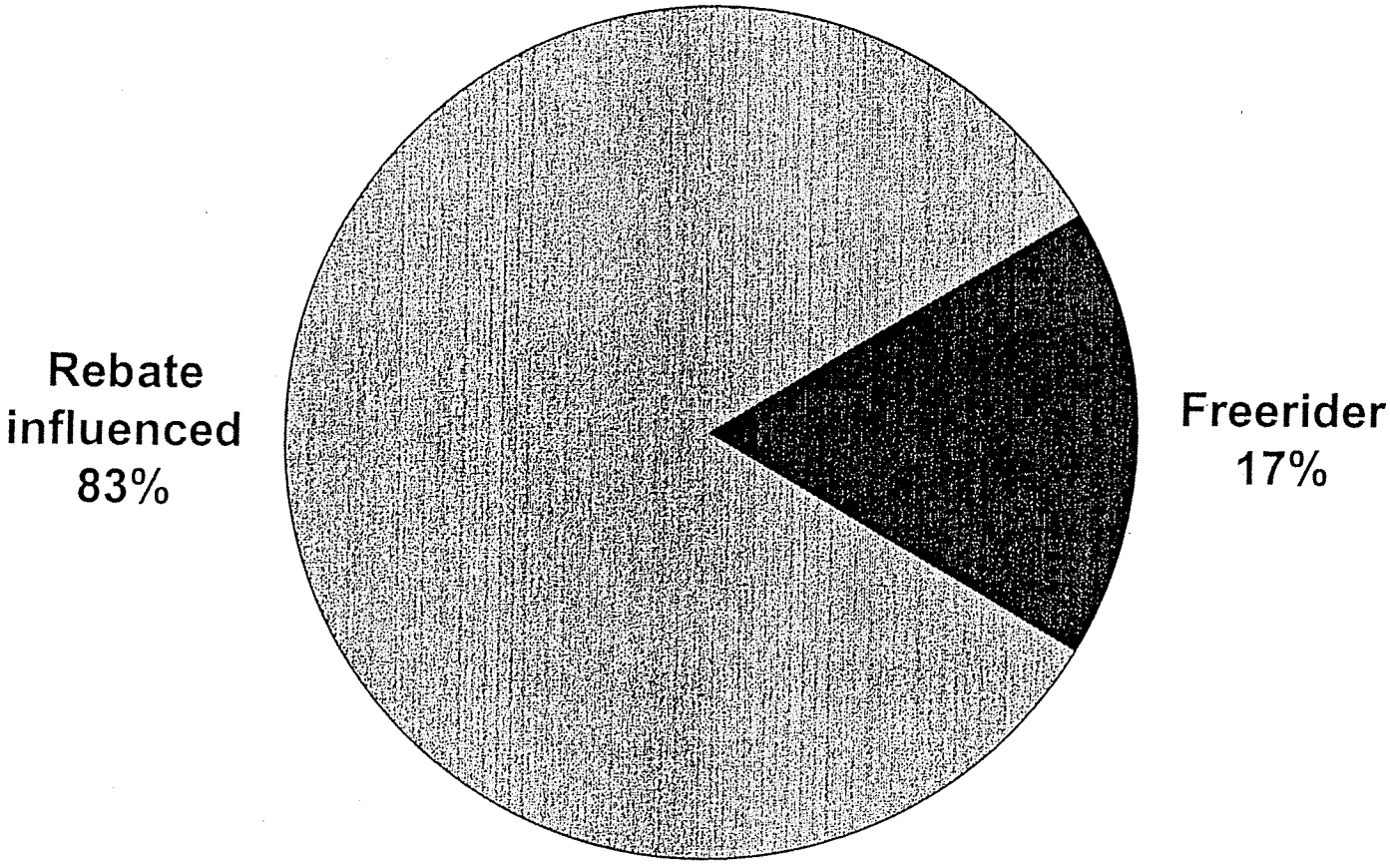
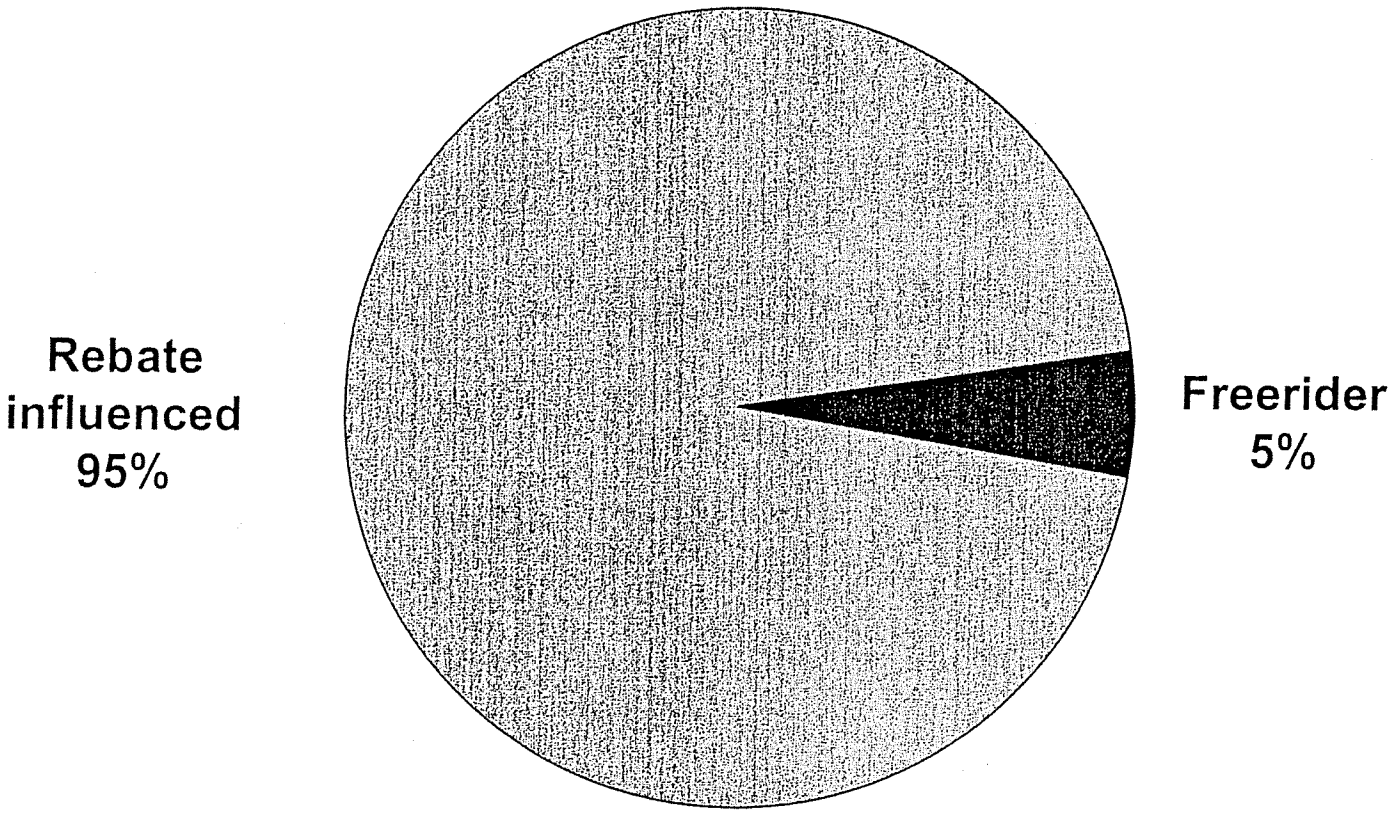
Freeriders



(Freerider = planned on heat pump; planned on Zone 3 insulation; likely to buy even without rebate on high efficiency unit and on Zone 3 insulation)

(n = 41)

Clearly Freerider



(Clearly Freerider = planned on heat pump; planned on Zone 3 insulation; very likely to buy even without rebate on high efficiency heat pump and on Zone 3 insulation)

(n = 44)

Appendix C: Data Collection Form & Customer Installation Report

MOBILE HOME NEW CONSTRUCTION

A Demand Side Management Program

Date _____ AEP Confirmation No. _____

Dealer Name _____

Address _____

Telephone No. _____

City _____ State _____ Zip _____

Salesperson _____

Tax Exempt No. _____ Social Security No. _____

Purchase Date _____ Home Size _____X_____

One Site Date _____

Zone Three Insulation _____ yes Fireplace _____ yes _____ no Sky lights _____ yes _____ no
(must have to qualify for incentive)

Description of HVAC Equipment

Manufacturer _____ System Size _____
In Tons

Outdoor Unit Model # _____ Serial # _____
Indoor Unit Model # _____ SEER _____ HSPF _____

To Qualify Efficiency Ratings Must Be:
Split System 11.0 SEER or 7.2 HSPF
Package System 10.0 SEER and 6.8 HSPF

Heat Pump
Design: _____ Split System II _____ Package System
Installed in: _____ New Construction (Must be to Qualify)

Heat Pump Installed in
AEP/Kentucky Region _____ yes
(Must be to Qualify)

Social Security No _____
Electric Meter No. _____
Account No. _____

Customer Name _____

Street Address _____

City _____ State _____ Zip _____

Telephone No.
(H) _____
(W) _____
(O) _____

Mailing Address, if different: _____
_____

I verify that the existing equipment is currently being used to space condition the customer's residence at the above address

HVAC/Mobile Home Dealer Signature _____ Date _____

I verify that the above information is correct and I understand that the rebate I will receive is considered taxable income by the IRS.

