

Section 1: Executive Summary

Project Overview

Ameresco, Inc. is pleased to provide this Energy Audit Report to the Hawaii Public Housing Authority (HPHA), pursuant to the Energy Audit Agreement. This report is the culmination of a comprehensive utility study of 67 conventional federal public housing sites involving 5,269 dwelling units and associated facilities. The study included extensive site examination,¹ analysis of historical utility billing data for all utility services, building energy modeling, development engineering, and an investment grade financial assessment.

To the greatest extent feasible, we have attempted to respond in the energy conservation measures (ECMs) presented in this report to HPHA's desire to reduce energy and water costs while also addressing vital, utility-related capital needs. In each case, we compared measure payback against life cycle, but also considered other tangible benefits not directly related to savings in making our recommendations.

The current recommended package of improvements, totaling approximately \$44.1M, encompasses the best economic payback approach while addressing various capital-intensive upgrades. Savings under an Energy Services Agreement will cover the entire project capital cost via a guaranteed-savings, 20-year term financing, which is described in more detail later in this section.



¹ Our findings are based on the results of a complete survey of the common areas and mechanical rooms and in-apartment visits representing approximately a 10% sample of the portfolio.

Implementation of this project is expected to produce nearly \$4.3M in annual utility cost savings during the first year of project repayment,² representing a reduction of nearly 30% in utility expenditures. In addition, nearly half the total project investment is dedicated to renewable energy, including solar hot water heating systems at 14 developments and a solar photovoltaic power generating system. Combined, these renewable energy measures will generate about 25% of the overall project savings or about \$1M in the first year.

This Energy Audit Report is broken out into six main sections:

- Section 1 is this Executive Summary, which reviews the overall project financing and measure selection, costs and savings;
- Section 2 describes the utility baseline developed for this project, including any adjustments made, as well as the current tenant utility allowances and the utility rates applied to the savings;
- Section 3 presents a detailed description of the recommended ECMs, a summary of measures considered but not recommended, and general information detailing how Ameresco proposes to design, implement, and commission the ECMs and provide concurrent training and resident education;
- Section 4 describes the long term services proposed during the repayment term of the Energy Services Agreement (ESA), including annual equipment and systems inspections and measurement and verification of the savings; as well as the opportunity for resident education, and long-term maintenance services. Section 4 also presents the HUD conservation incentives proposed.
- Section 5 presents the existing site conditions reports; and
- Section 6 contains the attachments to this report which include the utility baselines, recommended product cut sheets, lighting audits, a summary of measure costs and savings by site, and a 20-year life cycle cost analysis.



² Project repayment is anticipated to begin in 2012, after a two-year construction cycle.

While we recognize that the final package of measures may be adjusted, it is our recommendation that the package we have developed, with input from HPHA staff and finance committee board members, is the most economically beneficial and comprehensive from a property upgrade and deferred maintenance perspective. We look forward to working with HPHA to finalize the package of measures and services in order to execute the Energy Services Agreement (ESA) by February 2010.

To that end, we propose the following next steps:

- HPHA Board of Directors approves the proposed scope of work and financing engagement letter at the October 15 board meeting;
- Ameresco develops the ESA and associated appendices; Ameresco and HPHA also determine the scope of long-term services (e.g. maintenance) (November);
- Submit the ESA to HUD for approval (November);
- Secure financing (January 2010);
- Secure HUD approval of the ESA (February 2010)
- Execute financing and ESA (February 2010)

Ameresco would like to acknowledge and give special thanks to Mr. Chad Taniguchi, Ms. Barbara Arashiro, Mr. Richard Speer, Mr. Glenn Sunakoda, and Mr. Marcel Audant, as well as the many other management and facilities staff whose input and support during the audit was invaluable. Ameresco would also like to thank the finance committee of the HPHA Board of Directors, including Mr. Travis Thompson, Ms. Linda Smith, and Mr. Eric Beaver for their input and guidance.

Environmental Benefit

Based on the energy savings projected for this project, the following reductions in greenhouse gas emissions are expected:

Greenhouse Gas	Emissions Reduction
CO ₂	8,500 Tons
SO _x	36,800 Lbs
NO _x	30,700 Lbs

The efficiency improvements and renewable energy component proposed in this project will provide a significant and sustainable step towards meeting Hawaii's Clean Energy Initiative goals by 2030.

A. Project Funding

1. Capital Lease

All funding for the project will be secured from guaranteed savings using a capital municipal lease. This is a financing obligation under which HPHA owns the installed equipment upon acceptance, and the lender, acting as lessor under the capital lease, retains a security interest (lien) on the equipment until the capital lease is paid in full at the end of the lease term. The capital lease is the most common financing structure provided to HUD as part of the project approval process and the structure most often applied to performance contracts.

Current interest rates on these projects are ranging between 5-6.5%, depending on the tax-exempt or taxable (leveraging the federal government's offer of such tax credits or rebates as Build America Bonds) status, market stability, the finance term (including the construction period), HPHA's financial stability, PHAS report scores, bank-qualified or non bank-qualified status (bank-qualified indicates that the PHA will not issue more than \$30 million in tax-exempt financing in a given calendar year). The actual interest rate typically will float until actual closing of the project financing occurs, subsequent to HUD approval.

