

Measure: Appliance Efficiency Initiative (E13)

In cooperation with existing and future appliance efficiency rebate, education and energy efficiency awareness efforts, the City should actively promote the economic benefits of consumer upgrades to energy efficient appliances, including heating, ventilating, air conditioning, water heaters, and other appliances.

In conjunction with manufacturer labeling (i.e. Energy Star) the measured savings from recent Federal and utility sponsored appliance rebate programs in Arizona demonstrate the cost, energy and greenhouse gas emissions reduction potential of appliance replacements.

Emission reduction potential by 2020:	11,428 tCO ₂ e / yr.
Percentage of goal (2012):	0.06%
Percentage of goal (2020):	0.5%
Total annual average implementation costs:	\$413,000
Entity that bears the costs of implementation:	City of Tucson unless fees collected to fund the rebates and program administration
Cost/Savings per tCO ₂ e 2011-2020:	Savings \$42 / tCO ₂ e
Net annual savings average 2011-2020:	\$258,467 / yr.
Entity that realizes the financial return:	Homeowners
Equitability (progressive/regressive, income/revenue neutral, etc):	Absent a subsidy for appliance purchases, replacements will likely be made by those homeowners with the financial ability to upgrade.
Potential unintended consequences:	Waste management issues as well as potential life-cycle environmental impacts arising from extraction and manufacturing.

Background information:

Advances in appliance technology to achieve national energy efficiency targets are resulting in a new generation of most appliances. However, due to the ten-year and sometimes longer life span of existing appliances, homeowners may go several years before feeling an opportunity to upgrade or simply replace their current models.

Programs have been designed and implemented at all levels of government to encourage the replacement of existing appliances with more energy efficient models. Results from these programs are beginning to be reported.

The Department of Energy reported preliminary findings in September of 2010 of the first nationwide appliance rebate program funded under the American Recovery and Reinvestment Act (ARRA).¹ Through June 30, 2010, DOE paid out a total of 689,000 rebates nationwide at a cost of \$98 million (an average of \$142 per rebate).

Actual energy savings based on products rebated totaled 83,665,176 kWh. Total actual dollar savings came to \$27,525,678. There were also considerable water savings being realized as the result of the appliance rebate programs.

By mid-2011 more extensive data should be available from both the ongoing Tucson Electric Power HVAC rebate program and the 2010 State Appliance Rebate program, supported under the national program mentioned above.

Status Quo / Business as Usual:

In the absence of a steady promotional effort aimed at replacing energy-inefficient appliances with newer, more efficient models, consumers will continue receiving mixed signals as to the value of such upgrades. At best, conversion to more energy efficient models will not occur until appliances break or until new labeling standards result in only energy efficient models being available.

Consumers often have a difficult time reconciling a higher first cost for an energy efficient appliance and would benefit from more consistent, easy-to-understand success stories as to life-cycle cost and energy savings advantages of higher first-cost appliances. Coupled with even small rebates, this information often spurs consumer purchasing of energy efficient appliances, particularly in an era of rising energy costs.

Description of Measure and Implementation Scenario:

The City is encouraged to cooperate with other levels of government, Tucson Electric Power, and appliance manufacturers/retailers to conduct a widespread promotion campaign encouraging Tucson households to switch to more energy (and often) water efficient appliances.

No financial incentives are proposed under this initiative though experience from government and utility programs show a high consumer interest in appliance rebates. The campaign should provide easy-to-understand information on cost savings likely as well as references to resources that may be available in the way of rebates, tax credits, or other incentives.

The campaign should also have a target goal of 10,000 appliance replacements over the decade, with 1,000 replacements being achieved each year through 2020. The campaign should be designed to measure and communicate progress towards this goal in ways that keep household interest high and momentum going. An important selling point to the campaign will be its emphasis on cost savings to households that frees up utility expenses for other family needs.

The City's role in the initiative would be carried out by an existing and perhaps re-directed FTE who would also have responsibility for other collaborative and promotional efforts (i.e. Expanded Residential Energy Efficiency) in support of the overall climate action plan implementation. The City's FTE cost was estimated at \$45,000/year in the Expanded Residential Energy Efficiency measure and would not need to be duplicated.

Has the Measure been implemented elsewhere and with what results:

The City of Lauderhill together with the State of Florida created a financial assistance program for residents to purchase appliances that consume less energy. Lauderhill's program, funded by an Energy Efficiency and Conservation Block grant to the city, provides interest free loans to city residents to purchase Energy Star washers, dishwashers, refrigerators, freezers, solar water heaters, tankless water heaters, and air conditioners with a 16 SEER rating or higher.

The loans can only be used in the residents primary home. Loans were secured to the appliances purchased, and linked to the borrowers checking or savings account to provide for automatic monthly payments to the city. Payments are for 12 or 24 months, with the minimum loan of \$400 and the maximum loan of \$2000.²

The City of St. George Utah's Energy Services Department offers rebates for Energy Star eligible appliances used in primary residences. Rebates are available for clothes washers, electric heat pump water heaters, electric hot water heaters and refrigerators. Equipment must meet program standards specified on the program application. Rebates apply to only primary residences and are only available to residents living in SGESD service territory.

