from landfills, reduce energy consumption in upstream commodity manufacturing by offering recycled feedstock, and reduce emissions generated by landfill decomposition. The goal of this program is to increase waste diversion rates to 25% for paper, and 10% for other materials from City facilities. While both of the diversion goals are conservative, the materials diverted by this measure will save more than 46,000 cubic yards of landfill space per year and the associated disposal costs.[8]

Table: Because the program has not yet started, the diversion rate and thus GHG reduction is uncertain. Therefore the table below indicates expected savings from this program. Once the program begins, analysis can be done on the City's diversion rate and associated emissions reductions. City baseline operations produce approximately 11,500 tons of waste per year. Assuming an increase in diversion of 10% per year for five years, at the end of the five-year program an estimated 5,759 tons of trash will be produced.

	Cost of Trash	Cost of Recycling	Trash Avoided	Recycling Rebate	Total Cost	Savings
Baseline	$1,500,000	$0	0%	0%	$1,500,000	$0
Year 1	$1,500,000	$326,103	10%	15.8%	$1,624,579	($124,579)
Year 2	$1,500,000	$326,103	20%	15.8%	$1,474,579	$25,421
Year 3	$1,500,000	$326,103	30%	15.8%	$1,324,579	$175,421
Year 4	$1,500,000	$326,103	40%	15.8%	$1,174,579	$325,421
Year 5	$1,500,000	$326,103	50%	15.8%	$1,024,579	$475,421
Total Net Savings						**$877,107**

Strategy #14: Recycling Program for Residents

Responsible Department: Solid Waste Department

Status: In Progress

Source of Update: Sarah Mason, MYR

Estimated Completion Date: Ongoing

Project Update in Brief: In 2005, the City of Houston diverted approximately 3% of the household waste picked up by our Solid Waste Department (SWD). Since then SWD has implemented several programs to address residential waste:

- **Heavy trash**: Heavy trash pickup now occurs every other month instead of monthly. In the intervening months only organic material, such as tree debris, is picked up. This has led to noticeable improvements in diversion rates; as well as keeping organic material from being landfilled. The graphs below clearly show the success of this program as the odd numbered months have significantly higher diversion rates than even numbered months.

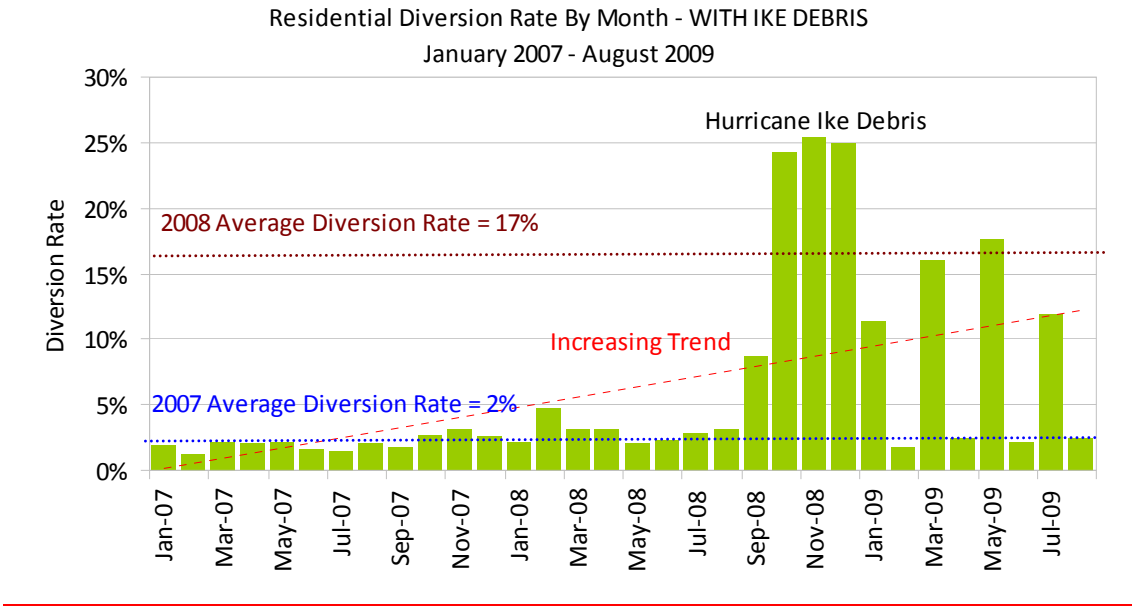
- **Biodegradable bags**: City Council passed an ordinance on September 2, 2009 requiring all grass and leaf material to be put in biodegradable bags to divert them from the landfill.