Customer Signature _____ Date _____

2003
MOBILE HOME NEW CONSTRUCTION PROGRAM

Agreement #	Customer Name	Customer Address	City	Customer Acct Number	M/H Dealer	Customer Date	M/H Dealer Date	Received Date	Accts. Payable Date	Check Mailed Date	Heat Pump SEER	Heat Pump HSPF	A/C SEER	Mobile Home Dimension	Skylight Y/N	Fireplace Y/N
03-01	Spears, Jerry	9130 Robinson Crk Rd	Pikeville	0325893990	Glenn's	10/10/2002	12/14/2002	01/02/2003	01/02/2003	01/15/2003	12	7.6		16X76	y	n
03-02	Swindall, Virgie	520 Marshalls Branch	Jenkins	0346961590	Glenns	10/22/2002	12/14/2002	01/02/2003	01/02/2003	01/15/2003	12	7.6		32X76	n	y
03-03	Kendrick, Christene	167 Shop Branch Rd	Stanville	0307288740	LUV	01/06/2003	01/06/2003	01/06/2003	01/06/2003	01/15/2003	10	7.2		32X56	n	y
03-04	Ritchie, Abbey	14 Tribbey Camp Rd	Bulan	0384175610	White's	01/03/2003	01/03/2003	01/06/2003	01/06/2003	01/15/2003	10	7.5		28X68	n	y
03-05	Bowling, Roderick	Brickyard Hill	Jenkins	0396705890	Glenn's	01/06/2003	01/02/2003	01/10/2003	01/10/2003	01/21/2003	12	7.2		28X60	y	y
03-06	Collins, Wanda	629 Brush Crk	Argillite	0338523740	Fleetwood	01/17/2003	01/17/2003	01/22/2003	01/22/2003	02/06/2003	10	7.2		28X60	n	y
03-07	Dolson, James	Pond Fork Rd	Phelps	330599880	LUV	01/04/2003	02/13/2003	02/12/2003	02/13/2003	03/04/2003	10	7.2		28x68	y	y
03-08	Sexton, Timothy	11814 Hwy 160	Whitesburg	0342734090	Glenns	11/25/2002	02/13/2003	02/24/2003	02/24/2003	03/05/2003	12	7.6		28X60	n	y
03-09	Flynn, Ron	191 Riffe Hollow	Rush	0375673630	Dream	02/25/2003	02/25/2003	02/24/2003	02/27/2003	03/11/2003	10	7.2		28X70	n	y
03-10	Taylor, Darlene	84 Williams Branch	McVeigh	0348977050	Hylton	11/07/2002	11/07/2002	02/24/2003	02/27/2003	03/11/2003	11	7.2		28X62	n	y
03-11	Justice, James	211 Peach Orchard Br.	Pikeville	0302522120	Keene's	02/26/2003	02/26/2003	02/27/2003	02/27/2003	03/11/2003	10	7.2		24X60	n	n
03-12	Kimbler, Roy	1152 Kimbler Ln	Hager Hill	0303545120	LUV	02/06/2003	02/06/2003	02/06/2003	02/28/2003	03/11/2003	10	7.2		32X56	n	y
03-13	Webb, Nellie	153 Number three Hill	Jenkins	0394084890	Whitehall	02/25/2003	02/26/2003	02/28/2003	02/28/2003	03/14/2003	10	7.2		14X56	n	n
03-14	Crawford, Nyoka	99 Corkwood Lane	Mayking	0309447970	Adkins	03/06/2003	03/06/2003	03/14/2003	03/14/2003	03/26/2003	12	7.6		28X72	n	y
03-15	Childers, Junior	67 Rose Hollow	Elkhorn City	0371061520	Glenn's	11/22/2002	03/08/2003	03/21/2003	03/21/2003	04/03/2003	12	7.6		28X44	n	n
03-16	Thacker, Terry	2884 Shelby Dry Fork	Shelbiana	0312300044	LUV	03/25/2003	03/24/2003	03/25/2003	03/26/2003	04/07/2003	10	7.2		28X68	y	y
03-17	Knight, Robert	8059 Hwy 119 N	Jenkins	0311050400	LUV	03/26/2003	03/26/2003	03/27/2003	03/27/2003	04/07/2003	11	7.2		28X44	n	n
03-18	Griffith, Roger	74 Straight Fork	Cornettsville	0380400854	Watts	03/18/2003	03/18/2003	03/28/2003	03/28/2003	04/08/2003	10.5	6.9		16X76	y	n
03-19	Blanton, Nick	Combs Road	Combs	0308591631	Watts	03/07/2003	03/07/2003	03/28/2003	03/28/2003	04/08/2003	12	7.9		16X80	n	n
02-20	Horn, Anthony	550 Weddington Branch Rd	Pikeville	0377725860	LUV	04/11/2003	04/11/2003	04/14/2003	04/14/2003	04/24/2003	11	7.2		16X76	n	n

Appendix C

Tabulation of Data from Installation Information Form

I. Summariztion of Data Regarding New Mobile Home
   a) Size of Mobile Home (Average Size 1,650 ft.^{2})

Under 700 ft.^{2}	0.3%
700 - 800 ft.^{2}	1.9%
800 - 1,000 ft.^{2}	5.6%
1,000 - 1,200 ft.^{2}	7.6%
1,200 - 1,400 ft.^{2}	20.3%
1,400 - 1,600 ft.^{2}	12.2%
1,601 - 1,900 ft.^{2}	16.4%
>=1,900 ft.^{2}	35.7%

II. Information Regarding New Heat Pump Installation
   a) SEER (Average SEER = 10.65)

10	60.7%
10.1 - 10.9	2.8%
11	6.1%
11.1 - 11.9	6.9%
12	22.7%
>12	0.8%

   b) HSPF (Average HSPF = 7.35)

<=6.8	0.8%
6.9 - 7.5	73.7%
7.6 - 8.0	24.7%
> 8.0	0.8%

Appendix D: Energy Impact Reduction

Appendix D

Energy Impact Reduction

I. ASHRAE Heating and Cooling Degree Day Models

A. Heating Degree Model:

Heat Pump System: $E_h = 24*[H_L/(T_i - T_o)]*[HDD/1000*HSPF]$

Electric Resistance: $E_h = 24*[H_L/(T_i - T_o)]*[HDD/3413]*C_D$

where;

E_h = Annual Energy Savings (kWh)
H_L = Design Heat Loss (Btu/h)
T_i = Indoor Thermostat Setting (^{0}F)
T_o = Outdoor Design Temperature (^{0}F) @ $97^1/_2$% db
HDD = Annual Heating Degree Days (^{0}F-days)
HSPF = Heating System Performance Factor (Btu/Wh)
C_D = Adjustment factor for solar and internal heat gains, dimensionless

and,

24 is a conversion factor for hrs/day
1000 is a conversion factor for Wh/kWh
3413 is a conversion factor for Btu/kWh

B. Cooling Degree-Day Model:

Central Air Conditioner/Heat Pump:

$E_c = 24*[H_G/(T_o - T_i)]*[CDD/1000*SEER]$

where;

E_c = Annual Energy Savings (kWh)
H_G = Design Heat Gain (Btu/h)
T_o = Outdoor Design Temperature (^{0}F) @ $2^1/_2$% db
T_i = Indoor Thermostat Setting (^{0}F)
CDD = Annual Cooling Degree Days (^{0}F-days)
SEER = Seasonal Enrgy Efficiency Ratio (Btu/Wh)

with, 24 and 1000 being conversion factors as defined above.

Appendix D

Energy Impact Reduction

II. Estimation of Heat Losses and Heat Gains

A. Mobile Homes @ AEP/KPCo Coal Run service facility (Phase I/Period I):

Given Conditions: E_h = 4,332 kWh* and E_c = 1,173 kWh*(Home 3/Zone 2 Heat Pump)
E_h = 8,708 kWh* and E_c = 1,483 kWh*(Home 2/Zone 2 Elec.Furn.&CAC)
T_i = 72 ^{0}F Heating and Cooling Thermostat Settings
T_o = 9 ^{0}F** Outdoor Design Temperature for Heating and,
92 ^{0}F** Outdoor Design Temperature for Cooling
HDD = 4,393 ^{0}F-days** (Normalized)
CDD = 1,033 ^{0}F-days** (Normalized)
HSPF = 8.0 Btu/Wh
SEER = 12.0 Btu/Wh
C_D = 0.75
* Load Research Data Results
** Jackson, Ky. National Weather Station

Unknown: H_L = Design Heat Loss (Btu/h)
H_G = Design Heat Gain (Btu/h)

B. Design Heat Loss & Heat Gain Estimates:

Home 3/ Zone 2 Heat Pump:

$H_L = [E_h*(T_i-T_o)*1000*HSPF]/[24*HDD]$
H_L = [4,332 kWh*(72^{0}F-9^{0}F)*1000*8.0 Btu/h]/[24*4,393 ^{0}F-days] = 20,708 Btu/h

$H_G = [E_c*(T_o-T_i)*1000*SEER]/[24*CDD]$
H_G = [1,173 kWh*(92^{0}F-72^{0}F)*1000*12.0 Btu/h]/[24*1,033 ^{0}F-days] = 11,355 Btu/h

Home 2/ Zone 2 Electric Furnace with CAC:

$H_L = [E_h*(T_i-T_o)*3413]/[24*HDD*C_D]$
H_L = [8,708 kWh*(72^{0}F-9^{0}F)*3413]/[24*4,393 ^{0}F-days*0.75] = 23,679 Btu/h

$H_G = [E_c*(T_o-T_i)*1000*SEER]/[24*CDD]$
H_G = [1,424 kWh*(92^{0}F-72^{0}F)*1000*12.0 Btu/h]/[24*1,033 ^{0}F-days] = 13,785 Btu/h

Assume Maximum H_L and H_G (rounded off): H_L = 23,700 Btu/h
H_G = 13,800 Btu/h

Appendix D

Energy Impact Reduction

III. Estimation of Energy Impact Savings

A. Characteristics Mobile Homes Sold To 250 Program Participants (2003 - 2004):

Given Conditions:

H_L = 23,700 Btu/h*
H_G = 13,800 Btu/h*
T_i = 72 °F (Heating) & 71 °F (Cooling) for Thermostat Settings
T_o = 9 °F** Outdoor Design Temperature for Heating and,
92 °F** Outdoor Design Temperature for Cooling
HDD = 4,393 °F-days** (Normalized)
CDD = 1,033 °F-days** (Normalized)
HSPF = 7.35 Btu/Wh*** (2003 - 2004 Participant Average)
SEER = 10.65 Btu/Wh*** (2003 - 2004 Participant Average)
SEER = 10.00 Btu/h (Minimum Standard Efficiency)
C_D = .75
A_2/A_1 = Area of Participant Mobile Home vs.Mobile Home at Test Site
= 1,650 sq.ft.***/980 sq.ft.= 1.6837 (Adjustment for H_L and H_G)

* Estimated From Load Research Data Results
** Jackson, Ky. National Weather Station
*** Data Collection Form - Customer Installation Reports

B. Engineering Estimated Annual Energy Savings for MHNC Program:

Heat Pump System:

$E_h = 24*[H_L*A_2/A_1/(T_i - T_o)]*[HDD/1000*HSPF]$
$E_h = 24*[23{,}700\ Btu/h*1.6837/(72^0F - 9^0F)]*[4{,}393^0F\text{-}days/1000*7.35\ Btu/Wh] = 9{,}086\ kWh$

$E_c = 24*[H_G*A_2/A_1/(T_o - T_i)]*[CDD/1000*SEER]$
$E_c = 24*[13{,}800\ Btu/h*1.6837/(92^0F - 71^0F)]*[1{,}033^0F\text{-}days/1000*10.65\ Btu/Wh] = 2{,}576\ kWh$

Electric Furnace w/CAC:

$E_h = 24*[H_L*A_2/A_1/(T_i - T_o)]*[HDD/3413]*C_D$
$E_h = 24*[23{,}700\ Btu/h*1.6837/(72^0F - 9^0F)]*[4{,}393^0F\text{-}days/3413]*0.75 = 14{,}911\ kWh$

$E_c = 24*[H_G*A_2/A_1/(T_o - T_i)]*[CDD/1000*SEER]$
$E_c = 24*[13{,}800\ Btu/h*1.6837/(92^0F - 71^0F)]*[1{,}033^0F\text{-}days/1000*10.0\ Btu/Wh] = 2{,}743\ kWh$

Energy Savings:

E_h (Electric Furnace) - E_h (Heat Pump) = 14,911 kWh - 9,086 kWh = 5,286 kWh
E_c (Central Air) - E_c (Heat Pump) = 2,743 kWh – 2,576 kWh = 167 kWh

Appendix D

Energy Impact Reduction

C. Engineering Estimated Annual Energy Savings From High Efficiency Central AC:

Assumptions:

H_G = 21,350 Btu/h*
T_i = 71 ^{0}F (Cooling) for Thermostat Settings
T_o = 92 ^{0}F** Outdoor Design Temperature for Cooling
CDD = 1,033 ^{0}F-days** (Normalized)
SEER = 12.00 Btu/Wh
SEER = 10.00 Btu/h (Minimum Standard Efficiency)
* Estimated Based on Typical Home
** Jackson, Ky. National Weather Station

High Efficiency Central AC System:

$E_c = 24*[H_G/(T_o - T_i)]*[CDD/1000*SEER]$
$E_c = 24*[21,350 \text{ Btu/h}/(92^0\text{F} - 71^0\text{F})]*[1,033^0\text{F-days}/1000*12 \text{ Btu/Wh}] = 2,100$ kWh

Standard Efficiency Central AC System:

$E_c = 24*[H_G/(T_o - T_i)]*[CDD/1000*SEER]$
$E_c = 24*[21,350 \text{ Btu/h}/(92^0\text{F} - 71^0\text{F})]*[1,033^0\text{F-days}/1000*10.0 \text{ Btu/Wh}] = 2,520$ kWh

Energy Savings:

E_c (High Efficiency CAC) - E_c (Standar Efficiency CAC) = 2,520 kWh – 2,100 kWh = 420 kWh

Appendix E: Demand Impact Reduction

Appendix E

Demand Impact Reduction

AEP Previous Studies

Winter Load Factor = 0.283
Summer Load Factor = 0.254

Winter Demand Reduction = $\frac{\text{Winter Energy Saving (kWh)}}{\text{Winter Load Factor x Hours in Winter Seasons}^{(1)}}$

Summer Demand Reduction = $\frac{\text{Summer Energy Savings (kWh)}}{\text{Summer Load Factor x Hours in Summer Seasons}^{(2)}}$

Mobile Home New Construction Program – High efficiency Heat Pump

Average Winter Demand Reduction = $\frac{4{,}228 \text{ kWh}}{0.283 \times 5{,}088 \text{ hrs}}$ = 2.94 kW

Average Summer Demand Reduction = $\frac{131 \text{ kWh}}{0.254 \times 3{,}672 \text{ hrs}}$ = 0.14 kW

Mobile Home New Construction Program – Central AC

Summer Load Factor = 0.159

Average Summer Demand Reduction = $\frac{420 \text{ kWh}}{0.159 \times 3{,}672 \text{ hrs}}$ = 0.72 kW

(1) Winter Season is October through April
(2) Summer Season is May through September

EVALUATION REPORT

for the

MODIFIED ENERGY FITNESS PROGRAM

in

Kentucky Power Company

Program Period: January 2003 - December 2004

Resource Planning & Economic Forecasting
Corporate Planning & Budgeting Department
American Electric Power

August, 2005

TABLE OF CONTENTS

I. EXECUTIVE SUMMARY

This report summarizes the results of the process evaluation, impact evaluations, and cost/benefit evaluation that were performed for Kentucky Power Company's (KPCo or Company) Modified Energy Fitness (MEF) Program during its first two years (January 2003 through December 2004). The MEF Program was approved by the Kentucky Public Service Commission (KPSC or Commission) as a three year program. As approved, the Company's goal was to serve 500 customers during each year of the program. However, the Company underestimated the number of annual participants in the initial application due to the customers' overwhelming endorsement of the program. The Collaborative agreed that the program should run consecutively until the 1,500 participants are achieved. On September 24, 2004, the Commission approved the Collaborative's request to audit an additional 500 customers' homes in 2005 for a total number of homes in this program of 2,000 versus the original approved number of 1,500 homes. The implementation contractor, Honeywell DMC Services, Inc. (DMC), completed 542 audits in 2003, 725 audits in 2004, and expects to complete an additional 730 audits in 2005.

The Company's MEF Program was developed to further promote conservation and efficient use of electricity by improving the energy fitness of electric heated residential homes. The major goals of the program were to: (1) reduce customer usage of electric energy for space heating; (2) reduce customer usage of electric energy for water heating; (3) encourage the use of energy efficient measures in the home of residential customers; (4) increase customer services and customer satisfaction; (5) to educate customers as to the proper application of high efficiency measures such as compact fluorescent bulb (CFB) for lighting, cleaning refrigerator coil, caulking, weather stripping and etc.; and (6) reduce the Company's long-range peak demand.

To achieve the MEF Program goals, the program was offered to residential customers in the KPCo region, who currently utilize an electric heating system and an electric water heater and use a minimum average of 1,000 kWh per month. Customers have overwhelmingly endorsed this program since its inception in March 2003.

The potential program participants were informed of the MEF Program through direct mail, which described the program explaining that all the services were free of charge, and that the implementation contractor, Honeywell DMC Services, Inc., would contact the customer directly, offer the program, and arrange for a time to implement the program at the customer's home.

The MEF Program net total cumulative annual energy savings is estimated to be 2,899 MWh (which includes 10% Transmission and Distribution loss savings). This corresponds with a 2,525 ton reduction in carbon dioxide (CO_2) emissions, a 20 ton reduction in sulfur dioxide (SO_2) emissions, and a 6 ton reduction in nitrogen oxide (NO_x) emissions based on two years of actual and one year of estimated participation. Each participant experienced an average savings of 1,453 kWh at the meter. The net total demand reduction was 1,086 kW in winter and 352 kW in summer (including 11% Transmission and Distribution loss savings). These impacts translate into 0.544 kW and 0.176 kW net reductions per participant at the meter, in winter and summer, respectively.

The MEF Program was found to be cost effective based upon the Total Resource Cost (TRC) and Utility Cost (UC) economic tests, but not cost effective based upon Rate Impact Measure (RIM) test. The participant test was not applicable since the services were free of charge to the participants.

II. TECHNOLOGY DESCRIPTION

A. Background

A primary contributor to a home's inefficiency in space heating and cooling is air infiltration through the home's envelope and excess air leakage in the heating and cooling ductwork. Heating and cooling equipment inefficiencies are also a contributor, but the effects from upgrading a home's heating and cooling system can be nullified if the home's air infiltration is not at acceptable minimum levels and the ductwork is not properly sealed to prevent air leakage.

B. Benefits

The MEF Program provided the qualifying customer free service to install various weatherization measures to reduce the home's air infiltration and energy conservation measures to improve the home's water heating efficiency and lighting efficiency. Customer education was provided to greatly enhance the customer's understanding of the importance of improving their home's energy efficiency and incorporating energy conservation activities in their daily lifestyles. The benefits for the services provided in the program are described in detail below.

1. Air Leakage Correction:

Air leakage through the structure of the home due to the infiltration of outside air and the exfiltration of conditioned indoor air is a major contributing factor toward the home's heating and cooling demand and energy use. In homes that are not properly sealed to prevent excessive air infiltration and exfiltration, the home's total heat losses and heat gains can be significantly affected by the convection of heat through the home structure by air flow. Potential areas of air infiltration and exfiltration in the home, aside from windows and exterior doors, are around pipe and electrical chase ways, chimneys, attics, wall cavities, basements and crawl spaces.

Ducted heating and cooling systems can hinder heating, ventilation, and air conditioning (HVAC) system efficiency when air leakage through duct seams and other ductwork components exists. Correcting this deficiency can result in significant electric heating and cooling energy savings. This savings, in some cases, can be more significant than the savings achieved from sealing air leakage in the structure of the home.

Home heat loss and heat gain due to the infiltration of outside air into a home is retarded by applying weatherization measures such as weather-stripping, caulking, switch and outlet gaskets, foam sealant and pliable backer rod in leakage areas in the outside walls, and around doors and windows. The rate of air leaking into a home is based on the difference between the outdoor and indoor air pressure acting on the walls of the home. The pressure differences are directly related to the wind velocity and its direction on the walls. The wind velocity builds up pressure on the windward side of the home and a slight vacuum on the leeward side. The build-up of outdoor pressure on the windward side causes air to infiltrate through crevices in the wall construction and cracks around the windows and doors, and exfiltrate through the same type of wall components on the leeward side, thus attributing to greater heat loss and heat gain in the home.

Various sealing measures used for air leakage correction are weather-stripping, caulking, door sweeps, foam sealant and plug/outlet gaskets. Duct sealing or mastic tape is used for sealing duct leaks. The use of blower door tests can measure the amount of air leakage and indicate the location of air leaks with the use of a pressure testing instrument. Customer education can be a benefit by informing participants of low cost measures that they can install to reduce air leakage and increase their comfort level.

2. Water Heating Efficiency:

Hot water energy usage is normally the home's second largest electrical energy usage next to electric space heating. There are a variety of energy conservation services and measures that can be provided to improve the domestic hot water system's overall efficiency, and thus reduce the hot water electrical energy consumption and demand. A walk-through inspection can identify appropriate energy conservation services and measures to implement.

A hot water system's energy consumption is the input energy needed to raise a quantity of water from the average input temperature of the cold water supply to the desired outlet hot water temperature. This energy consumption is made up of energy associated with system standby losses and useful energy. System standby losses relate to heat losses from the heated water in the hot water tank and pipe distribution system, while useful energy relates to the amount of heated water used. The installation of a water heater wrap around the water heater tank and pipe insulation to the piping distribution system, along with the setting back of the water heater thermostat, will reduce the system standby losses and improve the overall water heater system efficiency. The installation of an energy saving showerhead and also faucet aerators will reduce the useful energy consumption. Customer education provides information that is used to determine the appropriate domestic hot water measures and services to be offered to the customer.

3. Lighting Efficiency:

A compact fluorescent bulb utilizes an electronic or magnetic ballast to supply electricity to the bulb in the same manner as a fluorescent lamp. Compact fluorescent bulbs are made in the shape of incandescent light bulbs. For appropriate levels of hourly use, the replacement of an incandescent light bulb with a compact fluorescent bulb of equivalent lumen output can result in

an energy savings of 75%, with a life expectancy 13 times greater, thereby greatly improving the lighting efficiency of the lamp. Today's generation of compact fluorescent bulbs are more adaptable for residential lighting uses. Their smaller physical size, along with their instantaneous start, dimness capability and stamina for outdoor use allows for more applications in a residential home. Also, customer education can be helpful in instructing participants on the efficient use of lighting in their home.

4. Refrigerators/Freezer Coil Cleaning:

Refrigerators and freezers are normally the largest energy consuming electrical appliances next to electric space heating/cooling systems and electric water heating systems. As the refrigerator/freezer coil collects dirt and dust, the unit operational efficiency decreases. Therefore, the cleaning of condenser coils can increase the efficiency of the refrigerator/freezer and thereby reduce the energy consumption by up to 18%.

5. Waterbed Cover:

Waterbeds are commonly found in many residential low-income households because they are lower in cost compared to most conventional beds. However, since they are heated by an electric heating element, their energy consumption can be significant and in some cases nearly equal to or greater than that of a refrigerator or freezer. By installing an insulating cover, which is a foam pad, directly on the waterbed mattress underneath the sheets, the heating energy used to heat the waterbed can be reduced by as much as 60% or more because the insulating cover reduces the heat losses escaping from the mattress. During the winter season, the waterbed temperature is normally set to near normal body temperature, which is significantly higher than room temperature. Therefore, a significant heat loss can occur through the waterbed mattress.