Rebates will be paid in the form of a credit to the customer electrical utility account. Include a paid receipt with qualifying purchase highlighted, then sign and mail application to the contact address above. Refrigerator rebates are available to all SGESD customers. Hot water heater rebates are only available to "all electric homes".

Rebates are paid in the form of a credit issued on the electrical account.

In 2010, the State of Arizona implemented a mail-in rebate program using \$6,237,000 in American Recovery and Reinvestment Act (ARRA) funds to help residents replace older, inefficient appliances with ENERGY STAR[®] qualified appliances. Eligible products included: clothes washers, dishwashers, gas storage water heaters, gas tankless water heaters, electric heat pump water heaters, refrigerators, freezers, room air conditioners, and solar water heaters (both electric and gas back-up).

Rebates varied based on the appliances' efficiency levels. Consumers were also required to self-certify the replacement of an old appliance.³ The program had one key objective: help individual consumers replace old and inefficient appliances with new appliances that are generally 15-50% more energy efficient.⁴

In Arizona, the ARRA funds rebates applied to clothes washers (\$3,151,000) will result in energy and water savings of \$4,677,000 over the life of the clothes washers purchased.⁵

As of December 31, 2010, Arizona had provided more than 26,000 rebates ranging from \$75 for room air conditioners to \$500 for solar water heaters. The program prompted the purchase of more than 24,000 ENERGY STAR[®] qualified appliances, bringing in some \$21 million in sales.⁶

No estimated energy efficiency savings data from this program will be available until March 2011 as final calculations and validations of rebates usage are still underway. Results will be posted on the State Commerce Authority webpage.⁷

Also in 2010, Tucson Electric Power Company (TEP) and Unisource Energy (UES) customers were eligible for rebates of up to \$250 for installing a new high efficiency air conditioning unit or heat pump (minimum of 14 SEER).⁸ TEP is unable yet to disclose the number of rebates distributed or the expected energy savings anticipated as a result of this program.⁹

Energy/Emission analysis:

Absent any kind of directed funding available (e.g. rebates, credits, or new appliance purchases) for specific kinds of appliances it is difficult to forecast the range or number of existing home appliances that might be replaced in a voluntary, information-based campaign.

However, multiple experiences with forms of community-based social marketing has shown that awareness and peer behavior are often enough to stimulate behavior change in others. We project that a minimum of 10% of Tucson homeowners and landlord/tenants would be influenced by a successful energy efficient appliance promotion campaign to the point of replacing one energy inefficient appliance in their

home with one carrying an Energy Star label.

To illustrate the energy and emissions savings potential of this response, we use the case of an Energy Star air conditioner delivering approximately 1,260 kWh energy savings per year (note that for Tucson’s climate, EPA predicts that an Energy Star air conditioner will save 1,673 kWh/yr.).¹⁰

As air conditioning is estimated to be 75% of the energy use of the four major home appliances in the Tucson area (dishwasher, clothes washes, refrigerator and central air conditioner), and central air conditioning units have the biggest difference (and therefore the most initial purchase cost barrier) between Energy Star and inefficient units, this analysis will henceforth assume that the rebates are used for air conditioning replacements.

If ten percent of Tucson homeowners (who have not already purchased an Energy Star air conditioner) were to participate, a total of 10,000 energy efficient appliances might be replaced with less-efficient units. At 1,260 kWh savings annually per unit, the savings for 10,000 replacement air conditioners would reach 12,600,000 kWh/yr by 2020.

Greenhouse gas emissions savings from this activity would total 1.1 tCO₂e per year per unit, based on 2 pounds of GHG emissions by TEP for each kWh.

On the assumption that 10,000 air conditioning unit replacements occurred because of the initiative, total GHG savings in 2020 would amount to 11,428 tons. Accumulative savings from 2011-2020 would be 61,714 tCO₂e. Over the lifetime of the appliances, the accumulative savings would be 113,143 tCO₂e.

Climate Change Impact Summary

COT 1990 Citywide GHG emissions (baseline):	5,461,020 tCO ₂ e
MCPA 7% reduction target for COT:	5,078,749
2012 BAU GHG emissions projection:	7,000,000
2020 BAU GHG emissions projection:	7,343,141
GHG emissions reduction to meet 7% goal (2012):	1,921,251
GHG emissions reduction to meet 7% goal (2020):	2,264,392
Contribution of this Measure:	11,428 tCO ₂ e

Economic analysis:

There are two scenarios for an existing air conditioning unit to be replaced: a window unit, or a central unit. As the EPA reports that the difference between a central unit that

is inefficient and an Energy Star unit is ~\$500, and the difference between window units ~\$100, this analysis assumes an average City rebate of \$388 based upon the following:

Savings resulting from 1,000 efficient air conditioning units per year is estimated at 325 kWh per house per \$100 of price difference between inefficient and Energy Star units (based on the ~\$500 difference and 1,673 kWh/yr difference between central air conditioners.¹¹

The annual savings of 1,142 tCO₂e is based on 1000 units each saving 1,260 kWh, which translates to a rebate requirement of $(1260/325 * 100) = \$388$ rebate per unit.