[8] To find landfill space saved, we utilized a mixed materials estimate of approximately 3.3 cubic yards of landfill space saved for every ton of waste diverted.

- **Single-stream pilot**: A single stream pilot program has been implemented in 20,508 houses to test feasibility in Houston. Residents are given a 96-gallon recycling bin for paper, cardboard, plastics, glass, and metals. Participation is over 75%. SWD is also working with RecycleBank on this project to investigate the added benefits such a program could produce.

One innovative example of sustainability integrated into the SWD's operations is the SWD's response to Hurricane Ike. Hurricane Ike created approximately 5.7 million cubic yards of tree material. Working collaboratively, the Solid Waste Department and the Clinton Climate Initiative diverted 100% of this solid waste from landfills and burning; in turn the hurricane debris was sent to composting and mulching operations.

As the graphs below indicate, there is an increasing trend in recycling from January 2007 to August 2009. However, this increasing trend is skewed by the aforementioned Ike debris in the first graph; therefore, the second graph shows the increasing trend without the Ike debris. It is interesting to note that the diversion rate is steadily increasing from an average of 2% in 2007 to an average of 4% in 2008 (without Ike debris). When 2009 data is available, the average is expected to be greater than 4% bringing the City closer to the goal of a 9.5% diversion rate from residential recycling. In short, between 2007 and 2009, it is expected that the implementation of these recycling efforts will increase the average curbside recycling rate by 100%.