Ameresco has already completed a competitive process for seeking investor or bank participation in this project, nationwide and locally. As a result, Ameresco has identified an investment bank with the willingness, capability, and experience with similar projects to secure competitively-priced financing for this project. Recently, Ameresco has been quoted an all-inclusive finance rate for this project at approximately 4.78%. This all-in rate is based on the expectation that HPHA would be successful in obtaining an "A-" rating from Standard and Poor's and use of the federal government stimulus program involving Build America Bonds.

To close the project financing, HPHA will need to provide its three most recent years of financial statements to Ameresco, as well three years of its PHAS reports and other similar management information. A rating on the credit and project may be required during this process. During the document preparation process, HPHA will need to provide a Board Resolution, an Opinion of Counsel (affirming the lease is a legal, valid and binding agreement for HPHA), and an insurance certificate indicating coverage. Often, legal property descriptions (obtained from deeds or other documents acceptable to the investor), are also needed before project closing. Once credit review is obtained, the lender will proceed to close the project financing, subject to execution of the Energy Services Agreement with Ameresco, and to HUD approval.

Throughout the 20-year repayment term of the project, Ameresco will work with HPHA to secure the necessary HUD conservation incentives required for the repayment of the lease.

2. Utility Rebates

Ameresco has estimated that approximately \$362,842 in electric rebates are available from the Hawaii Energy Efficiency Program, as presented in Table 1.A.³ At this time, neither the gas company nor any of the respective water providers are known to offer any rebates which would be available to the housing authority for this project. Ameresco will continue to work in collaboration with HPHA to secure additional conservation incentives.

Table 1.A Projected Utility Incentives By Measure

Energy Conservation Measure	Big Island	Neighbor Islands	Oahu High-Rises	Oahu Low-Rises	Measure Total
ECM 5: Install Efficient Building Water Pressure Controls	-	-	\$ 4,800	-	\$ 4,800
ECM 6: Upgrade Common Area Lighting	\$ 3,714	\$ 2,144	\$ 25,742	\$ 6,500	\$ 38,101
ECM 7: Upgrade Apartment Lighting	-	\$ 23,651	-	-	\$ 23,651
ECM 8: Install High-Efficiency Air Conditioning	\$ 179	-	-	\$ 362	\$ 540
ECM 9: Install Energy Star Refrigerators	\$ 1,350	\$ 8,200	\$ 2,250	\$ 17,450	\$ 29,250
ECM 10: Install Vending Machine Controls	-	-	\$ 300	-	\$ 300
ECM 17: Install New Solar Domestic Water Heaters	\$ 43,000	\$ 18,000	-	\$ 210,000	\$271,000
Totals	\$ 48,243	\$ 51,995	\$ 28,292	\$ 234,312	\$ 362,842

All rebates would flow directly to HPHA and can be used to fund additional improvements or to reduce or pre-pay the debt on the project. In the cash flow presented in this section, Ameresco has assumed that any incentives will be used to reduce the amount financed.

³ Rebate amounts are subject to change, based on measure qualification and funding availability at the time of application.

3. Authority Cost Contribution

The project financing as currently presented in this report is entirely self-funding and does not require a capital cost contribution by HPHA.

B. Measure Selection

The measure matrices presented in Tables 1.B.1-4 present the recommended Energy Conservation Measures (ECMs) included in the Energy Audit Report. This package of measures represents the most beneficial mix of measures that will achieve both utility cost savings and needed capital upgrades, without sacrificing resident comfort or adversely impacting operations and maintenance costs.

In selecting measures for inclusion in this project, we first determined the measure simple payback (which equals the measure cost divided by the initial year savings) and compared that to the anticipated life cycle of the proposed equipment. Where measure paybacks were long or non-existent (i.e. little or no measurable savings), we also considered other factors or benefits, such as replacing aging roofs where new solar equipment was recommended. Listed here are the life cycle assumptions used in our analysis:

Measure Type	Useful Life
Water Fixtures	25 years
Lighting Fixtures	20 years
Solar Photovoltaic Systems	30 years
Solar Hot Water Systems	30 years
Building Water Pressure Controls	25 years
Window Air Conditioners	10 years
Refrigerators	10 years
Vending Machine Controls	20 years
Electric Meters	20 years
High Efficiency Packaged Water Heaters	20 years
Roofing Systems	25 years
Gas-fired Instantaneous Water Heaters	20 years
Electric Transformers	30 years

The above useful life estimates are based on properly maintained and serviced equipment.⁴

While other combinations of measures are possible given HPHA’s needs, we feel that the enclosed package represents the best combination of measures. Please refer to Section 3 of the audit report for a detailed description of the proposed measures. Section 3 also includes a summary of other

⁴The recent HUD notice, PIH-2009-16 (HA), *Guidance on Energy Performance Contracts, including those with terms up to 20 years*, provides accepted useful life estimates for a number of systems.

measures considered during the audit but not recommended at this time. Listed below is a brief summary of the proposed measures.