6. Programmable Thermostat

In the winter, significant savings can be obtained by manually or automatically reducing the thermostat's temperature setting for as little as four hours per day. These savings can be attributed to a building's heat loss in the winter, which depends greatly on the difference between the inside and outside temperatures. By turning the thermostat back 10°F to 15°F for 8 hours, a savings of 5% to 15% a year on a heating bill can be realized[1].

[1] http://www.eere.energy.gov/consumerinfo/factsheets/thermo.html

III. PROGRAM DESCRIPTION

The Modified Energy Fitness (MEF) program was targeted to residential customers within the KPCo Region who use electricity as their heating and water heating source and use a minimum of 1,000 kWh per month. The program provides an energy audit and consultation to pinpoint energy conservation measures that can be implemented by a customer and educate the customer on the benefits of energy efficiency. Participants were provided with the direct installation of appropriate energy conservation measures which can decrease energy consumption, lower their electric bills, and increase the comfort level of their home.

Contractor Selection

Upon Commission approval (September 24, 2002), the Company issued a Request for Proposal (RFP) on November 5, 2002 to four qualified energy service contractors. Two energy services contractors responded to KPCo's RFP. The selected contractor had to demonstrate the ability to implement this program on a turnkey basis including program promotion, participant recruitment, screening and scheduling, procurement and installation of energy conservation measures, tracking of program process, collection of required customer demographic information and other pertinent data in an economically acceptable manner.

Honeywell DMC Services, Inc. provided the most impressive proposal and was awarded the contract. DMC immediately began the recruiting and training of local staff, provided promotional plans, installation guidelines, and developed appropriate channels of communication.

Kentucky Power's DSM Collaborative renewed the contract with DMC on an annual basis in 2004 and 2005 due to a backlog of applicants. Customer demand for the program exceeded original projections of 500 participants per year. The Collaborative selected DMC as

the program implementation contractor because the channels of communication between Kentucky Power and DMC had been established, the clerical and management staff were familiar with the promotional and installation guidelines, and the installers of the energy conservation measures were trained. Startup costs would have been duplicated if another vendor had been selected to continue the program.

During the evaluation period, the contract prices for the installation of energy conservation measures remained the same as originally stated in DMC's bid. To improve the cost-effectiveness of the program, the DSM Collaborative reduced the number of installed CFB's from 2 to 1 and eliminated the refrigerator coil cleaning measure on May 6, 2004.

Program Promotion

DMC, as agreed to in the terms of the original contract, was responsible for program promotion including participant recruitment, screening and scheduling. KPCo provided DMC with a database of residential customers who use a minimum of 1,000 kWh per month and assisted with the development of a direct mail recruitment letter. A copy of the direct mail promotional letter is shown in Appendix A.

Recruitment letters were sent to 1,383 customers in 2003 and 1,768 customers in 2004. The initial mailing of recruitment letters began in April, 2003 with additional mailings being sent in May, June, July, August and November of 2003. The mailing of recruitment letters for 2004 began in January with additional mailings being sent in February, April, May, September, and October of 2004. Additional participants were obtained by referrals from program participants. The Company was successful in securing 542 participants in 2003 and 725 in 2004.

Program Implementation

The Scope of Work clarified contractor and the Company responsibilities and set forth program goals and guidelines for the contractor to follow. The Company and the contractor worked closely during the implementation design phase of the Program. Regular communications between the Company and DMC helped resolve any questions or situations that developed. Periodic quality control inspections were conducted by the Company to ensure the quality of installed energy conservation measures. Participant data was requested from DMC on an annual basis to ensure data collection guidelines were being followed.

IV. DATA COLLECTION

Data collection was extensive for the MEF Program so that an appropriate and comprehensive home energy analysis could be performed. The energy analysis included the load impact from the results of installing the multiple weatherization and other energy conservation measures in the home. The data collection also enabled the projection of load impacts for any recommended measure to be installed. This information was needed in order for the Company to perform appropriate process and impact evaluations of the program. The Company's evaluation objectives were: (1) determine the program's load impact, (2) assess the effectiveness of the program delivery mechanism and (3) assess the program's cost-effectiveness.

Data collection forms were used to obtain information on the customer's building structure, space heating/cooling system, hot water heating system and on the various weatherization and other energy conservation measures installed in the home. No demographic survey was conducted because DMC already collected demographic information (type of building, age of home, size of home). The Company and the Collaborative did not see a need for a survey to collect education level and income level of participants.

DMC completed the necessary data collection forms at the customer's home and then input the information into a computerized database at their office.

A. HomeSTAR Data Collection Form

DMC's HomeSTAR Data Collection Form was actually a set of individual forms used to record specific information on participants shown in Appendix B. The first form was designed to collect customer information such as home address, phone number, customer's account number, owner information, and demographic information. This form was also used to record specific information on each home's structural, thermal characteristics, heating and cooling system

characteristics, water heating system characteristics, compact fluorescent bulb installations and blower door test results. Additional information was also provided to the field technician to determine HVAC and water heating system efficiency, and building components' heat losses and heat transfer coefficients.

V. PROCESS EVALUATION

The process evaluation of the MEF program utilized the installation data, recruitment tracking data, and customer demographic information collected by DMC throughout the evaluation period to evaluate the delivery mechanism, promotional effectiveness and performance of the measures installed. The process evaluation, along with the impact evaluation, serves as a means to gauge the effectiveness in promoting a home energy efficiency program of this nature.

Delivery Mechanism: Kentucky Power Company provided DMC with a database of residential customers who use a minimum of 1,000 kWh per month and assisted with the development of a direct mail recruitment letter. The recruitment letter was sent to a total of 3,151 customers during the evaluation period. The goal of the Modified Energy Fitness Program was to target 500 customers each year, but due to overwhelming endorsement of the KPCo customers, the program was successful and reached 542 participants in 2003 and 725 in 2004. A copy of the direct mail recruitment letter is shown in Appendix A.

Promotional/Advertising Effectiveness: The program was promoted primarily through telemarketing services by DMC to the qualified customers and secondarily by participant referrals.

VI. IMPACT EVALUATIONS

Findings

The KPCo Modified Energy Fitness (MEF) Program's net total annual energy savings is estimated to be 2,899 MWh (which includes 10% Transmission and Distribution loss savings). This corresponds with a 2,525 ton reduction in carbon dioxide (CO_2) emissions, a 20 ton reduction in sulfur dioxide (SO_2) emissions, and a 6 ton reduction in nitrogen oxide (NO_x) emissions based on two years of actual and one year of estimated participation. Each participant experienced an average savings of 1,453 kWh at the meter. The net total demand reduction was 1,086 kW in winter and 352 kW in summer (including 11% Transmission and Distribution loss savings). These impacts translate into 0.544 kW and 0.176 kW net reductions per participant at the meter in winter and summer, respectively. For the above impact values, the freeridership, persistence and snapback effects were assumed from previous studies. Table 1 summarizes the load impact of the MEF Program.

Table 1: Average Load Impacts

	2003	2004	2005 Estimated	MEF Program
Annual Energy Savings/Participant	1,430 kWh	1,572 kWh	1,361 kWh	1,453 kWh
Winter Demand Reduction/Participant	0.54 kW	0.54 kW	0.54 kW	0.54 kW
Summer Demand Reduction/Participant	0.18 kW	0.18 kW	0.18 kW	0.18 kW
Net Total Annual Energy Savings[1]	837,803 kWh	1,067,581 kWh	993,729 kWh	2,899,112 kWh
Net Winter Demand Reduction[2]	305 kW	389 kW	393 kW	1,086 kW
Net Summer Demand Reduction[2]	98 kW	131 kW	122 kW	352 kW
(1) Includes 10% Transmission and Distribution Loss Savings				
(2) Includes 11% Transmission and Distribution Loss Savings				

Participant Classification

The MEF Program is offered to customers with electric water heating and electric space heating. As of end of year 2003 there were 542 participants in the program, of which approximately 62.6% had an electric heat pump, 7.7% had an electric resistance baseboard

heating, and 29.7% had an electric furnace or boiler. Table 2 summarizes the participants' space heating characteristics.

Table 2: Space Heating Characteristics

Type	Saturation		
	2003	2004	MEF Program
Electric Heat Pump	62.6%	56.2%	59.0%
Electric Resistance Heating	7.7%	4.9%	6.1%
Electric Furnace or Boiler	29.7%	38.9%	34.9%

Energy Impact Analysis

The following energy impact analysis uses data/assumptions gathered from the Energy Fitness Program evaluation of January 1996 – December 1998 to determine the inputs to the cost/benefit analysis unless otherwise indicated by year in which the data was recorded.

Electric Water Heater Conservation Measures:

To estimate base energy consumption for a typical water heater in the program in Kentucky, AEP electric water heating end-use metering results were used as a starting point. A preliminary water heater average consumption was 4,020 kWh for a typical water heater of 10 years old and tank size of 46 gallons with thermostat setting of 129°F. However, this base energy consumption had to be adjusted for tank size and efficiency to represent a typical water heater for the MEF Program. A typical water heater in the MEF Program was assumed to be approximately 45 (2003) and 43 (2004) gallons in size. The typical water heater efficiency over the two years was approximately 85%. As a result of adjustment for tank size and efficiency, a preliminary base energy consumption of 3,952 kWh, and 3,938 kWh was derived for 2003 and 2004 participants, respectively. Appendix D summarizes the assumptions for the base load calculation.

The impact for the water heater energy conservation measures was calculated separately for each participant because not every participant received all the measures. As a starting point, the individual participant's water heater energy consumption was calculated based on the data gathered by the program contractor, DMC, regarding the vintage year, tank size, temperature setting and efficiency of the water heater.

The next step in the evaluation process was to determine the impact of thermostat setback on the water heater energy consumption. On average, the water heater temperature was set back about 13°F to18°F, which resulted in an overall two year average annual energy savings of 364 kWh. In addition, due to the interactions between the water heater measures, the individual participant's water heater energy savings was affected by what measures were installed in their home. For example, due to reduced standby losses as a result of installation of a water heater jacket, the impact for an energy-saving showerhead and faucet aerators would be reduced for a participant receiving those measures.

A typical water heater system in the program had 16% tank losses and 3% distribution losses for a total of 19% system losses. The water heater jacket used in the program covered the top and side of the tank, and was assumed to reduce tank standby losses by 41%. Tank standby losses for the average water heater were calculated to be 616 kWh for participants receiving a water heater jacket and therefore a water heater jacket reduced these losses by 252 kWh, which was an average.

The pipe wrap reduced water heating distribution losses by 33% (for a minimum of 6 feet of wrap). The losses in the distribution system were 3% of the base energy, or approximately 118 kWh. Therefore, the average energy savings due to the pipe wrap was estimated to be 37 kWh for a participant in the program.

The energy savings contributed to an energy-saving showerhead is the sum of the water heater's useful energy plus reduced system standby losses. The energy-saving showerhead reduced the water usage by reducing the flow rate of water at the showerhead. It was assumed that showering typically uses 40% of the hot water's useful energy for a home having two showers. Therefore, for participants receiving energy-saving showerheads, the typical useful energy used for showering in a two-shower home was estimated to be 1,291 kWh. The typical water flow rates before and after the energy-saving showerhead installation were assumed to be 3.65 gpm and 2.5 gpm, respectively. In other words, the energy-saving showerhead's flow rate was approximately 68% of the old showerhead, resulting in a 32% savings in the hot water useful energy. If only one showerhead was replaced, the savings was assumed to be 60% of the savings for a two-shower home or 19% (0.6x32%=19%). The average useful energy savings for all participants over the evaluation period receiving energy saving shower heads was about 323 kWh per participant.