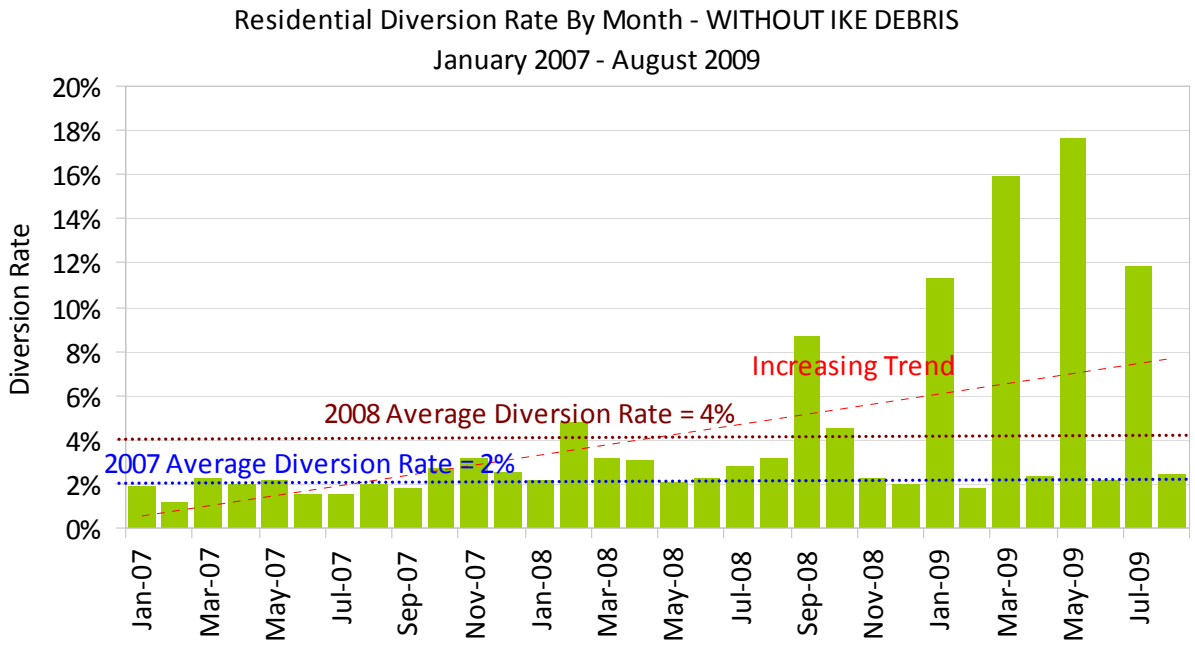


Table: The table below is the original table from the MERP 2005 baseline that estimated that the diversion rate would be 9.5% by 2010. Residential recycling has not yet reached this goal, but as the graphs above indicate, the city is getting closer to achieving this goal each month.

	Waste Stream					From Landfilled Waste	Diversion Rate
	Total	Diverted		Landfilled			
	tpy	tpy	yd^3 of landfill	tpy	yd^3 of landfill	GHG (tpy)	
Food/Sludge	171,797	0	0	171,797	566,929	476,945	0.0%
Paper	234,190	11,158	-36,820	223,033	736,008	207,886	5.0%
Plant/Yard	193,164	60,146	-198,481	133,019	438,962	91,243	45.2%
Wood/Textile	32,479	0	0	32,479	107,181	19,655	0.0%
Other	223,079	2,683	-8,854	220,396	727,307	0	1.2%
Total	854,710	73,986	-244,155	780,723	2,576,387	795,729	9.5%

Sources: 2010 tons of waste were extrapolated from 2005 using the projected population growth rate (11.3%). ICLEI's CACP software generated the emissions outputs shown in this table. To determine cubic yards of landfill space, we utilized a mixed materials estimate of approximately 3.3 cubic yards of landfill space for every ton of waste.

Additional Projects

Solar Energy

In April of 2008, the U.S. Department of Energy (DOE) selected Houston as one of 12 cities to be recognized as a Solar America City. With this recognition came a $200,000 DOE grant and a matching required grant of $200,000 from BP Solar. These funds were to be used to develop a strategy and plan for solar infrastructure in the region.

As such, with the funds, the City has installed solar panels on 2 of the City's buildings, the City Hall Annex and Code Enforcement Building. Each array of solar panels is expected to generate about 12,000-kilowatt hours of electricity per year. Since installation in June of 2008 (to March 2009), we have produced 13,908 kWh of power, netted a revenue of $6502, and had a small reduction in CO2 emissions of about 9 tons. These positive energy and cost savings and environmental benefits have shown how successful such solar programs can be.

In addition, the George R. Brown Convention Center recently (July 30, 2009) unveiled a 100-kW solar panel array pilot project atop the 16-acre roof. This pilot project was initiated by the City's General Services Department with funding and support from many institutions, including the Houston Endowment, Houston Advanced Research Center (HARC), and others. Installation of the two, 50-kilowatt solar systems on the 16-acre roof of the convention center was funded primarily by an $850,000 grant from Houston Endowment, Inc., a leading philanthropic foundation. Other funding was provided by the Houston Architecture Foundation ($10,000), American Institute of Architects - Houston Chapter ($10,000), and BP ($100,000), for a total budget of $970,000.[9] This pilot project is testing the efficiency, effectiveness, and operational costs associated with 2 different types of solar arrays. As the pilot project just began, the expected savings are 876,000 kWh per year and 582 tons per year of CO2e; however, actual GHG and cost savings will be recorded as the project progresses.

The City is also using Solar America City funds to pursue an extensive solar outreach and marketing campaign. The City, in partnership with HARC, has launched a solar installation website, solarhoustontx.org, which will be used to track all residential and commercial solar installations in the City. The City is also a partner in organizing the ASES Houston Solar Tour, which provides free tours of solar power applications in the City of Houston and its surroundings.