Measure Costs

Measure costs are 10,000 rebates averaging \$388 each = \$3,880,000. A 0.25 FTE at \$100,000/yr/FTE is assumed to be required to administer the program, bringing total average annual costs to \$413,000 over ten years 2011-2020, or \$4,130,000 for the 2011-2020 duration of the measure.

Measure Savings

Each unit saves 1260 kWh/yr, so one year's program of 1000 rebates saves 1,260,000 kWh at the price per kWh of that year. We assume that residential kWh prices are \$0.08/kWh in 2011 and increase at 2.4%/yr.

The consumer savings from new AC units purchased in 2011 is estimated at \$100,800. Savings from units purchased in 2020 is estimated at \$124,785.

We assume the appliance units have a 10-year lifetime. By 2020, the annual savings to consumers since 2011 totals \$1.25 million from the 10,000 units purchased.

A unit purchased in 2011 will save its owner ~\$1,124 over its ten-year lifetime. A unit purchased in 2020 will save its owner ~\$1,425 over its lifetime. The average unit purchased during the program will save ~\$1,275.

This analysis assumes that the City's \$388 rebate (using AC units as the example) for the higher priced efficient appliances is all that is required for consumers to purchase them without additional expenses.

Net Economic Impact

By 2020:

Measure Costs:	\$ 4,130,000
Measure Savings:	\$ 6,301,000
Net Savings:	\$ 2,584,670

Lifetime of the Appliances:

Measure Costs:	\$ 4,130,000
Measure Savings:	\$12,435,648
Net Savings:	\$ 8,718,648

The net savings achieved per tCO₂e saved:

In 2020:	\$73
2011-2020:	\$42
Lifetime of the appliances:	\$77

The net economic impact of the measure, based on a 1.5 multiplier of energy savings achieved, is projected to be:

In 2020:	\$1.87 million
2011-2020:	\$3.88 million
Lifetime of the appliances:	\$13.1 million

Co-benefits:

More energy efficient appliances result in life-cycle cost-savings to homeowners and potentially lower energy bills over time as utility power plant capacity additions are delayed or cancelled. Also, new appliances should perform more efficiently in general thus delivering more of the services they were created and paid for originally.

Equitability:

Most existing and earlier appliance rebate programs established income thresholds intended to steer rebates towards households most likely to benefit from reduced utility bills. These programs were progressive in nature depending on the structure of their income or other thresholds.

A more general outreach and promotion campaign, absent financial incentives, would likely be first taken advantage of by those able to trade up in their use of appliances, followed by those who are at or near the time when appliance replacements were necessary because of age or performance issues. There is nothing inherently inequitable about the proposal however.

Potential unintended consequences:

A wholesale appliance replacement program on the scale of 10,000 units would generate an equal number of units requiring safe end-of-use management (recycling or disposal).

In addition, the life cycle materials (and possibly energy) costs of an appliance that is more efficient to operate may have environmental consequences at the point of manufacture or materials extraction prior to manufacture of the appliance and its subcomponents. More information may be useful on the life-cycle energy and environmental impacts of Energy Star appliances.

Endnotes

¹ USDOE, "State Energy Efficient Appliance Replacement Program: An Assessment." September 30, 2010, at: <http://www.naseo.org/events/annual/2010/presentations/Macrae.pdf>.

² ELauderhillNews, 2010, at: <http://elauderhill.blogspot.com/2010/04/city-of-lauderhill-interest-free-energy.html>.

³ U.S. Department of Energy, Energy Savers Bulletin, at: http://www.energysavers.gov/financial/rebates/state_AZ.cfm.

⁴ Earth911.com. <http://earth911.com/news/2010/04/12/cash-for-appliances-already-huge-success-in-arizona/>.

⁵ NASEO, October 2010, at: http://www.naseo.org/rlf/Appliance_Rebates.pdf.

⁶ EnergySavers.gov, 2010, at: http://www.energysavers.gov/financial/rebates/state_AZ.cfm.

⁷ Communication with Michelle Bermudes, Arizona Energy Office. January 5, 2011.

⁸ Gridpoint, 2010, at: <http://sre3.com/locations.do?pagelD=phoenixrebatesincentives&cityid=phoenix&mcid=4>.

⁹ Communication with Vicki Boes, TEP, January 5, 2011.

¹⁰ Spreadsheet with assumptions are downloaded from: http://www.energystar.gov/index.cfm?c=products.pr_find_es_products.

¹¹ Spreadsheet with assumptions are downloaded from: http://www.energystar.gov/index.cfm?c=products.pr_find_es_products.