STATE OF COLORADO

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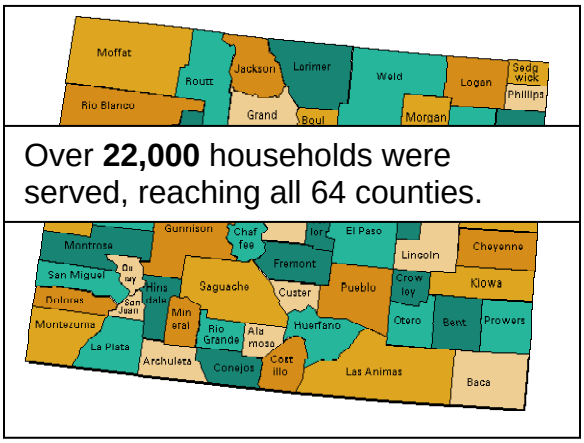
State Funded Energy Efficiency Services For Colorado's Low-Income Households: First Annual Report to the Colorado General Assembly October 1, 2007

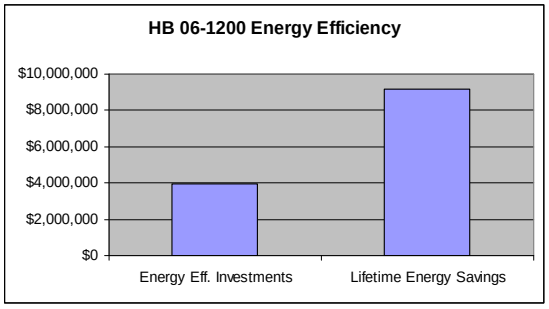
Executive Summary

House Bill 06-1200 provides state severance tax funds to the Governor's Energy Office (GEO) to make cost-effective investments in energy efficiency in low-income housing. During the 2006-07 state fiscal year, the GEO invested over $4.0 million in energy efficiency improvements in low-income housing across the state using these funds. Services were provided in all 64 counties, reaching over 22,000 households.



Over **22,000** households were served, reaching all 64 counties.

$**2.33** saved for each $**1** spent.



All services have been designed to yield at least two dollars in energy savings for each dollar expended. Preliminary estimates indicate that each dollar invested will yield $2.33 in energy savings over the lifetime of the devices installed and education provided[1]. A quantitative evaluation is underway, the results of which will be available by the end of this current fiscal year and factored into the operating plan for state fiscal year 08-09.

[1]Concerning "lifetimes", compact fluorescent bulbs are presumed to last 7 years, showerheads 10 years and insulation 20 years. Behavioral changes resulting from education are presumed to persist 3 years.
Supporting Document 1; Supporting Document 2; Supporting Document 3

Investments in residential energy efficiency have impacts well beyond the consumers' utility consumption. There are resulting benefits shared by all (environmental and economic), benefits to utility ratepayers (regarding costs associated with serving low-income customers) and benefits accruing to the household served (health, safety and comfort related).

One significant and quantifiable non-energy benefit of these efficiency investments is their positive impact upon global warming. The reduced carbon dioxide emissions resulting from these investments is estimated to be over 40 thousand metric tons over the lifetime of the devices installed and education provided.

40,000 metric tons of carbon dioxide will not be emitted due to these investments. (The average American creates about 10 tons/year through their home, car and travel.) (source: carbonfund.org)

While the statute authorizes a variety of approaches for achieving energy efficiency, the underlying intent was clear: significantly increase the number of homes receiving energy services. (Using federal and utility funds, GEO annually provides comprehensive "weatherization" services to about 4,000 homes each year, through the Energy $aving Partners program – E$P.)

In the 2006-07 state fiscal year, GEO launched the "First Response" initiative, delivering cost-effective and easy to install energy saving devices to over 21,000 households. Four new service delivery channels were researched and developed:

- home visits via Youth Corps
- interactions with clients during their request for energy assistance
- mailing efficiency devices to Low-income Energy Assistance Program (LEAP) recipients
- on-site electric usage audits and efficiency services targeting high electric usage LEAP recipients.