The system standby losses due to the energy-saving showerhead was less if a water heater jacket and pipe installation were installed in the home, since the standby losses had already been reduced. As a result of these interactions, the total energy savings of useful energy and system standby losses per participant attributed to an installation of an energy-saving showerhead was estimated to be 381 kWh.

Faucet aerators also reduced hot water usage by reducing the flow rate of water at the faucet. The energy savings due to installation of aerators is the sum of the water heater's useful energy savings plus reduced system standby losses. Approximately 6% of the hot water usage in a home is attributed to faucet usage which was 187 kWh for participants receiving faucet aerators (assuming 4 faucets per home). It was estimated that faucet aerators reduce the amount of hot

water consumption by 66%. But, on average, 1.5 aerators were installed in each home. Therefore, the faucet useful energy required was reduced by 46 kWh. The total average savings per participant attributed to installation of an average of 1.5 faucet aerators per home (including the interaction for pipe wrap and water heater jacket in the system standby losses) was estimated to be 58 kWh.

Lighting Measure:

Characteristics of the bulbs replaced by the compact fluorescent bulbs were gathered by DMC at the time of installation. The information regarding the wattage, and the number of hours of use per day of the bulb which was replaced by the CFB was used in the analysis. The results from participant usage indicated that the typical daily use of a light bulb replaced with a CFB was approximately 4.9 hours a day and had an average wattage of 76 W. The hourly energy savings per CFB was calculated to be 53 Wh. The annual energy savings/bulb was calculated by multiplying average daily hours of operation (4.9 hour) times 351 day/year (assuming two week vacation) to arrive at 91 kWh/bulb.

Refrigerator/Freezer Coil Cleaning Measure:

Refrigerators and freezers are normally the largest energy consuming electrical appliances next to electric space heating/cooling system and electric water heating systems. As the refrigerator or freezer coils collect dirt and dust, the unit's operational efficiency decreases. Therefore, the cleaning of condenser coils can increase the efficiency of a refrigerator or freezer and thereby reduce the energy consumption by up to 10%. For MEF participants, it was estimated that cleaning refrigerator or freezer condenser coils resulted in an annual energy savings of 138 kWh/unit.

Waterbed Cover:

Energy savings due to the installation of a waterbed cover were based on information obtained from the end-use metering of waterbeds conducted in an AEP DSM Program in another jurisdiction. The results of the end-use metering showed an estimated annual energy savings of 912 kWh.

Weatherization Measure:

Blower door tests were used to quantify the air flow rate before and after the installation of the weatherization measures. The DMC representative gathered blower door test data on the air flow rate and recorded the cubic feet per minute (CFM), and air changes per hour (ACH) which depends on volume of the home. This information was used to calculate the weatherization impacts. It should be noted that the weatherization measure energy impacts varied according to electric space heating system type (electric resistance, electric furnace or electric heat pump) due to their different heating efficiencies and performance characteristics.

The equations in Appendix E were used to estimate the energy savings due to weatherization measures for different types of space heating during the winter season (October

through April) and for space cooling during the summer season (May through September). Based on blower door test results, a participant in the MEF Program saved an average of 322 kWh during the heating season for the evaluation period. In addition, a participant which had air conditioning saved an average of 119 kWh during the summer season. Taking into consideration that not all participants had air conditioning the total average savings per participant was 420 kWh for the evaluation period. The results from the blower door test analysis are summarized in Table 3.

Programmable Thermostat Measure:

Annual energy savings for 2003 and 2004 participants was calculated using energy savings formulas provided by DMC. The savings was calculated by taking the seasonal usage multiplied by a usage factor (0.83) multiplied by a savings factor (0.03) multiplied by the average of the day, evening, and night setbacks. Based on those who set back their thermostat, the programmable thermostat measure has an annual energy savings per participant of 1,365 kWh.

Table 3: Weatherization Load Impact Evaluation

KENTUCKY POWER COMPANY

Modified Energy Fitness (MEF) Program

	2003	2004
Winter Season Heating Energy Savings by Space Heating Type (kWh)		
Electric Resistance	665	468
Electric Heat Pump	245	298
Electric Furnace	360	369
Weighted Average per Participant	311	334
Summer Season Cooling Energy Savings (kWh)		
Average/Participant	103	118
Total Weatherization Energy Savings (kWh)		
Average/Participant	468	502
Note: Only 99% (2003) and 99% (2004) of participants had air conditioning		

Demand Impact Analysis

The following demand impact analysis uses data gathered from the Energy Fitness Program evaluation of January 1996 – December 1998 to determine the inputs to the cost/benefit analysis unless otherwise indicated by year in which the data was recorded.

Electric Water Heater Energy Conservation Measures:

Demand impacts for water heater energy conservation measures were taken from the results of similar programs in other jurisdictions of the AEP System, and adjusted to reflect for the characteristics of water heaters of participants in the MEF Program. The average demand reduction due to the installation of a water heater jacket was estimated to be 0.022 kW and 0.025 kW at the time AEP System peak in winter and summer, respectively. In addition, the average AEP coincident peak demand reductions attributed to installation of an energy-saving showerhead were 0.133 kW in winter and 0.050 kW in summer. The demand reduction for participants with water heater setback was estimated to be 0.068 kW and 0.038 kW at the time of AEP winter and summer peak, respectively. The pipe wrap demand reductions were estimated to be 0.004 kW for both winter and summer peak. The demand savings for faucet aerators were estimated to be 0.021 kW in winter and 0.008 kW in summer.

Lighting Measures:

Peak demand savings for the CFB was estimated by multiplying the coincident factor for the CFB by the average hourly demand reduction to arrive at 0.009 kW/bulb for both summer and winter peak. The coincident factor is the proportion of time that the bulb is on at the time of the AEP system peak. This was estimated to be 20%, based upon the results of a similar CFB program in APCO's West Virginia jurisdiction. The average hourly demand reduction was derived from the wattage difference between the replaced bulb and the CFB.

Weatherization Measures:

The demand reductions for the weatherization measures for an average participant in the program was estimated based on the annual average energy savings and the application of a load factor estimated from other field studies to arrive at a demand reduction of 0.288 kW and 0.032 kW for winter and summer peak, respectively.

Refrigerator/Freezer Coil Cleaning Measure:

The refrigerator/freezer demand reductions, as a result of application of coil cleaning measures were estimated to be 0.015 kW and 0.019 kW for winter and summer peak demand, respectively.

Programmable Thermostat Measure

The demand reductions as the result of installing a programmable thermostat were estimated to be 0.317 kW and 0.205 kW for winter and summer peak demand, respectively.

Summary of Energy and Demand Impact Analysis

The energy and demand impact results for 2003 and 2004 participants and total participants of the MEF program are summarized in Tables 4-1 through 4-4 shown below.

Kentucky Power Company
Modified Energy Fitness (MEF) Program

Table 4-1: 2003 Summarization of Load Impact For Participants Added in 2003

	Energy Reduction (kWh)				Demand Reduction (kW)			
	kWh Reduction per Part.	# of Part.	Freeriders	Net Total Program	Per Participant		Net Total Program	
Measure	(1)	(2)	(3)	(4)	Winter	Summer	Winter	Summer
Water Heater								
Thermostat Setback	364	8	0%	2,912	0.068	0.038	0.5	0.3
Water Heater Jacket	252	87	25%	16,443	0.022	0.025	1.9	2.2
Pipe Wrap	37	256	25%	7,104	0.004	0.004	1.0	1.0
Faucet Aerator	46	223	25%	7,741	0.021	0.008	4.7	1.8
Energy Saving Showerhead	381	429	25%	122,636	0.133	0.050	57.1	21.5
Weatherization								
Blower Door Test/Seal Up*	485	586	0%	284,210	0.288	0.032	168.9	18.7
Miscellaneous								
Compact Fluorescent Bulb	91	586	5%	101,319	0.009	0.009	5.3	5.3
Coil Cleaning Refrigerator	138	584	20%	64,474	0.015	0.019	8.8	11.1
Programmable Thermostat	1,365	176	5%	228,228	0.317	0.205	55.8	36.0
Water Bed Cover	912	4	25%	2,736	0.130	0.068	0.5	0.3
Total Net Load Impact (including losses)**				837,803			304.5	98.2

* Not all participants had air conditioning

** Including 10% and 11% transmission and distribution loss savings for energy and demand impacts

Table 4-2: 2004 Summarization of Load Impact For Participants Added in 2004

	Energy Reduction (kWh)				Demand Reduction (kW)			
	kWh Reduction per Part.	# of Part.	Freeriders	Net Total Program	Per Participant		Net Total Program	
Measure	(1)	(2)	(3)	(4)	Winter	Summer	Winter	Summer
Water Heater								
Thermostat Setback	364	110	0%	40,040	0.068	0.038	7.5	4.2
Water Heater Jacket	252	50	25%	9,450	0.022	0.025	1.1	1.3
Pipe Wrap	37	224	25%	6,216	0.004	0.004	1.0	1.0
Faucet Aerator	46	267	25%	9,268	0.021	0.008	5.6	2.1
Energy Saving Showerhead	381	504	25%	144,076	0.133	0.050	67.0	25.2
Weatherization								
Blower Door Test/Seal Up*	485	679	0%	329,315	0.288	0.032	195.7	21.7
Miscellaneous								
Compact Fluorescent Bulb	91	468	5%	80,917	0.009	0.009	4.2	4.2
Coil Cleaning Refrigerator	138	255	20%	28,152	0.015	0.019	3.8	4.8
Programmable Thermostat	1,365	324	5%	420,147	0.317	0.205	102.8	66.3
Water Bed Cover	912	0	25%	0	0.130	0.068	0.0	0.0
Total Net Load Impact (including losses)**				1,067,581			388.7	130.8

* Not all participants had air conditioning

** Including 10% and 11% transmission and distribution loss savings for energy and demand impacts

Table 4-3: 2005 Estimation of Load Impact For Participants Added in 2005

	Energy Reduction (kWh)				Demand Reduction (kW)			
	kWh Reduction per Part.	# of Part.	Freeriders	Net Total Program	Per Participant		Net Total Program	
Measure	(1)	(2)	(3)	(4)	Winter	Summer	Winter	Summer
Water Heater								
Thermostat Setback	364	68	0%	24,752	0.068	0.038	4.6	2.6
Water Heater Jacket	252	79	25%	14,931	0.022	0.025	1.7	2.0
Pipe Wrap	37	277	25%	7,687	0.004	0.004	1.0	1.0
Faucet Aerator	46	283	25%	9,823	0.021	0.008	5.9	2.3
Energy Saving Showerhead	381	538	25%	153,795	0.133	0.050	71.6	26.9
Weatherization								
Blower Door Test/Seal Up*	485	730	0%	354,050	0.288	0.032	210.4	23.3
Miscellaneous								
Compact Fluorescent Bulb	91	608	5%	52,562	0.009	0.009	5.5	5.5
Coil Cleaning Refrigerator	138	0	20%	0	0.015	0.019	0.0	0.0
Programmable Thermostat	1,365	289	5%	374,761	0.317	0.205	91.7	59.1
Water Bed Cover	912	2	25%	1,368	0.130	0.068	0.3	0.1
Total Net Load Impact (including losses)**				993,729			392.7	122.8
* Not all participants had air conditioning								
** Including 10% and 11% transmission and distribution loss savings for energy and demand impacts								