Solar Bees©

The City has harnessed the sun's power in producing quality, safe drinking water for over 2 million customers in the Houston area. In April 2006, the City embarked on a project called the Lake Houston Solar Bee® project. The main issue at hand was that as a major source of drinking water for Houston area residents, Lake Houston was plagued by seasonal algal blooms, which imparted an unpleasant taste and odor to the water. A costly, short term fix was to treat the water with chemicals, such as copper sulfate; however, this process would impart another unpleasant taste, would only be short term, and most importantly, could adversely affect the normal biological system of the Lake.

Consequently, the City in partnership with the U.S. Geological Services and Houston Area Water Corporation installed 20 low-cost, energy-efficient solar-powered aeration mixers at Lake near the treatment plant intake. This technology allowed the lower waters to remain oxygenated and promoted the health of the Lake's natural ecosystem. More importantly, this technology was low cost producing an annual total savings of $769,000, 28% in energy cost avoidance and 78% in chemical cost savings. Using solar power in lieu of electricity avoids the $219,000 per year electricity bill (or 2,190,000 kWh). With the use of these Solar Bees®, there is a 67% reduction in the need for chemicals, which translates into $550,000 in chemical cost savings each year.

Even more, as a joint project with USGS, this is the first project that was to scientifically prove the specific benefits of this technology as they relate to drinking water treatment.

[9] http://news.harc.edu/Articles/tabid/1078/articleType/ArticleView/articleId/6/HARC-manages-Solar-Houston-Initiative-for-the-city.aspx

The Weatherization Program[10]

In early 2006, the City of Houston decided to be proactive in assisting residents to reduce their energy consumption. The City collaborated with CenterPoint Energy to weatherize 641 homes in the Pleasantville community by adding insulation, caulking and weather stripping. After the City made these simple modifications to participants' homes, they saved energy, decreased the emissions associated with power generation and saves money.[11]

During 2007, Valero Refining joined in this effort and underwrote the cost of weatherizing 75 homes.

As of early 2009, the City has weatherized over 7,000 homes in 12 neighborhoods. This program has focused on neighborhoods that have median household incomes of less than $40,000/year, residences less than 2000 square feet and built prior to 1965. The program has resulted in an approximate 5,808,000 kWh reduction and a cost savings of approximately $700,000, ranging from 12% to 18% energy savings, or an average $335 energy savings per home over a six month period compared to the previous year. Ultimately, on average, these homes save 2,000 kWh each year. Additionally, the City of Houston's General Services Department recently received $23 million in ARRA funds to weatherize an additional 30,000 homes in two years. With this funding, and through five contracts it has signed with local contractors, the City would not only increase the energy efficiency of the low-income housing stock, but also create and maintain jobs and reduce emissions even further. The cost savings to the community (and energy companies) associated with this reduction in energy use is also significant.

GHG Reductions from Weatherization[12]		
	# Homes	**GHG Reductions (tpy)**
2010	7,500	10,775
2012	37,500	43,100

Metro Passes for City Employees

The City's employee transit program offers Metropolitan Transit Authority Q Cards to City employees working in downtown Houston, at no cost to the employee.[14] Between 2004 and 2006, employee participation had increased by 20% or 175 employees. The avoidance of driving by the additional employees yielded the emissions reduction indicated in the table.

Emissions Reductions from Transit Program[13]		
	Projected 2010 Participants	**GHG Reductions (tpy)**
New Riders Since 2004	385	77

[10] Examples of weatherization procedures:

- Sealing cracks, gaps, holes especially around doors, windows, pipes, and other areas with high potential for heat loss, using caulk, foam sealant, weather-stripping, window film, door sweeps, and electrical receptacle gaskets.
- Installing drains or membranes to protect the home from both surface water and ground water.
- Providing proper ventilation to unconditioned spaces to protect the home from the effects of condensation
- Installing insulation in the walls, floors, and ceilings, around ducts and pipes, around water heaters, and near the foundation of the home.
- Replacing old drafty doors with tight-sealing, foam-core doors and older windows with low-energy, double-glazed windows.
- Replacing inefficient furnaces, boilers, water heaters, and air conditioning units with energy-efficient heating and cooling equipment and programmable thermostats.