Meanwhile, substantial energy savings opportunities exist within the homes served by E$P, beyond what federal or utility funding can provide. Thus, in the past fiscal year almost 1,400 new furnaces were installed and over 1,200 refrigerators were replaced in the 3,800 homes served via E$P.

Also, since increasing numbers of low-income households reside in multi-family properties, efficiency investments were also targeted to these dwellings. A total of 13 heating systems (space and water heat) were replaced, serving 324 residences.

Combining the energy and non-energy benefits, the investment of $4 million in the energy efficiency of low-income Colorado households will yield returns several times greater than the initial investment.

The Governor's Energy Office is pleased to present the following complete report and to serve as the conduit for low-income energy efficiency services in Colorado.

	Units of Service	Energy Savings	Anticipated Return on Investment	Estimated CO2 Offset	Other Benefits
Mass Distribution ("First Response" Initiatives)	21,291 Homes	22 million kWh 1.5 million therms	$2.79/$1.00	19,000 Metric Tons	2,708 CO/smoke detectors
Supplements to Federally funded "Weatherization" Services	1,230 refrigerators 855 furnaces	17 million kWh 1.9 million therms	$1.89/$1.00	15,000 Metric Tons	13 solar thermal air panels
Efficiency Investments in Multi-Family Housing	324 dwellings	7 million kWh 1.2 million therms	$2.18/$1.00	6,500 Metric Tons	1 - 5.1 kW solar PV system
Efficiency Investments in New Housing	36 dwellings	165,000 kWh 78,000 therms	$1.50/$1.00	175 Metric Tons	
TOTALS:	22,881 homes	46 million kWh 4.7 million therms	$2.33/$1.00	40,675 Metric Tons	

State Funded Energy Efficiency Services
For Colorado's Low-Income Households:
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Background

During the 2006 Colorado State Legislative session, an effort was put forth to assist low-income energy consumers in the midst of rising home energy costs. While previous legislative efforts had focused upon increasing the state's energy assistance (bill payment) resources, the 2006 session also directed resources to assisting these consumers reduce their energy usage.

On February 3, 2006, House Bill 06-1200 was signed into law. This statute appropriates state severance tax revenues to various energy-related assistance efforts, including home energy efficiency investments provided via the Governor's Energy Office (GEO).

The statute authorizes six general approaches to improving the energy efficiency of low-income housing {CRS 39-29-109(1.5)(h)(I)}:

> "(A) providing low-cost and cost-effective energy efficiency measures and energy education to low-income households in general;
> (B) retrofitting households with low-cost and cost-effective energy efficiency measures through the state weatherization assistance program;
> (C) providing heating system and other appliance replacement;
> (D) providing cost-effective renewable energy measures;
> (E) supplementing the funding for any energy efficiency measures or services offered to low-income households through electric or gas utility energy efficiency or renewable energy programs; or
> (F) paying a portion of the cost for energy efficiency upgrades to new housing built for low-income families."

Furthermore, GEO's efforts are guided by the following directives {CRS 39-29-109(1.5)(h)(III)}:

> "(A) serve as many low-income households throughout the state as possible;
> (B) achieve the maximum lifetime energy savings per dollar expended;
> (C) use competitive bidding procedures to hire contractors; and
> (D) whenever feasible, contract with Colorado accredited youth corps to provide labor."

The statute also directs GEO to "prepare and submit to the General Assembly an annual report that specifies {CRS 39-29-109 (1.5)(h)(V)}:

> (A) How the moneys were expended;
> (B) The number of households served;
> (C) The expected energy savings and other non-energy benefits; and
> (D) Recommendations for any future programs of this nature."

The following is that report.