ECM 1: Install HET Toilets

Ameresco proposes to replace existing apartment and common area toilets at most HPHA sites with new, high efficiency (HET) toilets that use 1.28 gallons of water per flush. The proposed toilet products use between 20% and 60% less water than the current stock of toilets in place and are certified by the EPA for both performance and efficiency. This measure will not only provide significant water savings, but will also fully modernize and standardize the stock of toilets throughout the majority of HPHA developments. The sites excluded from this measure were those found to have existing toilets with efficient or measured low flush rates or the cost of water was low.

ECM 2: Install Low-Flow Showerheads & Faucet Aerators

At locations where new toilets are proposed, Ameresco also proposes to furnish and install 1.75 gallons-per-minute (GPM) fixed-mount and 1.5 GPM handheld showerheads to replace existing standard flow models. Additionally, Ameresco proposes to replace all kitchen and bathroom aerators at affected sites with new aerators rated at 1.5 and 1.0 GPM, respectively.

ECM 3: Install Front-Loading Washers

Ameresco proposes to replace leased and select HPHA-owned top-loading washing machines in community laundry rooms at sites also receiving new apartment-based water conserving fixtures with more efficient front-loading washing machines. Compared to the existing top-loading washers, the new washers will use significantly less water and energy and require less detergent per load.

ECM 4: Install New Sink Faucets

Ameresco proposes to replace all aging kitchen faucets at Kuhio Park Terrace high rise buildings A and B with new hardware including low-flow aerators. The proposed measure will save water, while also providing residents with better functioning hardware.

ECM 5: Install Efficient Building Water Pressure Controls

Ameresco proposes to replace the current building water pressure booster pumps at Kalakaua Homes, Paoakalani, and Kalanihuia with new, high-efficiency packaged booster pump systems. The new booster pumps will be equipped with variable frequency drive (VFD) controls, resulting in more effective and efficient building water pressure delivery.

ECM 6: Upgrade Common Area Lighting

Ameresco proposes to install energy efficient lighting systems in the common areas that will reduce existing energy and maintenance costs. The upgrade will feature new, premium efficiency linear fluorescent T8 lamps operating on electronic ballasts, as well as high-quality compact fluorescent lamps or fixtures. In addition, selected areas, such as offices, restrooms, and community rooms, having intermittent occupancy, will receive occupant-sensing lighting controls.

ECM 7: Upgrade Apartment Lighting

Ameresco proposes to install energy efficient lighting systems throughout most apartments. The primary lighting retrofit in the apartments will consist of new compact fluorescent lamps or fixtures in various configurations. In addition, new, premium efficiency linear fluorescent T8 lamps and electronic ballasts will be retrofit into existing fixtures.

ECM 8: Install High Efficiency Air Conditioning

Ameresco proposes to replace old and inefficient window-type air conditioning units with more efficient, Energy Star rated units.

ECM 9: Install Energy Star Refrigerators

Ameresco proposes to replace select old and inefficient refrigerators throughout the HPHA portfolio with Energy Star rated models.

ECM 10: Install Vending Machine Controls

Ameresco proposes to install occupancy sensing, plug load controllers to reduce the unnecessary operation of vending machines during periods of low use.

ECM 11: Consolidate Electric Meters

Ameresco proposes to consolidate the individual apartment electric meters at Waipahu II and Wahiawa Terrace into one electric meter and HECO account per building. In addition, new check meters will be installed in the existing common area and apartment utility meter sockets to allow for check metering if HPHA desires. This ECM will have the effect of greatly reducing the number of monthly meter charges while also reducing the electric rate paid by HPHA by switching from residential-based to less costly commercial-based tariffs.

ECM 12: Install New Transformers

Ameresco proposes to replace the existing outdoor building transformer at Paoakalani and the 40 year old transformer and high voltage switchgear at Makua Alii with new, energy-efficient equipment

of the same configuration. The proposed installations will improve the electrical service reliability at the two developments.

ECM 13: Install Solar Photovoltaic Arrays

Ameresco proposes to install a 107.36 kWdc (89.1 kW) solar photovoltaic (PV) system on the rooftop of Makamae that will generate nearly 50% of the buildings current energy use. As part of this installation, HPHA will also be able to take advantage of HECO's net energy metering rule. Net energy metering will allow HPHA to export surplus electricity into the grid when the power generated by the PV system exceeds the requirement of the building, thereby obtaining the full savings benefit of the proposed PV system.

ECM 14: Install Electric Check Meters

At Kuhio Park Terrace, Waipahu II, and Wahiawa Terrace, Ameresco proposes to implement a check-metering system featuring Automated Meter Reading (AMR). The new AMR system will provide a seamless means for HPHA to monitor apartment electric consumption and bill residents for any usage above a set threshold level. The housing authority will have the ability to access and download consumption data and overage usage by apartment via a web-based host service for its billing purposes. Check metering has the advantage over converting to tenant-paid utilities because the electric use continues to be master-metered and the utility billing remains on a lower cost, commercial rate.