Table 4-4: 2003 - 2005 Summarization of Load Impacts For Participants Added in 2003 - 2005

	Energy Reduction (kWh)				Demand Reduction (kW)			
	kWh Reduction per Part.	# of Part.	Freeriders	Net Total Program	Per Participant		Net Total Program	
Measure	(1)	(2)	(3)	(4)	Winter	Summer	Winter	Summer
Water Heater								
Thermostat Setback	364	186	0%	67,704	0.068	0.038	12.6	7.1
Water Heater Jacket	252	216	25%	40,824	0.022	0.025	4.8	5.4
Pipe Wrap	37	757	25%	21,007	0.004	0.004	3.0	3.0
Faucet Aerator	46	773	25%	26,832	0.021	0.008	16.2	6.2
Energy Saving Showerhead	381	1,471	25%	420,506	0.133	0.050	195.6	73.6
Weatherization								
Blower Door Test/Seal Up*	485	1,995	0%	967,575	0.288	0.032	574.9	63.7
Miscellaneous								
Compact Fluorescent Bulb	91	1,662	5%	234,798	0.009	0.009	15.0	15.0
Coil Cleaning Refrigerator	138	839	20%	92,626	0.015	0.019	12.6	15.9
Programmable Thermostat	1,365	789	5%	1,023,136	0.317	0.205	250.4	161.4
Water Bed Cover	912	6	25%	4,104	0.130	0.068	0.8	0.4
Total Net Load Impact (including losses)**				2,899,112			1,085.9	351.7
* Not all participants had air conditioning								
** Including 10% and 11% transmission and distribution loss savings for energy and demand impacts								

VII. COST/BENEFIT EVALUATION

Results

Cost/benefit analyses of DSM programs may be performed using either a historical basis or a prospective basis. From a historical basis, actual costs and load impacts for DSM programs participants during a historical period (such as the first year of a program) are utilized to assess the net benefits. The net benefits may be calculated over a 20-year period for the first year's participants. These are after-the-fact analyses which could be utilized to determine the cost-effectiveness of previous activity, but may not by representative of the future and therefore, should not be the basis for DSM program decision-making.

Cost/benefit analyses from a prospective basis anticipate future DSM program participation, costs and impacts. These analyses expand upon actual field experience (cost, impact, etc.) to estimate the net benefit from projected implementation in the future. The foundation of DSM program knowledge serves as a basis to estimate projected costs, impacts, etc. This is the real value of field experience: applying what has been learned to guide decisions on future DSM program implementation.

On a prospective basis, the MEF Program is found to be cost effective using the TRC and UC tests. Prospective basis means that the cost benefit analysis was run for 20 years with the base year being 2003. The actual number of participants was used for the first two years, and the expected number of participants was used for the last year. The Participant Test was not applicable since there were no participant costs in the program. However, the RIM results which are more significant in today's environment are strongly negative.

B/C Ratio	Economic Test
2.92	Total Resource Test
0.80	Rate Impact Measure
3.40	Utility Cost
N/A	Participant

Assumptions

I. Program Costs (2003 $)

The cost/benefit analysis was performed using projected program costs based on the actual program costs realized in 2003 but adjusted to exclude any one-time costs such as meters and contractor's startup costs. The program evaluation period covers years 2003 – 2004 with a total of 1,267 participants. The total MEF Program costs were $479,964 (as of December 31, 2004), including promotional/administrative, customer incentives, evaluation and other miscellaneous costs. The average per participant cost was approximately $378.

A breakdown of actual program costs for year 2003 and 2004 are outlined in Table 5.

Table 5: Actual Program Costs

	2003	2004	Program
Promotional and Administrative (excluding Company labor)	$ 0	$ 0	$ 0
Evaluation	$ 2,807	$ 196	$ 3,003
Contractor	$ 201,870	$ 275,091	$ 476,961
Total Program Cost	**$ 204,677**	**$ 275,287**	**$ 479,964**

The anticipated program costs used in the cost/benefit on per participant basis are shown in Table 2. The anticipated promotional and administration costs, along with contractor costs are expected to increase in the future, therefore, the average cost per participants increases by $10.

Table 6: Anticipated Costs

Costs Used in Cost/Benefit Analysis	Per Participant
Promotional and Adminstrative	$ 10
Evaluation Cost (including AEP Labor)	$ 22
Contractor	$ 330
Total	**$ 362**

II. Load Impacts (Average-Per-Participant)

A. Compact Fluorescent Bulb

Annual Energy Savings	91 kWh
Winter Demand Reduction (at time of AEP peak)	0.009 kW
Summer Demand Reduction (at time of AEP peak)	0.009 kW
Life	6 years
Freeriders	5 %
Program Participation Level	83.3 %

B. Low Cost Water Heating (WH) Measures

Low Cost Water Heating (WH) Measures	**Pipe Wraps & Faucet Aerators**	**WH Thermostat Setback**
Annual Energy Savings	85 kWh	364 kWh
Winter Demand Reduction (at time of AEP peak)	0.021 kW	0.068 kW
Summer Demand Reduction (at time of AEP peak)	0.008 kW	0.038 kW
Life	10 years	6 years
Freeriders	25 %	0 %
Program Participation Level	38.3 %	9.3 %

C. Water Heater Jacket and Energy Saving Showerhead

Water Heater Jacket and Energy Saving Showerhead	**Water Heater Jacket**	**Energy Saving Showerheads 1-2**
Annual Energy Savings	252 kWh	381 kWh
Winter Demand Reduction (at time of AEP peak)	0.022 kW	0.133 kW
Summer Demand Reduction (at time of AEP peak)	0.025 kW	0.050 kW
Life	6 years	20 years
Freeriders	25 %	25 %
Program Participation Level	10.8 %	73.7 %

D. Weatherization Measures

Annual Energy Savings	485 kWh
Winter Demand Reduction (at time of AEP peak)	0.288 kW
Summer Demand Reduction (at time of AEP peak)	0.032 kW
Life	15 years
Freeriders	0 %
Program Participation Level	100 %

E. Waterbed Covers Measure

Annual Energy Savings	912 kWh
Winter Demand Reduction (at time of AEP peak)	0.130 kW
Summer Demand Reduction (at time of AEP peak)	0.068 kW
Life	3 years
Freeriders	25 %
Program Participation Level	0.3 %

F. Refrigerator Coil Cleaning Measure

Annual Energy Savings	138 kWh
Winter Demand Reduction (at time of AEP peak)	0.015 kW
Summer Demand Reduction (at time of AEP peak)	0.019 kW
Life	2 years
Freeriders	20 %
Program Participation Level	42.1 %

G. Programmable Thermostat Measure

Annual Energy Savings	1,365 kWh
Winter Demand Reduction (at time of AEP peak)	0.317 kW
Summer Demand Reduction (at time of AEP peak)	0.205 kW
Life	15 years
Freeriders	5 %
Program Participation Level	39.5 %

H. Average MEF Load Impact per Participant

Annual Energy Savings	1,453 kWh
Winter Demand Reduction (at time of AEP peak)	0.544 kW
Summer Demand Reduction (at time of AEP peak)	0.176 kW

Appendix A: Sample of Direct Mail Letter

AEP AMERICAN ELECTRIC POWER

Kentucky Power Company
Modified Energy Fitness Program
11233 Kevin Avenue
Ashland, KY 41102

KENTUCKY POWER COMPANY

The **Modified Energy Fitness Program is a Free weatherization program** for **Kentucky Power's** All Electric Customers.

Kentucky Power is committed to their customers and the environment. We have been serving your energy needs for more than 80 years. We have created a program to help with both. The **Modified Energy Fitness Program** is designed to help you save energy while maintaining your level of comfort. The program identifies key areas within your home where you are losing valuable energy. Honeywell DMC Services, a nationally recognized energy management firm, has been contracted by **Kentucky Power** to provide this residential energy efficiency service to our qualified customers.

To qualify for the program you must: **have a billed usage of over 1000 kWh monthly, own a single family home, heat with electricity**, and **have an electric hot water heater. (Program is not available to gas customers)**

By participating in The Modified Energy Fitness Program you will receive:

- **Free** Air Infiltration Diagnostic Test
- **Free** Customized Report
- **Free** Energy Savings Booklet
- **Free** Energy Conservation Measures *(Installation of measures is solely based on determined need by the auditor)*:
  - * Hot Water Tank Insulating Blanket
  - * Pulsating Low Flow Showerhead
  - * Low Flow Faucet Aerators
  - * Weatherstripping / Caulking / Doorsweep
  - * Duct Sealing
  - * Compact Fluorescent Light Bulbs
  - * Water Bed Insulation Cover
  - * Programmable Thermostat
  - * **All Free!!!!!!!!!!!!!!!!!!!!!!!!**

A representative of Honeywell DMC Services will contact you to schedule an energy audit of your home within a few days of receiving this letter. Remember that there is nothing to buy, and no follow-up sales call will result from your participation in the program. If you have any questions or wish to **enroll immediately, call 1-866-225-0686.**

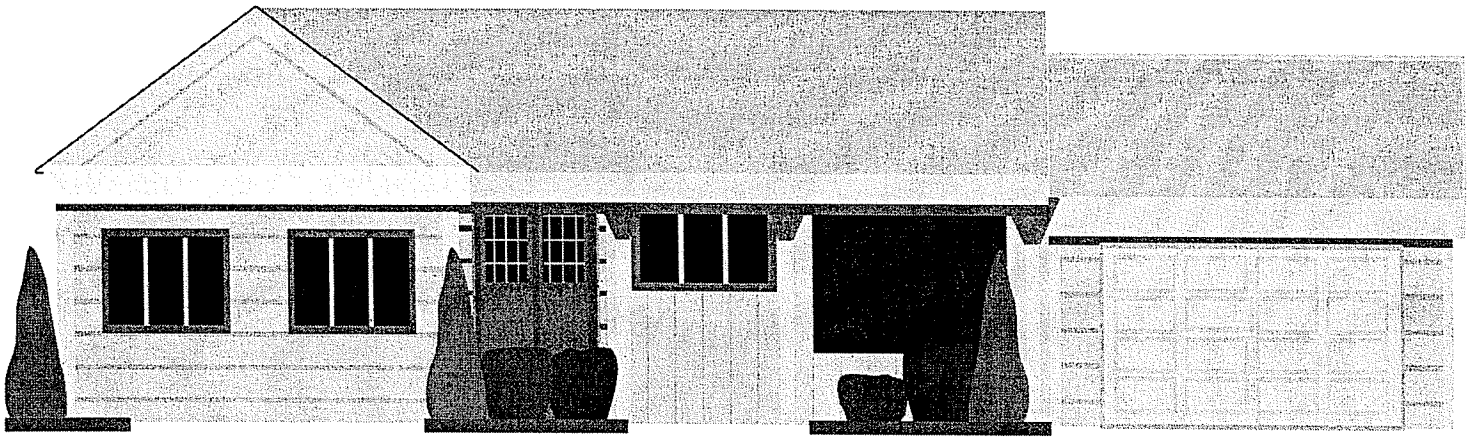
Sincerely

Don Music
Customer Services Coordinator
Kentucky Power 1-800-572-1113

Dan Sturdevant
Program Manager
Honeywell DMC Services

Appendix B: Home STAR Data Collection Form

HomeSTAR Data Collection Form



Customer Information

Auditor Last Name

Audit Date ___/___/___

Customer First Name

Customer Last Name

Address

City/Town

State KY

Zip Code

Home Phone Number ___-___-___

Account Number ___-___-___-___-___

Demographics

Residence Type:

- Single ☑
- Multifamily ☐

Home Type:

- Detached Garage ☐
- Attached End Garage ☐
- Attached Middle ☐
- Attached Vertical ☐
- Mobile Home ☐

Conditioned Area: ☐☐,☐☐☐

Number of Stories Above Grade: ☐

Age of Home: ☐☐

Ownership Type:

- Owner ☑
- Renter ☐

Portion of Year In Home:

- All Year ☐
- Winter Only ☐
- Summer Only ☐

Number of Occupants:

- Adults ☐
- Teens ☐
- Children ☐
- Seniors ☐

Air Leakage/Condition Rating:

- Tight **(Good - 01)** ☐
- Average **(Fair - 02)** ☐
- Drafty **(Poor - 03)** ☐

Domestic Hot Water

Fuel Type:

- Electric ☑
- Gas ☐

DHW Type:

- Standard ☐
- Tankless Coil ☐
- Instantaneous ☐
- Solar ☐
- Other ☐

Percent (%): ☐☐☐

Age: ☐☐☐

Size (gallons: ☐☐

Tank Wrap:

- Not Needed **(AIP - 1)** ☐
- **Warning Label - 2** ☐
- **Poor Cond. - 3** ☐
- **No Access - 4** ☐
- **CDNW - 5** ☐
- Insulated ☐
- Needs Insulation ☐

Conditioned Space: Y ☐ N ☐

Temp Before: ☐☐☐

Temp After: ☐☐☐

Pipe Insulation Type:

- Not Needed ☐
- Insulated ☐
- Needs Insulation ☐

Pipe Insul. Rec.(ft) ☐☐

Basement

Type:

- Full
- Crawl - Open
- Crawl - Enclosed
- Slab
- Garage, Under

Rec. Insulation:

- Insulated
- Needs Insulation

Ceiling Sq. Ft.

Rim Joist Rec.

- Not Needed
- Insulated
- Needs Insulation

Perimeter:

Conditioned Space: Y / N

Ceiling Type:

- Plaster - 1
- Wood - 2
- Stucco - 3
- Open - 4

Insulation Present:

- None - 0
- Cellulose - 1
- Fiber. Batts - 2
- Loose Fiber - 3
- Rock Wool - 4
- Urea Formldhyd - 5
- Other - 6

Basement Cont.

Add inches:

Recommend Wall Insulation: Y / N

Wall square Footage:

Basement Face: N / S / E / W

% of Basement above Grade: %

Heating System

Fuel Type: 1 (Electric ☑, Gas) 2 (Electric ☑, Gas)

System Type:

- Hot Water Boiler
- Air
- Resistance
- Heat Pump

Size (Mbtus): k

Efficiency:

Heated Space (%):

Recommendation:

- No Action
- System Maintenance
- Replacement

Age:

Distribution

Type: 1 2

- Duct Round
- Duct Rect
- Elbows

Insulation Existing:

- Yes
- No

Insulation Rec. Y N Y N

Length

Location: 1 2 1 2

- Base Unisul - 1
- Base Insul. - 2
- Crawl - 3
- Attic Unisul. - 4
- Attic Insul. - 5
- Garage Uninsul. - 6
- Garage Insul. - 7

Window AC

Total Window/Wall units:

Average Age of Units:

EER:

Units used:

- Never
- Rarely
- Sometimes
- Always

Daytime Setting:

Night Setback:

Thermostat

Current Setting:

T-stat Type:

Setback Rec.(# of Deg.):

T-Stat set points:

- Day Temp
- Day Setback
- Night Temp
- Night Setback

Cooling

Type: 1 2

- Central
- Heat Pump
- % of House
- Age:
- SEER:
- Tons: . .
- Temperature Setting:

Use:

- Never
- Rarely
- Sometimes
- Always

Recommendation:

- No Action
- System Maintenance
- Replacement

Windows

Type:

- Double Hung
- Casement
- Fixed

Size:

- Small
- Medium
- Large
- Extra Large

# of Glazings:

Quantity:

Condition:

- Good
- Fair (W/S Caulk)
- Fair (Add Storm)
- Poor (Replace)

Orientation:

N
S
E
W

Shading:

- **None - 1**
- **Blnds/Drpe-2**
- **Shades - 3**

Doors

Type:

- Solid
- Slider
- Atrium
- Steel

Quantity:

Condition:

- Good
- Fair (W/S Caulk)
- Fair (Add Storm)
- Poor (Replace)

Shading:

- **None - 1**
- **Blnds/Drpe-2**
- **Shades - 3**

Orientation:

N S E W

N S E W

N S E W

Walls

Type: 1 2 3 4

- Other
- Wood
- Aluminum
- Brick
- Stucco
- Vinyl

Walls Cont.

Insulation Present: 1 2 3 4

Y N

Y N

Y N

Y N

Insulation Type:

- None
- Cellulose
- Fiber. Batts
- Loose Fiber.
- Mineral/Rockwool
- UREA Formldhyd
- Other

Length: 1 2 3 4

Height: 1 2 3 4

Orientation:

N S E W

N S E W

N S E W

N S E W

Partition Type:

- **Open**
- **Closed**

Wall Type:

- **Exterior**
- **Partition**

Siding Color:

- **Light**
- **Dark**

Attic

Types:

	1	2	3	4
Floored				
Unfloored				
Knee wall				
KW Flat Floored				
KW Flat Unfloored				
Flat Roof				

Square Feet:

1 , 2 ,

3 , 4 ,

Insulation Type:

None				
Cellulose				
Fiber. Batts				
Loose Fiber.				
Mineral/Rockwool				
UREA Formldhyd				
Other				

Depth: 1 2

3 4

Rec. Insul. Type:

None				
Cellulose				
Fiber. Batts				
Loose Fiber.				
Mineral/Rockwool				
UREA Formldhyd				
Other				

Attic Cont.

Recommended Inches:

1 2 3 4

Is Vent Required:

Y	Y	Y	
N	N	N	

Access Type:

	1	2	3	4
No access avail.				
Ceiling access				
Knee wall				
Pull down stairs				
Temporary				
Walk up stairway				
Exterior access				

Access Insul. Type:

None				
Cellulose				
Fiber. Batts				
Loose Fiber.				
Mineral/Rockwool				
UREA Formldhyd				
Other				

Access Insul. Rec.:

Not Needed				
Insulated				
Needs Insul.				

Lighting

Location: 1 2 3 4

- b-Bedroom
- d-Dining
- e-Exterior
- f-Family/Sitting
- h-Hallway
- k-Kitchen
- l-Living
- o-Office/Study
- p-Porch/utility
- w-Work/Shop

Existing Quantity:

1 2 3 4

Watts:

1 2 3 4

Hours per Week:

1 2 3 4

Replace Watts:

1 2 3 4

Product Installed:

23 Watt CFL

Quantity Installed:

1 2 3 4

Quantity Rec.:

1 2 3 4

Refrigerator

Size:

1 2 3 4

Defrost Type: 1 2 3 4

- Manual
- Automatic

Style:

- Side by Side
- Freezer Top
- Freezer Bottom

Age:

1 2 3 4

Make: _____

Model: _____

Measure/Table Usage:

1 2 3 4

Recommendation:

- Leave alone
- Replace
- Remove

Freezer

Size: 1 2 3 4

Auto Defrost: Y / N

Age: 1 2 3 4

Style:

- Upright
- Chest

Recommendation:

- Leave alone
- Replace
- Remove

Appliances

Kitchen Aerator:		Y		N
Low-Flow Showerhead:		Y		N
Bathroom Aerator:		Y		N
Bathroom Ventilated:		Y		N
Ventilation Needed:		Y		N

Pool/Hot Tub

Pool Heater Fuel:

- Gas
- Electric

Pool Temp. Setting:

Pool Cover:

- No Cover
- Solar Cover
- Other

Covered % of Time:

Hot Tub Size (gallons):

Hot Tub Location:

- Outside
- Inside

Hot Tub Temp. Setting:

Appliance List

Appliance:	Quantity	Hrs. Use
Electric Range/Stove		
Gas Range/Stove		
Clothes Washer		
Gas Dryer		
Electric Dryer		
Attic Fan		
Ceiling Fan		
Dehumidifier		
Sump Pump		
Pool Pump		
Humidifier		
Electric Blanket		
Waterbed		
Stereo		
Color TV		
B&W TV		
Aquarium		
Computer		
Laser Printer		
Fax Machine		
Well Pump		
Microwave		
Dishwasher		
Other		

PRE-TEST

Number of Floors

Number of Occupants

Outside Temp.

Inside Temp.

Volume

Surface Area

Minimum Vent.

Windshield Factor

Shielded

Average

Exposed

	House	Fan Pressure	Fan Configuration	CFM Airflow
1			O A B C	
2			O A B C	
3			O A B C	
4			O A B C	
5			O A B C	

CFM @ 50

AC/H

Correlation Coefficient r= 0.99

Flow Coefficient c= .

Exponent n= .

POST-TEST

Number of Floors

Number of Occupants

Outside Temp.

Inside Temp.

Volume

Surface Area

Minimum Vent.

Windshield Factor

Shielded

Average

Exposed

	House	Fan Pressure	Fan Configuration	CFM Airflow
1			O A B C	
2			O A B C	
3			O A B C	
4			O A B C	
5			O A B C	

CFM @ 50

AC/H

Correlation Coefficient r= 0.99

Flow Coefficient c= .

Exponent n= .