State Fiscal Year 06-07 Energy Efficiency Investments, Corresponding to the Options Set Forth in the Statute

- Concerning the delivery of low-cost and cost-effective energy efficiency services on a large scale {39-29-109(1.5)(h)(I)(A), C.R.S.}:
    - Piloted the concepts on a small scale (212 homes – 63 single family; 149 multi-family units in 6 properties); August – November, 2006.
    - Initiated a competitive request for proposals (July – September 2006), yielding six viable proposals covering the three delivery approaches;
    - Negotiated and executed contracts (October 2006 – February 2007); For the period January 2007 – January 2008:
        - Contracted with six Youth Corps (aggregated via the Mile High Youth Corps), to visit low-income households in ten counties and install high efficiency light bulbs, shower heads and carbon monoxide/smoke detectors and conduct energy consumer education
        - Contracted with *Take It For Granted, Inc.* to visit homes in two counties to install high efficiency light bulbs, shower heads and setback thermostats and conduct quarterly energy consumer education, as well as conduct an electric usage audit and meter the refrigerator (for replacement via the E$P Program)
        - Contracted with Energy Outreach Colorado to incorporate energy efficiency education into their delivery of utility bill payment assistance through ten of their local agencies serving ten counties, along with providing to each client a kit containing high efficiency light bulbs and shower heads for installation by the recipients
        - Contracted with three vendors to mail light bulbs, shower heads and consumer education materials to low-income households in 51 counties

Project/Activity	# Homes Served	# of light bulb conversions	Estimated electric savings (kWh) – lifetime	# of shower head conversions	Automatic Setback Thermostat	Estimated gas savings (therms) - lifetime
First Response – pilot testing	212	1,765 (installed)	667,170	224		73,920
First Response – Mass Mailing	17,288	68,728 (mailed)	9,807,226	17,162		566,346
First Response- Client Intercept Workshops	1,050	2,100	642,978	1,050		103,950
First Response – Installation Visits	2,381	29,466	9,043,007	1,733		171,567
Targeted Electric Services	360	5,177	1,570,143	206	100	22,159
TOTALS:	21,291	107,236	21,730,524	20,375	100	938,302

Total Expenditures (sfy 06-07): $1,386,131

Estimated Value of Lifetime Energy Saving Measures[2]: $2,932,405
Electric: $1,970,645
Gas: 961,760

Simple Return on Investment: 2.12:1.0

Estimated Impact on Energy Savings Resulting from Consumer Education[3]: $707,805 ($51,523 electric; $656,282 gas)

Adjusted Simple Return on Investment: 2.63:1.0

[2] Estimated Energy Savings values are based upon analysis of other programs, and were pre-set in the Request for Proposal document. **Supporting Document 1; Supporting Document 2; Supporting Document 3**

[3] Estimated savings from energy education are based upon analysis of other programs, and were pre-set in the RFP document.

Notes on the *First Response* and *Targeted Electric* services:

(1) The savings estimates presume various levels of effectiveness, depending upon the method used to deliver the efficiency devices to eligible households. Specifically:
   a. For Mass Mailing, it is presumed that 37.5% of the light bulbs provided and 10% of the showerheads provided will be installed
   b. For the Client Intercept Workshops, it is presumed that 81% of the light bulbs provided and 30% of the showerheads provided will be installed
   c. For the Installation Visits, it is presumed that 90% of the light bulbs installed will stay installed and that 30% of the showerheads encountered will have a new showerhead installed.

Non-Energy Services: $76,744 of the expenditures was for health and safety-related services (installation of carbon monoxide and/or smoke detectors). When removed from the Return on Investment calculation, the simple return on investment is 2.79:1.0. In other words, for each dollar expended on energy efficiency, $2.79 worth of energy will not be consumed.