ECM 15: Install High Efficiency Central Domestic Water Heaters

Ameresco proposes to replace the domestic water heating systems at Ka Hale Kahaluu, Makua Alii, Punchbowl Homes, Kalanihulia, Makamae, Pumehana, and Spencer House with new, energy-efficient, condensing-type water heaters. These water heaters operate at efficiencies in excess of 90% under most operating conditions, and will significantly reduce energy use and greenhouse gas emissions related to domestic hot water production at the affected sites.

ECM 16: Install New Solar Domestic Water Heaters

Ameresco proposes to install new or refurbish existing solar domestic hot water heating systems at a total of 14 developments. The new solar water heating equipment will provide HPHA with clean, renewable, free hot water that will displace at least 90% of the existing electric or gas water heating energy in most cases, while greatly reducing the carbon footprint of HPHA facilities and helping the State of Hawaii meet its goal of 40% renewable energy by 2030.

ECM 17: Replace Roofs

In anticipation of the proposed solar hot water installations included under ECM-16, Ameresco proposes to replace the existing roofs on the two Kuhio Park Terrace (KPT) towers and the 21 buildings of Kuhio Homes. In addition, Ameresco will also install new perimeter fencing on both KPT towers, and re-roof the KPT community building.

ECM 18: Install Gas Fired Instantaneous Water Heaters

Ameresco proposes to correct existing hot water service deficiency problems while also reducing utility costs at Mayor Wright Homes by replacing the existing electric and gas back-up hot water heating equipment with new, gas-fired, instantaneous hot water heating units. Given the uncertain long term disposition of this property, this measure provides a lower cost, yet effective alternative to installing new solar hot water heaters.

Table 1.B.1 Measure Matrix - Big Island

ECM #	Description	Lanakila Homes I	Lanakila Homes II	Lanakila Homes IV	Hale Aloha O Puna	Hale Olaloa	Kauhale O'Hanakahi	Pahala	Pomaikai Homes	Punahale Homes	Ka Hale Kahaluu	Hale Hookipa	Kaimalino	Kealakehe	Nani Olu	Noelani II	Hale Hauoli	Ke Kumu 'Ekolu	Noelani I
		1004	1013	1104	1051	1052	1097	1045	1029	1028	1061	1053	1032	1070	1063	1078	1031	1097	1071
1	Install HET Toilets	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Install Low-Flow Showerheads & Faucet Aerators	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Install Front-Loading Washers							✓			✓	✓		✓		✓	✓		✓
4	Install New Sink Faucets																		
5	Install Efficient Building Water Pressure Controls																		
6	Upgrade Common Area Lighting	✓			✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
7	Upgrade Apartment Lighting	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	Install High-Efficiency Air Conditioning	✓																	
9	Install Energy Star Refrigerators						✓	✓				✓				✓			✓
10	Install Vending Machine Controls																		
11	Consolidate Electric Meters																		
12	Install New Transformers																		
13	Install Solar Photovoltaic Arrays																		
14	Install Electric Check-Meters																		
15	Install High-Efficiency Central Domestic Water Heaters										✓								
16	Install New Solar Domestic Water Heaters												✓			✓		✓	✓
17	Replace Roofs																		
18	Install Gas-Fired Instantaneous Water Heaters																		

Table 1.B.2 Measure Matrix - Neighbor Islands

ECM #	Description	Kapaa	Hale Hoolulu	Hale Nana Kai O Kea	Hui O Hanamaulu	Kalaheo	Kekaha Ha'aheo	Eleele Homes	Hale Hoonanea (Port Allen)	Home Nani	Kawaiilehua Federal	Kahekili Terrace [a & b]	David Malo Circle	Makani Kai Hale I	Piilani Homes	Makani Kai Hale II	Kahale Maa Federal
		1018	1019	1054	1021	1022	1064	1020	1055	1023	1086	1017	1016	1092	1044	1097	1088
1	Install HET Toilets	✓		✓	✓	✓	✓	✓	✓	✓	✓						✓
2	Install Low-Flow Showerheads & Faucet Aerators	✓		✓	✓	✓	✓	✓	✓	✓	✓						✓
3	Install Front-Loading Washers																✓
4	Install New Sink Faucets																
5	Install Efficient Building Water Pressure Controls																
6	Upgrade Common Area Lighting	✓	✓	✓	✓		✓		✓	✓		✓		✓	✓	✓	✓
7	Upgrade Apartment Lighting	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	Install High-Efficiency Air Conditioning	✓															
9	Install Energy Star Refrigerators	✓		✓	✓	✓			✓			✓	✓	✓	✓		
10	Install Vending Machine Controls																
11	Consolidate Electric Meters																
12	Install New Transformers																
13	Install Solar Photovoltaic Arrays																
14	Install Electric Check-Meters																
15	Install High-Efficiency Central Domestic Water Heaters																
16	Install New Solar Domestic Water Heaters										✓		✓				
17	Replace Roofs																
18	Install Gas-Fired Instantaneous Water Heaters																