PRESSURE PAN TEST

CAPTURE ALL PRESSURE PAN READINGS

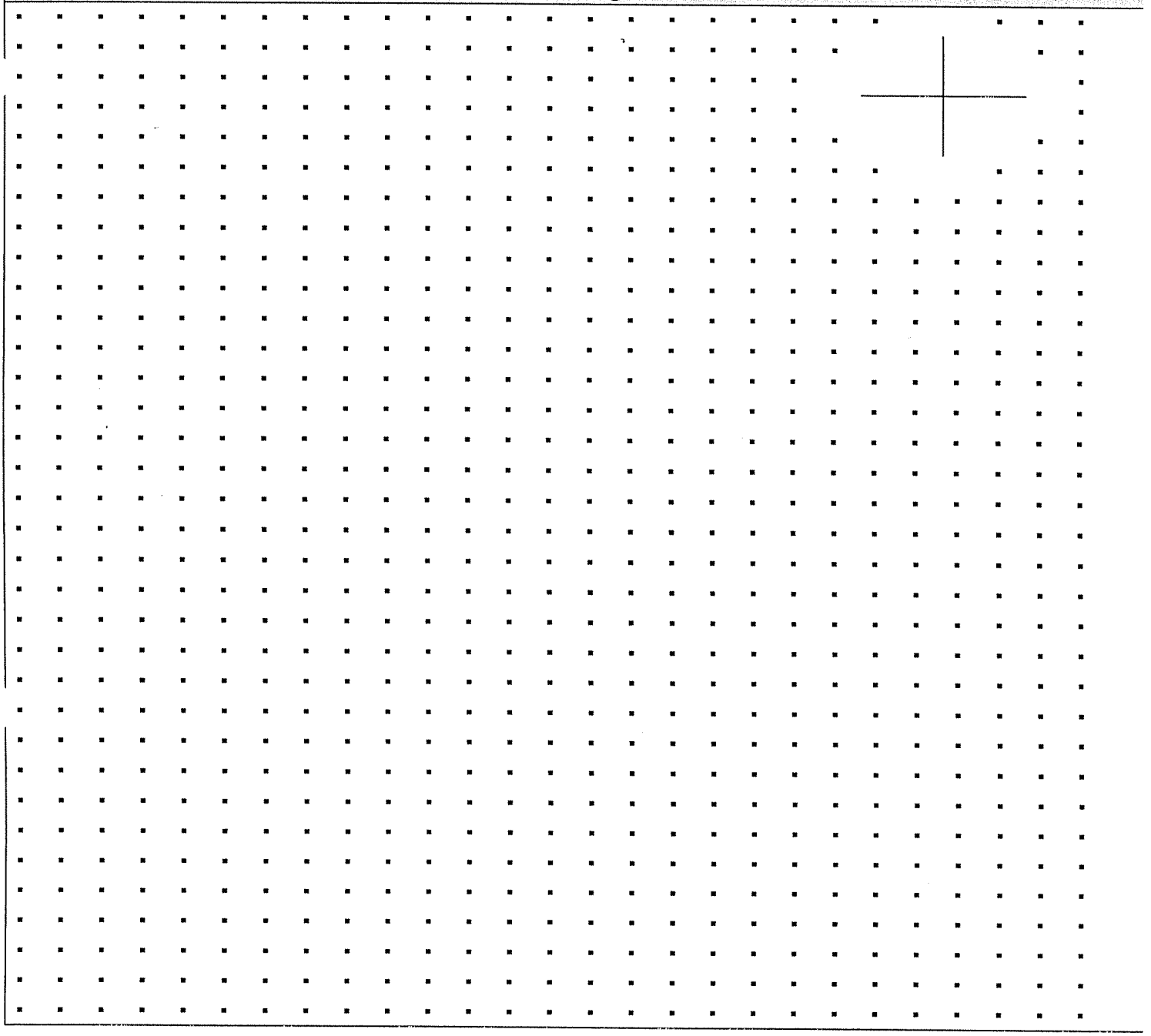
LOG ONLY THE HIGHEST PRE-TEST AND POST-TEST READINGS INTO THE COMPUTER

Pre	Post	Pre	Post	Pre	Post	Pre	Post

Installations

	Recommend	Installed
Audit Services:	1	1
Blower Door Test	1	1
Programmable Thermostat (Heat Pump)		
Programmable Thermostat (Electric Furnace)		
Compact Fluorescent Bulb (2 installed)		
Low Flow Showerhead (Installed)		
Water Heater Wrap (Installed)		
Setback Water Heater Thermostat		
Switch and Outlet Gaskets (Installed)		
Hot Water Pipe Insulation - 1/2"		
Hot Water Pipe Insulation - 3/4"		
Kitchen Aerators (Installed)		
Faucet Aerators (Installed)		
Refrigerator Coil Cleaning Kit	1	1
Waterbed Covers (Installed)		
Caulk (per lineal foot)		
Weatherstrip (per lineal foot)		
Door Sweep (each)		
Duct Sealing - Aluminum Tape (per foot)		
Duct Sealing - Aluminum Grip Tape (per foot)		
Education Booklet (each)	1	1

House Diagram



Notes/Comments

Appendix C: Home STAR Customer Survey Questionnaire and Form Results

Appendix C

Modified Energy Fitness Participants Demographic Survey Results
Kentucky Power Company

Dwelling Data:

Type of Building

	2003	2004
Single Family	99.5%	99.7%
Multi Family	0.5%	0.2%
Blank	0.0%	0.1%

Age of Home

	2003	2004
2 years or under	0.0%	1.0%
3 to 5 years	4.9%	5.4%
6 to 10 years	16.7%	16.7%
11 to 15 years	14.7%	17.0%
16 to 20 years	10.7%	12.6%
21 to 30 years	27.5%	24.0%
31 to 40 years	14.0%	13.1%
Over 40 years	11.5%	9.9%
Do Not Know	0.0%	0.3%

Configuration

	2003	2004
Detached	43.8%	39.9%
Attached End	17.3%	16.3%
Attached Middle Horizontal	0.6%	0.0%
Attached Middle Vertical	1.1%	0.7%
Mobile Home	36.5%	43.0%
Do Not Know	0.7%	0.1%

Size of Home

	2003	2004
Under 1200 $ft.^2$	36.9%	38.4%
1201 - 2000 $ft.^2$	41.1%	42.5%
2001 - 3000 $ft.^2$	15.8%	14.5%
Over 3000 $ft.^2$	6.2%	4.6%
Do Not Know	0.0%	0.0%

Appendix C

Modified Energy Fitness Participants Demographic Survey Results
Kentucky Power Company

Participant Energy Use Characteristics:

AC Use

	2003	2004
Never	44.4%	45.1%
Sometimes	0.9%	0.1%
Always	54.2%	54.4%
Do Not Know	0.5%	0.4%

Room AC Use

	2003	2004
Never	84.2%	84.9%
Sometimes	1.6%	0.0%
Always	14.2%	15.1%
Do Not Know	0.0%	0.0%

Central AC Use

	2003	2004
Never	0.2%	0.3%
Sometimes	0.0%	0.2%
Always	98.6%	98.6%
Do Not Know	1.2%	0.9%

Appendix D: Water Heating Assumptions

Appendix D

Water Heating Assumptions
Modified Energy Fitness (MEF) Program

I. Water Heater Base Load
   a. APCo-Virginia WHASH End-Use Metering

Control Group (Sept. '93 – Aug. '94)	4,020	kWh
Tank Age	10	Years
Vintage Assumed	1984	
Tank Efficiency (Default)	0.836	
Thermostat Setting	129	°F
Tank Size	46	Gallons
Winter Peak Demand	0.84	kW
Summer Peak Demand	0.31	kW

$$4{,}020 \text{ kWh} = X / 0.836 \rightarrow X = 3{,}361 \text{ kWh}$$

II. 2003 MEF Base Load Per Water Heater Characteristics

Tank Age		8	Years
Tank Efficiency (Actual)		0.848	
Thermostat Setting		127	°F
Tank Size		46	Gallons
Adjustment for Tank Efficiency	3,356 kWh / 0.85 = 3,954		kWh
Adjustment for Size	$EF_A = (0.93 - (0.87 - 0.85)) - (.00132 * 45.07) = 0.851$		
(Tank Efficiency = 0.87 for 46 Gallons)			
No Adjustment for Thermostat Setting (127°F vs. 129°F)			
Annual Energy Usage		3,952	kWh
Winter Peak Demand		0.83	kW
Summer Peak Demand		0.30	kW

Appendix D

Water Heating Assumptions
Modified Energy Fitness (MEF) Program

III. 2004 MEF Base Load Per Water Heater Characteristics

Tank Age		8	Years
Tank Efficiency (Actual)		0.847	
Thermostat Setting		124	°F
Tank Size		46	Gallons
Adjustment for Tank Efficiency	3,356 kWh / 0.85 =	3,954	kWh
Adjustment for Size (Tank Efficiency = 0.87 for 46 Gallons)	$EF_A = (0.93 - (0.87 - 0.85)) - (.00132 * 42.86) =$	0.851	
No Adjustment for Thermostat Setting (124°F vs. 129°F)			
Annual Energy Usage		3,952	kWh
Winter Peak Demand		0.83	kW
Summer Peak Demand		0.30	kW

Appendix E: Blower Door Evaluation Assumptions

Appendix E

Blower Door Evaluation Assumptions
Kentucky Power Company
Modified Energy Fitness (MEF) Program
Blower Door Evaluation

Evaluation of Blower Door Test Results

I. Engineering Model to Calculate Heating Energy Savings

Q_H	=	Vol. * (AC/Hr_b- AC/Hr_a) * HC * HDD * 24 Hr/Day * Cd	Where Q_H in Btuh (Heat Loss)
E	=	Q_H/3413	For Electric Furnace, Resistance, or Boiler
E	=	Q_H/(1000*HSPF)	For Electric Heat Pump
E	=	Q_H/(1000*HSPF)*A	For Electric Add-On Heat Pump
			Where E is kWh

a. Given in DMC Database

i.	Vol.	Conditioned Volume ($ft.^3$)
ii.	AC/hr_b	Air Changes/Hr Before (Pre-Test)
iii.	AC/hr_a	Air Changes/Hr After (Post-Test)
iv.	Heating System Type	Electric Resistance
		Electric Heat Pump
		Electric Furnace
		Electric Boiler
		Other
v.	Add-On Heat Pump	Yes, No
vi.	Geothermal Heat Pump	Yes, No
vii.	Heating Seasonal Performance Factor (HSPF)	
viii.	Condition of House (Thermal Integrity)	Good
		Fair
		Poor

b. Weather and Home Characteristic Data

HC	=	Heating Coefficient of Air	= 0.018	For 70°F Standard Air (Btu/$ft.^3$ - °F)
HDD	=	Heating Degree Days (Kentucky Region)	= 4,676	(°F - Day)
Cd	=	Adjustment Factor for		Value Based on Condition of House
		Solar and Internal Gains	= 0.30	Good
			= 0.65	Fair
			= 0.90	Poor
A	=	Add-On Heat Pump Adjustment	= 0.759	

Appendix E

Blower Door Evaluation Assumptions
Kentucky Power Company
Modified Energy Fitness (MEF) Program
Blower Door Evaluation

II. Engineering Model to Calculate Cooling Energy Savings

Q_C = HG Sensible + HG Latent

Where

ΔCFM	= ΔAC/HR * Vol. * 0.0167
HG_s (Sensible)	= 1.1 * ΔCFM * $(t_o - t_i)$
HG_s	= 14.3 * ΔCFM; t_o = 91°F, t_i = 78°F)
HG_L (Latent)	= 0.68 * CFM * ΔGrains Moisture
HG_L	= 11.56 * CFM; ΔGrains = 17 @ 55% RH

Q_C = (14.3 + 11.56) * ΔCFM

Q_C = 25.86 * ΔCFM Where Q_C in Btuh (Heat Gain)

E = (Q_C * 24 Hr/Day * CDD) / (Δt * 1000 * SEER)

Where E is kWh

HC	=	Heating Coefficient of Air	= 0.018	For 70°F Standard Air (Btu/ft.^{3} - °F)
Δt	=	95 F - 75 F	= 20 F	
CFM	=	Air Flow Rate		ft.^{3} / Min.
Δ CFM	=	Change in Air Flow Rate Before and After Weatherization		
CDD	=	Where CDD is Cooling Degree Days (Kentucky Region)	= 1,121	(°F - Day)
SEER	=	Seasonal Energy Efficiency Ratio		
RH	=	Relative Humidity		