- Concerning heating system and other appliance replacements (via the E$P Program) {39-29-109(1.5)(h)(I)(B) and (C), C.R.S.} :
  - Contracted with each of the eight E$P program local service provider agencies to perform the following as "E$P Plus" services (services added to the E$P services already being provided):
    - Heating system replacements for efficiency (when deemed cost-effective; generally from below 70% to over 90% efficiency); 689 systems replaced
    - Upgrading proposed health/safety-based heating system replacements (systems identified as unsafe under the Crisis Intervention Program[4]are generally replaced with 80% efficient systems); HB 06-1200 funds are used to increase the efficiency to 90+%; 168 systems upgraded
    - Refrigerator replacements for efficiency (when kWh savings from new unit will yield a positive payback over life of unit); 1230 refrigerators replaced
    - 13 heating systems (boilers/domestic water heat) were replaced in multi-family properties, serving 324 residences
    - Two high efficiency water heaters were installed in single family residences

- Concerning the provision of cost-effective renewable energy measures (additional E$P Plus activities) {39-29-109(1.5)(h)(I)(D), C.R.S.} :
  - Testing the feasibility and cost-effectiveness of installing solar thermal air panels; 13 panels have been installed and are being evaluated
  - Testing the feasibility and cost-effectiveness of installing solar photovoltaic electric generation on multi-family low-income properties; one 5.1 kW system installed
  - Testing the feasibility and cost-effectiveness of other appliance replacements: one corn/pellet stove and two high efficiency water heaters have been installed

  Total Expenditures on E$P Plus Activities: $2,492,755

  <u>Anticipated Energy Savings of E$P Plus Activities</u>

  - 3.2 million therms (over lifetime of measure); about $3.3 million in gas savings for the consumers
  - 22.8 million kWh (over lifetime of measures); about $2.1 million in electric savings for the consumers

[4] The Crisis Intervention Program is a component of the state's Low-income Energy Assistance Program (LEAP)

Anticipated Return on Investment (Savings to Investment Ratio) for E$P Plus:

$5,438,179 in savings / $2,492,755 in costs = 2.18:1.0

($2.18 in energy savings for each $1 invested)

- Concerning energy efficiency upgrades to new housing built for low-income families {39-29-109(1.5)(h)(I)(F), C.R.S.}:
  - A list of cost-effective energy upgrades has been incorporated into the funding applications used by the Division of Housing and the Colorado Housing and Finance Authority. Contracts/agreements have been executed with each of these partners (March 2007 with the Division of Housing; July 2007 with CHFA). Funds were obligated to DOH in SFY 06-07 and committed to projects. These commitments ($250,000) have been rolled forward into SFY 07-08.
  - During the development of the GEO-DOH and GEO-CHFA partnerships, GEO piloted investing in new low-income housing, in conjunction with Energy Outreach Colorado[5]. Four projects met GEO criteria and funds were committed in SFY 06-07 as follows:
    - Colorado Rural Housing Development Corporation: $25,000 for ten unit project in Monte Vista to upgrade systems (furnace, water heater) and insulation above local code, and improve efficiency of kitchen appliances
    - Habitat for Humanity of Metro Denver: $20,000 to upgrade the structural and mechanical energy efficiency for seven homes
    - NE Denver Housing: $24,000 for energy efficiency upgrades associated with an 18 unit apartment complex; ($2,310 expended during SFY 06-07; balance to be re-obligated via SFY 07-08 funds)
    - Third Way Center (group home): $15,930 for replacement of boiler and domestic water heater

Total SFY 06-07 Investments in New Construction: $63,240

Anticipated Lifetime Energy Savings from These Investments: ~$ 95,000
Gas Savings: ~ $80,000 Electric Savings: ~$15,000

Total Energy Savings Impact of SFY 06-07 Investments

Anticipated Lifetime Energy Savings from all SFY 06-07 Investments:

Electricity:	46.8 million kWh	$4.2 million
Gas:	4.8 million therms	$4.9 million

Total Amount Expended in SFY 06-07: $4.0 million[6]
Benefit-to-Cost (Savings to Investment ratio): $2.33 per $1.00