Table 1.B.3 Measure Matrix - Oahu Low Rise Sites, Kuhio Homes, and Central Office

ECM #	Description	Kalakaua Homes	Makua Alii	Paoakalani	Punchbowl Homes	Kalanihua	Makamae	Pumehana	Kuhio Park Terrace	Kuhio Homes	HPHA Central Office
		1062	1012	1036	1011	1024	1046	1047	1010	1007	N/A
1	Install HET Toilets	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Install Low-Flow Showerheads & Faucet Aerators	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Install Front-Loading Washers	✓	✓	✓	✓	✓	✓	✓	✓		
4	Install New Sink Faucets								✓		
5	Install Efficient Building Water Pressure Controls	✓		✓		✓					
6	Upgrade Common Area Lighting	✓	✓	✓	✓	✓	✓	✓	✓		
7	Upgrade Apartment Lighting	✓	✓	✓	✓	✓	✓	✓	✓	✓	
8	Install High-Efficiency Air Conditioning										
9	Install Energy Star Refrigerators						✓				
10	Install Vending Machine Controls					✓			✓		✓
11	Consolidate Electric Meters										
12	Install New Transformers		✓	✓							
13	Install Solar Photovoltaic Arrays						✓				
14	Install Electric Check-Meters								✓		
15	Install High-Efficiency Central Domestic Water Heaters		✓		✓	✓	✓	✓			
16	Install New Solar Domestic Water Heaters								✓	✓	
17	Replace Roofs								✓	✓	
18	Install Gas-Fired Instantaneous Water Heaters										

Table 1.B.4 Measure Matrix - Oahu Low Rise Sites

ECM #	Description	Puuwai Momi	Hale Laulima	Salt Lake	Waipahu I	Waipahu II	Kalihi Valley Homes	Mayor Wright Homes	Kaahumanu Homes	Kamehameha Homes	Spencer House	Waimaha-Sunflower	Kau'ioakalani	Mailli I	Mailli II	Nanakuli Homes	Koolau Village	Hookipa Kahaluu	Kaneohe Apartments	Kauhale O'hana	Waimanalo Homes	Waimanalo Homes II	Kauhale Nani	Wahiawa Terrace	Kupuna Home O'Waiialua	Palolo Valley Homes
		1026	1027	1066	1038	1039	1005	1003	1009	1099	1073	1057	1091	1033	1108	1035	1030	1072	1069	1090	1025	1107	1056	1015	1050	1008
1	Install HET Toilets	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Install Low-Flow Showerheads & Faucet Aerators	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	Install Front-Loading Washers			✓		✓							✓					✓							✓	✓
4	Install New Sink Faucets																									
5	Install Efficient Building Water Pressure Controls																									
6	Upgrade Common Area Lighting	✓	✓		✓	✓	✓			✓	✓	✓	✓			✓	✓	✓	✓	✓			✓	✓	✓	✓
7	Upgrade Apartment Lighting	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8	Install High-Efficiency Air Conditioning	✓						✓																		
9	Install Energy Star Refrigerators							✓		✓											✓					
10	Install Vending Machine Controls																									
11	Consolidate Electric Meters					✓																		✓		
12	Install New Transformers																									
13	Install Solar Photovoltaic Arrays																									
14	Install Electric Check-Meters					✓																		✓		
15	Install High-Efficiency Central Domestic Water Heaters										✓															
16	Install New Solar Domestic Water Heaters	✓	✓						✓								✓	✓								✓
17	Replace Roofs																									
18	Install Gas-Fired Instantaneous Water Heaters							✓																		

C. Measure Savings and Costs Summary

Appearing in Table 1.C is a compilation of the savings, costs, and simple paybacks for all of the recommended measures at all facilities. For a similar breakdown by individual site, please refer to Attachment G of this report.

The project costs presented in Table 1.C are inclusive of the following:

- Equipment and materials
- State of Hawaii general excise tax
- City permits
- Installation labor
- Subcontractor performance and payment bonding
- Ameresco performance and payment bonding
- Engineering services and quality control
- Project management
- On-site construction supervision
- Audit fee
- Financing services
- Subcontract administration, including handling of payment requisitions, monitoring for compliance with Davis-Bacon wage requirements, and handling of all federally mandated wage earnings reports
- Commissioning
- Staff training
- Resident education during construction
- Tenant coordinators (a total of 6 tenant coordinators over a 22-month period has been included)
- Overhead and profit

The costs associated with equipment and materials, taxes, installation labor, any outsourced engineering or other professional services, and bonding comprise the project “direct costs.” The remainder of the cost components are collectively termed the project “indirect costs,” which are

estimated on a project basis and then prorated over the measure direct costs to form the total project cost for each measure.