[11] Savings were calculated for a three-month period, based on each household's net energy (kWh) reduction at $0.16/kWh, the price-to-beat cost of energy during June, July, and August 2006 as compared to the same months in 2005.

[12] Source: The Energy Division of the General Services Department provided the kilowatts of energy consumed. ICLEI's CACP software generated the emissions outputs

[13] Source: The Human Resources Department provided the number of program participants. Vehicle miles travelled is the product of the number of new riders, each travelling 27 trips per month, 12 months per year, at approximately 29 miles per trip. ICLEI's CACP software produced the emissions outputs shown here.

[14] Designated downtown worksites include 611 Walker, City Hall, City Hall Annex, etc.

This trend of increased participation is expected to continue through 2010.

Flex in the City

Flex in the City encourages employers to try alternative scheduling options such as compressed work weeks, telecommuting to work, and flexible start and end times, eliminating their employees' rush-hour commutes on Houston's roads. While employers measure the effect of Flex in the City on productivity, the City measured the effect on mobility. An improvement in mobility was realized just by moving a relatively small number of cars off the roads during peak congestion periods. Commuters on the North and Southwest Freeways saved 906 peak-commute hours because of the 2006 Flex in the City.[15] While this is primarily a congestion mitigation measure that does not decrease the vehicle miles traveled, the outcome is a notable reduction in the community's emissions because vehicles spend less time idling in traffic.

Power to People

The City of Houston, CenterPoint Energy, Wal-Mart, and Sam's Club co-sponsored the launch of the Houston Power to People campaign designed to educate Houstonians on ways to reduce energy consumption and save money. The education campaign began with volunteers going door-to-door to homes in the Houston area handing out compact fluorescent light bulbs (CFLs). In 2007, 10,000 CFLs were distributed. Since the CFLs are used in place of inefficient bulbs, Houston-area residents reduced their greenhouse gas emissions by 365 tpy.[16]

Power to People has displays set up at retail outlets throughout the Houston area to provide information on steps residents can immediately and inexpensively take to minimize energy consumption in their homes. The information is also available at www.houstonpowertopeople.com, which the City developed and maintains.