[5] Energy Outreach Colorado operates an "Energy Solutions Grants" program which makes investments in energy efficiency upgrades in new low-income housing during construction.
[6] Expenditure details by vendor and project area **Supporting Document**

State Fiscal Year 05-06 Activities (February – June 2006)

Since the funding was authorized late in the 05-06 fiscal year, and since competitive procurement was required to select service delivery contractors, activities in state fiscal year 2005-06 were limited to program design and pilot testing. Also, highest priority was placed by GEO on pursuing low-cost strategies that would serve as many low-income households as possible. Within that context, GEO took the following actions toward designing services:

- Recruited various local experts to a brainstorming session, convened on March 16, 2006
- Concerning the delivery of low-cost and cost-effective energy efficiency services on a large scale:
    - Conducted a review of best practices across the country, concerning utility or government administered programs;[7]
    - Identified three potentially viable approaches to low-cost mass distribution of energy efficiency services;
    - Quantified the anticipated energy savings benefits of each approach[8]
    - Crafted a competitive request for proposals to deliver these three approaches
- Concerning heating system and other appliance replacements:
    - Prepared and tested a decision making protocol (savings to investment calculation) for use in the state weatherization assistance program (Energy $aving Partners, or E$P) to replace heating systems[9]
    - Negotiated short-term pilot testing of the protocol with four of the state's eight E$P program local service provider agencies
    - Installed 225 new heating systems using the protocol (and a blend of state and federal funding sources); modified protocol for statewide implementation, effective 07/01/07.

- Concerning energy efficiency upgrades to new housing built for low-income families:
    - Developed a matrix of costs and benefits for possible efficiency upgrades (above code upgrades)[10]
    - Initiated negotiations with the primary state funders of new low-income housing (Division of Housing within the Department of Local Affairs and the Colorado Housing and Finance Authority) for their inclusion of the benefit/cost matrix into their funding processes, (with funds to be provided via GEO)

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[7] See final report from APPRISE, Inc. "Findings and Recommendations – Mass Distribution Models" **Supporting Document**

[8] See Excel spreadsheets delineating anticipated energy savings, as used in the competitive solicitation of proposals (RFP JS-00002-07, State Division of Purchasing) **Supporting Document 1; Supporting Document 2; Supporting Document 3**

[9] See "Furnace Replacement Protocol" (pdf file) at: **Supporting Document**

[10] See "E$P New Construction Appendix 9-13" **Supporting Document**

Non-Energy Benefits Resulting From Energy Savings

A study of non-energy benefits resulting from weatherization services[11] identifies the following range of benefits attributable to energy efficiency investments in low-income housing:

- Utility Ratepayer benefits: reduced collection and arrearage (bad debt) costs; fewer service calls

- Household benefits: water costs; property value increases; increased health, safety and comfort; and reduced mobility. Specific to the Colorado services provided:

    - 2,708 carbon monoxide and/or smoke detectors were installed via visits to clients' homes.
    - Also, in a recent Colorado study, 56% of homeless families reported utility costs as a reason for their homeless, the second most frequent reported reason[12]

- Societal benefits: air emissions; and economic impacts (employment, circulation of funds through local economies, etc.). The societal benefits specific to Colorado as a result of 06-07 investments:

    - Reduced Carbon Dioxide Emissions
        - Over the lifetime of the electric efficiency measures installed, 84 million pounds (38 thousand metric tons) of carbon dioxide will not be emitted into the atmosphere as a result[13]
        - Over the lifetime of the gas efficiency measures installed, 5.3 million pounds (2,600 metric tons) of carbon dioxide will not be emitted into the atmosphere as a result[14]

    - Water Conservation from showerhead replacements:
        - 20,375 showerheads x 9,000 gallons/yr. saved x 10 yr. lifetime = 1.8 billion gallons

The non-energy impact of federal weatherization services is estimated to be valued at more than $3,300 for each home served, services which average under $1,800 per home and yield energy benefits in excess of $3,100. While the services provided via the HB 06-1200 funds were not directly analogous to weatherization services, this analysis conveys that the non-energy benefits are significant.