Table 1.C ECM Summary
All Developments

Totals		6,802,173	2,347,179	130,129	29,403	176,667	\$ 44,149,930	\$ 4,265,658	10.4
#	Description	Master Paid Electric Savings (kWh)	Resident Paid Electric Savings (kWh)	Master Paid Natural Gas Savings (therms)	Resident Paid Natural Gas Savings (therms)	Master Paid Water Savings (kgal)	Total Project Costs	Dollar Savings	Total Payback
1	Install HET Toilets	0	0	0	0	96,460	\$ 3,834,844	\$ 525,565	7.3
2	Install Low-Flow Showerheads & Faucet Aerators	418,245	423,727	77,793	15,843	70,184	\$ 978,678	\$ 954,141	1.0
3	Install Front-Loading Washers	7,950	0	2,486	0	4,188	\$ 91,092	\$ 33,570	2.7
4	Install New Sink Faucets	0	0	5,117	0	5,835	\$ 181,596	\$ 51,140	3.6
5	Install Efficient Building Water Pressure Controls	64,038	0	0	0	0	\$ 271,373	\$ 16,642	16.3
6	Upgrade Common Area Lighting	567,343	0	0	0	0	\$ 689,898	\$ 164,861	4.2
7	Upgrade Apartment Lighting	1,514,307	1,088,871	0	0	0	\$ 5,635,924	\$ 823,516	6.8
8	Install High-Efficiency Air Conditioning	5,234	0	0	0	0	\$ 13,042	\$ 1,847	7.1
9	Install Energy Star Refrigerators	93,903	204,419	0	0	0	\$ 794,270	\$ 97,890	8.1
10	Install Vending Machine Controls	4,368	0	0	0	0	\$ 3,909	\$ 1,134	3.4
11	Consolidate Electric Meters	0	0	0	0	0	\$ 192,002	\$ 15,093	12.7
12	Install New Transformers	0	0	0	0	0	\$ 569,891	\$ -	-
13	Install Solar Photovoltaic Arrays	163,917	0	0	0	0	\$ 996,241	\$ 41,304	24.1
14	Install Electric Check-Meters	1,147,602	0	0	0	0	\$ 914,213	\$ 307,888	3.0
15	Install High-Efficiency Central Domestic Water Heaters	0	0	24,772	0	0	\$ 1,020,720	\$ 77,074	13.2
16	Install New Solar Domestic Water Heaters	1,445,203	630,162	86,761	13,561	0	\$ 18,748,245	\$ 972,277	19.3
17	Replace Roofs	0	0	0	0	0	\$ 7,104,195	\$ -	-
18	Install Gas-Fired Instantaneous Water Heaters	1,370,065	0	-66,800	0	0	\$ 2,109,799	\$ 181,714	11.6

D. Cash Flow Projection

Please refer to Table 1.D for the cash flow generated for this project. For purposes of this report, we have assumed a 4.78% finance rate in the project cash flow, with construction starting in February 2010 and lasting 24 months, and an escalating lease payment (as savings escalate over the term of the contract). In addition, we have assumed that interest during construction will be capitalized, and the financed amount is net of any utility rebates available.

The savings used in the cash flow are based on the predicted consumption savings, valued at the average cost per unit of energy or water utilizing projected 2012 utility rates, the base rates, which are then escalated annually by 3%. During the repayment term, the savings rates will be valued at the greater of the then-current retail utility rates or the escalated base rates. For more information on determination of the projected utility rates, please refer to Section 2.C. For more information on the HUD funding methods proposed for this project, please refer to Section 4.A of this report.

In accordance with HUD Notice PIH 2006-06, *Guidance on Energy Performance Contracts with Terms up to 20 Years*, further adjustments to the utility costs savings should be considered to account for the degradation or discounting of savings over the debt repayment period associated with an extended finance term. Any savings adjustment factors are included in the life-cycle cost analysis presented in Attachment I of this report, with the adjusted savings applied to the cash flow.

For this project, we have assumed the following savings degradation factors in the cash flow:

- Refrigerators and window air conditioners: Life cycle of this equipment is typically around 10 years; therefore, after Year-10 of the project repayment period, savings associated with these measures cease.
- Apartment plumbing fixtures: one percent annual savings degradation per year, compounding after Year-10 of the project repayment period, is applied to account for normal equipment wear and tear.
- For all remaining measures, no savings degradation factors were applied since with the proper maintenance and repair these measures should last up to or beyond the 20-year project term.

The life cycle cost analysis also factors in any added (incremental) maintenance costs associated with each measure. For this project, we have budgeted for a preventative maintenance and repair reserve fund for the following measures:

- Solar Photovoltaic System

- Solar Domestic Hot Water Systems
- Central Domestic Hot Water Systems
- Building Water Pressure Booster Pumps
- Electric Check-Meters
- Instantaneous Hot Water Heaters

Collectively, the Year-1 maintenance reserve fund amount is projected at \$570,043, escalated at 3% annually thereafter. Please refer to the individual ECM maintenance service descriptions in Section 3.B as well as the general discussion in Section 4.D for more information regarding the maintenance services and costs.