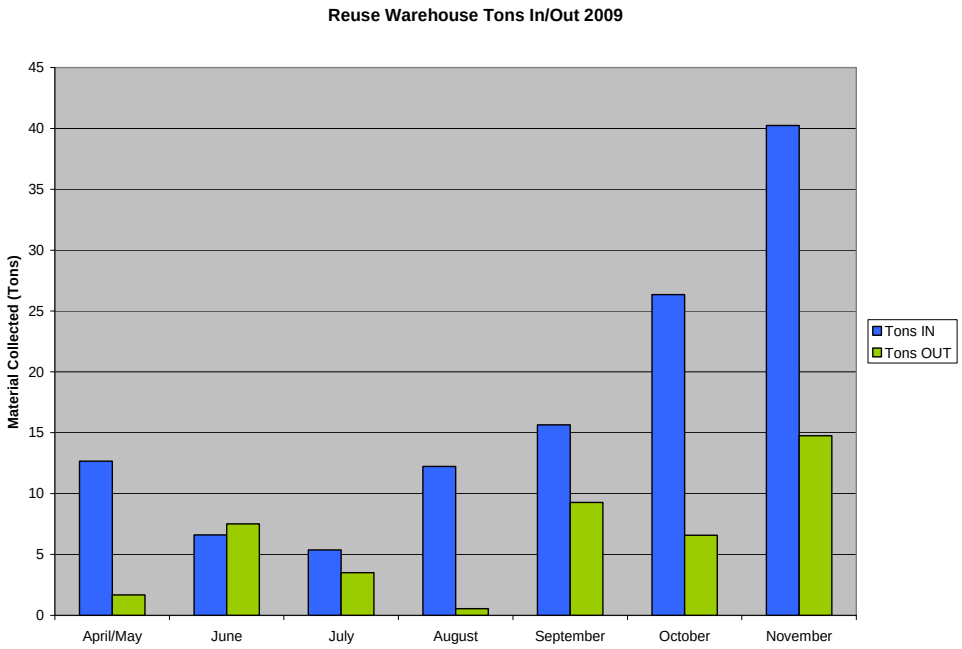
Building Materials Warehouse

A 2004-2005 study completed by the Houston-Galveston Area Council of Governments (H-GAC) and Houston Advanced Research Center (HARC), showed approximately 38% of the waste stream in the Houston area is comprised of construction and demolition material. In order to divert some of this waste away from landfills, the City of Houston will build and operate a warehouse to collect and redistribute reusable materials.

Nationally, construction and demolition warehouses are successfully diverting reusable materials and providing community development opportunities. In Houston, the Habitat for Humanity Re-Store and Historic Houston are the two largest, if not the only two existing building material reuse projects in the City. Habitat's Re-Store assists low/moderate income people by providing items to fix or improve their home. Historic Houston's facility targets home builders/remodelers looking to incorporate unique features of homes. The City's building materials warehouse, which opened in June 2009, is available to non-profit groups needing reused materials at no cost. This project was funded by a $150,000 HGAC solid waste reduction grant and utilizes a formerly unused City warehouse. The project will continue to be operated and funded under the City of Houston's Solid Waste Department. As data and results for this project become available, the GHG and cost savings associated with this program will be reported.

[15] Savings in peak-commute hours taken from www.houstontx.gov/flexworks/flexinthecity/index.html.

[16] ICLEI's CACP software generated the emissions reduction output based on saving 507,600 kWh/year. The annual energy savings is the difference between 10,000, 13 watt CFLs and 10,000 60-watt bulbs used three hours/ day.



Source: 2009 data provided by Sarah Mason, based on recorded amounts.

Wastewater Treatment Plant Energy Efficiency Project

As of the writing of this Update, the Public Works Department is developing an innovative approach to reduce the City's consumption of electricity and natural gas by wastewater operations, one of the most energy intensive sectors of City operations. The first phase of the program involves an Investment Grade Audit (IGA) for six wastewater treatment plants (WWTPs), as well as the lift stations servicing those plants. This IGA passed City Council on December 16, 2009. The long-term project set several goals for wastewater operations: a significant decrease in the amount of energy used, reduction of criteria air pollutants as well as greenhouse gas emissions, development of more sustainable operations, and disaster resilience. Proposed energy savings measures include both liquids processing and sludge processing facilities, as well as the possible decommissioning of up to four WWTPs.

The program takes advantage of authorization by the Texas legislature that allows energy saving performance contracting (EPC) to pay for the modifications. Under an EPC, the energy services company, in this case Siemens, provides a contractual guarantee to the City for the amount of energy reduced. If energy conservation measures do not produce the predicted energy savings, Siemens must reimburse the City for the shortfall. The monetary savings from these energy reductions pay for the project costs over a number of years. Use of an EPC is an innovative way for Public Works Department to address funds needed for infrastructure improvements.

This project is being done in conjunction with the City's partnership with the Clinton Climate Initiative (CCI). CCI's mission is to reduce green house gases in practical and measurable ways, through creative purchasing consortiums and by tapping into energy savings to pay for project costs.

The initial facilities covered are 69th Street, Almeda Sims, Sims North, Sims South, Clinton Park, Homestead, and the lift stations associated with those WWTPs. The six targeted WWTPs are responsible for using over 40% of the energy purchased by the City. This project has the potential to be the largest energy efficiency program at the City of Houston.