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[11] Non-Energy Benefits of the Weatherization Assistance Program: A Summary of Findings From the Recent Literature; Oak Ridge National Laboratory; 2001 **Supporting Document**

[12] Colorado Statewide Homeless Count, Summer 2006, p. 11; (Executive Summary, February 2007) **Supporting Document**

[13] For each kWh not consumed, 1.8 lbs. of carbon dioxide is not emitted.

[14] For each therm of natural gas not consumed, 1.206 lbs. of carbon dioxide is not emitted.

Lessons Learned

A complete qualitative and quantitative evaluation of first year expenditures is underway, particularly focusing upon the First Response, Targeted Electric Services and E$P Plus activities. Complete results will be available by the end of the SFY 07-08 fiscal year and reported to the State Legislature in the next annual report. A preliminary review yields the following observations which are being incorporated into the next phase of projects.

- First Response Project:
  - Wastage can be reduced and the likelihood of mailed materials being installed can be increased by first sending all targeted households an inquiry and "business response card." Through such an interaction, the household communicates back their interest and the specific quantities of materials (light bulbs and shower heads) they desire to install.
  - The effectiveness of the Point-of-Contact workshop model can be increased, in terms of frequency of savings devices being installed and reduced wastage, by personalizing the "kit" contents to each clients. One immediate outcome of each one-on-one interaction would be to determine the client's kit contents based upon their willingness to install the contents.
  - One tangential value of the Installation Visits is the ability to assess the home for other cost effective energy efficiency services. Some of the Youth Corps have been trained in making such assessments and referring prospective clients to the E$P Program. This concept needs to be expanded to all Youth Corps.

- Target Electric Services
  - These visits to 360 homes, as a pilot concept, successfully identified over 100 refrigerators where a replacement was a cost-effective energy efficiency investment. These were referred to the E$P Program who has established procedures and vendor partners concerning refrigerator replacement and safe decommissioning of the old units. In 2007-08 the need is for better consumption data (via utility companies) so that more high electric/low gas usage homes can be identified and approached via this relatively low-cost strategy (vs. the comprehensive strategy offered via E$P).

- E$P Plus
  - While it is generally cost-effective to "piggyback" additional services on top of the E$P service delivery infrastructure, there is a need to seek a balance between saving more energy on E$P clients' homes (about 4,000/yr.) versus redirecting these additional investments into other homes not yet served. In 2007-08, the E$P Program will explore using HB 06-1200 funds to make targeted investments in homes requiring more services than what is provided by the First Response strategies, yet, less than what is

provided by E$P. Such homes may only require the replacement of an appliance (refrigerator/freezer) or heating system (furnace, water heater).

- Investments in New Construction
  - The initiative set forth in SFY 06-07, in terms of assisting builders with the marginal costs of energy efficiency upgrades, will quickly be usurped by implementation of HB 07-1146, concerning local energy codes. Also, both DOH and CHFA are working on establishing minimum energy efficiency standards for projects they fund (above code), which further reduces the need for this assistance. Thus, further funding in this area is being phased out in SFY 07-08.

- Renewable Energy and Existing Housing
  - Only one technology has so far been identified as having a strong potential for cost-effectiveness (e.g., yielding an energy savings at least twice the value of the investment cost). That technology is solar thermal space heating. Based upon manufacturer's statements and third party analysis, a product was selected for limited installation. Thus far, it appears that the conditions necessary for optimal performance (southern/western solar exposure; limited shading) do not occur with great frequency amongst low-income housing. Also, the actual output of the systems installed (units of energy; airflow) are less than anticipated and make the cost-effectiveness questionable. Therefore, no additional systems will be installed beyond the 40 initial units purchased, until a complete quantitative analysis can be conducted.