The remaining measures are not anticipated to add to but may even reduce existing maintenance costs. However, HUD rules pertaining to energy performance contracts do not allow accounting for deferred maintenance costs in the project cash flow.

The cash flow also includes Ameresco's long-term services fee associated with monitoring and verification of the project savings, annual measure inspections, and providing support to the housing authority in securing the HUD incentives, as described in Section 4 of this report. The associated fee for the first year of repayment is \$182,752, and will escalate annually at a rate of 3% over the contract term. Resident education during the repayment term has not been included as part of our long-term services, but could be added for an additional fee. However, resident education during the project construction phase is included as part of our construction services.

As we prepare the Energy Services Agreement, the project cash flow may be adjusted to reflect revised scope or finance rate, for example. The final cash flow projection is contained as an attachment to the Energy Services Agreement.

Table 1.D Cash Flow Projection
All Sites - 20-Year Comprehensive ECM Package

Base Use and Rates

	Electric (kWh)	Gas (therms)	Water (kgal)	Tenant Allowances
Base Use	17,405,593	634,967	699,888	\$4,732,736
2012 Rates	\$0.2960	\$3.0763	\$5.2900	-
Escalation	3.00%	3.00%	3.00%	3.00%

Master Metered Savings Projection

	Electric (kWh)	Gas (therms)	Water (kgal)
Consumption	6,802,173	130,129	176,667
2012 Rates	\$0.2907	\$3.1308	\$5.5101
Escalation	3.00%	3.00%	3.00%
Savings-1st Year	\$1,977,211	\$407,413	\$973,447
Adjustment [1]	\$15,093		
Net Savings	\$1,992,304	\$407,413	\$973,447

[1] Rate tariff savings associated with meter consolidation measure

Cash Flow Data

Project Funding	
Project Cost	\$ 44,149,930
Utility Rebates	\$ (367,642)
Customer Cost Contribution	\$ -
Net Project Cost	\$ 43,782,288
Construction Loan Interest	\$ 4,628,026
Minimum Lease Proceeds	\$ 48,410,314
Construction Term (months)	24
Finance Term (yrs)	20
Estimated Finance Rate	4.78%

Resident Paid Savings Projection

	Electric (kWh)	Gas (therms)	Water (kgal)
Consumption	2,347,179	29,403	-
2012 Rates	\$0.3256	\$4.3609	-
Escalation	3.00% All Tenant Paid Rates		
Savings-1st Year	\$764,268	\$128,226	-

Year	Base Electric Bill	Base Gas Bill	Base Water Bill	Tenant Allowances	Total Utilities & Allowances	Electric Savings	Gas Savings	Water Savings	Resident Paid Savings	Total Savings	Debt Payment	Ameresco Annual Fees	Incremental Maintenance Costs	Savings Minus Debt, Fees, Maint.	Debt, Fees, Plus Maint. As % of Savings
2012	\$ 5,151,604	\$ 1,953,334	\$ 3,702,415	\$ 4,732,736	\$ 15,540,089	\$ 1,992,304	\$ 407,413	\$ 973,447	\$ 892,494	\$ 4,265,658	\$ 2,992,779	\$ 182,752	\$ 570,043	\$ 520,084	88%
2013	\$ 5,306,152	\$ 2,011,934	\$ 3,813,488	\$ 4,874,718	\$ 16,006,292	\$ 2,052,073	\$ 419,636	\$ 1,002,651	\$ 919,269	\$ 4,393,628	\$ 3,082,563	\$ 188,235	\$ 587,144	\$ 535,686	88%
2014	\$ 5,465,336	\$ 2,072,292	\$ 3,927,892	\$ 5,020,960	\$ 16,486,480	\$ 2,113,635	\$ 432,225	\$ 1,032,730	\$ 946,847	\$ 4,525,437	\$ 3,175,040	\$ 193,882	\$ 604,759	\$ 551,757	88%
2015	\$ 5,629,297	\$ 2,134,460	\$ 4,045,729	\$ 5,171,589	\$ 16,981,075	\$ 2,177,044	\$ 445,191	\$ 1,063,712	\$ 975,252	\$ 4,661,200	\$ 3,270,291	\$ 199,698	\$ 622,901	\$ 568,309	88%
2016	\$ 5,798,175	\$ 2,198,494	\$ 4,167,101	\$ 5,326,736	\$ 17,490,507	\$ 2,242,355	\$ 458,547	\$ 1,095,623	\$ 1,004,510	\$ 4,801,036	\$ 3,368,400	\$ 205,689	\$ 641,589	\$ 585,359	88%
2017	\$ 5,972,121	\$ 2,264,449	\$ 4,292,114	\$ 5,486,538	\$ 18,015,222	\$ 2,309,626	\$ 472,304	\$ 1,128,492	\$ 1,034,645	\$ 4,945,067	\$ 3,469,452	\$ 211,860	\$ 660,836	\$ 602,919	88%
2018	\$ 6,151,284	\$ 2,332,382	\$ 4,420,878	\$ 5,651,135	\$ 18,555,679	\$ 2,378,915	\$ 486,473	\$ 1,162,347	\$ 1,065,685	\$ 5,093,419	\$ 3,573,535	\$ 218,215	\$ 680,661	\$ 621,007	88%
2019	\$ 6,335,823	\$ 2,402,354	\$ 4,553,504	\$ 5,820,669	\$ 19,112,349	\$ 2,450,282	\$ 501,067	\$ 1,197,217	\$ 1,097,655	\$ 5,246,221	\$ 3,680,741	\$ 224,762	\$ 701,081	\$ 639,637	88%
2020	\$ 6,525,898	\$ 2,474,424	\$ 4,690,109	\$ 5,995,289	\$ 19,685,720	\$ 2,523,791	\$ 516,099	\$ 1,233,134	\$ 1,130,585	\$ 5,403,608	\$ 3,791,163	\$ 231,505	\$ 722,114	\$ 658,826	88%
2021	\$ 6,721,674	\$ 2,548,657	\$ 4,830,812	\$ 6,175,147	\$ 20,276,291	\$ 2,599,504	\$ 531,582	\$ 1,270,128	\$ 1,164,502	\$ 5,565,716	\$ 3,904,898	\$ 238,450	\$ 743,777	\$ 678,591	88%
2022	\$ 6,923,325	\$ 2,625,117	\$ 4,975,737	\$ 6,360,402	\$ 20,884,580	\$ 2,626,708	\$ 544,031	\$ 1,295,457	\$ 1,111,879	\$ 5,578,075	\$ 3,913,569	\$ 245,603	\$ 766,090	\$ 652,812	88%
2023	\$ 7,131,024	\$ 2,703,870	\$ 5,125,009	\$ 6,551,214	\$ 21,511,117	\$ 2,703,852	\$ 556,748	\$ 1,321,163	\$ 1,142,463	\$ 5,724,227	\$ 4,016,109	\$ 252,972	\$ 789,073	\$ 666,073	88%
2024	\$ 7,344,955	\$ 2,784,987	\$ 5,278,759	\$ 6,747,750	\$ 22,156,451	\$ 2,783,262	\$ 569,739	\$ 1,347,246	\$ 1,173,881	\$ 5,874,128	\$ 4,121,279	\$ 260,561	\$ 812,745	\$ 679,543	88%
2025	\$ 7,565,304	\$ 2,868,536	\$ 5,437,122	\$ 6,950,183	\$ 22,821,144	\$ 2,865,002	\$ 583,008	\$ 1,373,705	\$ 1,206,156	\$ 6,027,871	\$ 4,229,145	\$ 268,378	\$ 837,128	\$ 693,220	88%
2026	\$ 7,792,263	\$ 2,954,592	\$ 5,600,235	\$ 7,158,688	\$ 23,505,779	\$ 2,949,141	\$ 596,561	\$ 1,400,538	\$ 1,239,311	\$ 6,185,551	\$ 4,339,774	\$ 276,429	\$ 862,241	\$ 707,108	89%
2027	\$ 8,026,031	\$ 3,043,230	\$ 5,768,243	\$ 7,373,449	\$ 24,210,952	\$ 3,035,751	\$ 610,402	\$ 1,427,745	\$ 1,273,370	\$ 6,347,268	\$ 4,453,234	\$ 284,722	\$ 888,109	\$ 721,204	89%
2028	\$ 8,266,812	\$ 3,134,527	\$ 5,941,290	\$ 7,594,652	\$ 24,937,281	\$ 3,124,903	\$ 624,536	\$ 1,455,325	\$ 1,308,357	\$ 6,513,120	\$ 4,569,596	\$ 293,263	\$ 914,752	\$ 735,510	89%
2029	\$ 8,514,816	\$ 3,228,563	\$ 6,119,528	\$ 7,822,492	\$ 25,685,399	\$ 3,216,671	\$ 638,970	\$ 1,483,273	\$ 1,344,297	\$ 6,683,211	\$ 4,688,931	\$ 302,061	\$ 942,194	\$ 750,025	89%
2030	\$ 8,770,261	\$ 3,325,420	\$ 6,303,114	\$ 8,057,167	\$ 26,455,961	\$ 3,311,134	\$ 653,707	\$ 1,511,590	\$ 1,381,216	\$ 6,857,646	\$ 4,811,314	\$ 311,123	\$ 970,460	\$ 764,748	89%
2031	\$ 9,033,368	\$ 3,425,182	\$ 6,492,208	\$ 8,298,882	\$ 27,249,640	\$ 3,408,369	\$ 668,753	\$ 1,540,270	\$ 1,419,140	\$ 7,036,532	\$ 4,936,820	\$ 320,457	\$ 999,574	\$ 779,681	89%
Total	\$ 138,425,523	\$ 52,486,803	\$ 99,485,288	\$ 127,170,395	\$ 417,568,009	\$ 52,864,322	\$ 10,716,991	\$ 25,315,792	\$ 22,831,514	\$ 111,728,619	\$ 78,388,634	\$ 4,910,616	\$ 15,317,272	\$ 13,112,098	88%