FINAL REPORT

Optimal Level of Funding for Utah Weatherization Program

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1.0 Introduction

This study examines the optimal level of funding for a Natural Gas DSM Low Income Weatherization Program in Utah. To determine the optimal funding level for this program, GDS has worked closely with staff of the Utah Department of Community and Economic Development (Division of Housing and Community Development), the Utah Energy Office, Questar Gas Company, the Utah Division of Public Utilities and other interested stakeholders to prepare estimates of the remaining potential for such a program in Utah, based on the documented assumptions discussed in this study. This report also presents the costs and benefits to the State of Utah of such a program (including a discussion of non-energy benefits). This report also describes the criteria that have been used to present data related to the optimal funding level for this energy efficiency program for Low Income customers of Questar Gas Company.

The main objectives for this project are the following[1]:

1. To evaluate the existing Utah Low Income Weatherization Assistance Program (WAP) using the most current data relating to the market potential and energy savings potential for this Program. For this objective, GDS will identify the total maximum achievable, cost effective energy savings potential in the residential low income sector in Utah
2. To identify what portion of the energy savings potential is being acquired with the State Community Services Office Low Income Weatherization Program (LIWP) under current funding
3. To estimate what additional funding would be needed to acquire <u>all</u> potential cost effective energy savings in the low income residential sector and
4. To identify the energy and dollar savings that could be acquired and how much it would cost to support funding of additional weatherization measures and services up to the production capability of the existing Utah LIWP services network, i.e. without additional administrative or weatherization crew staffing.

This report presents data and analysis concerning the optimal funding level for a low-income natural gas DSM weatherization program for the State of Utah, and a detailed basis for these recommendations.

Table 1-1 below provides an overview of the findings of this analysis pertaining to each of the four study objectives listed above.

[1] These objectives were provided to GDS Associates on June 21, 2004 by Jeff Burks of the Utah Energy Office via e-mail.

Table 1-1: Summary of Findings	
Study Objective	**Finding**
1. Determine the maximum achievable cost effective potential for the Low Income Weatherization Program for Homes with Natural Gas Space Heat	There are 72,306 low-income households in Utah that use natural gas for space heating that remain to be weatherized as of September 2004. The maximum achievable cost effective potential energy savings are 1,900,202 Dth per year (equivalent to 53.3% of pre-installation natural gas space heating usage of low income customer housing units remaining to be weatherized). This potential savings is based upon the remaining market needing weatherization services of 72,306 low income homes in Utah, and the maximum achievable cost effective potential savings of 26.28 Dth per year per low income housing unit served. The Total Resource Cost test (TRC) benefit/cost ratio for the Low Income Program is **1.12** excluding non-energy benefits of the Program.
2. Identify what portion of the energy savings potential is being acquired with the State Community Services Office Low Income Weatherization Program (LIWP) under current funding and staffing.	With current funding, 1,317 low-income homes with natural gas space heat can be served each year. With this level of funding, it will take 55 years to achieve the maximum achievable cost effective potential in the 72,306 homes remaining to be weatherized. Less than two percent of the maximum achievable cost effective potential is being attained each year with the current level of funding.
3. Estimate what additional funding would be needed to acquire all potential cost effective energy savings in the low income residential sector	To acquire all potential cost effective energy savings in the low income residential sector in a ten-year time frame would require total funding of $18.1 million a year, as shown in Table 8-1. This translates to additional funding of $13.3 million over the current annual program budget of $4.8 million. The amount of additional funding needed varies up or down from this amount depending upon the time frame for completion that is selected and the level of weatherization funding from non-utility sources.

4. Identify the energy and dollar savings that could be acquired and how much would it cost to support funding of additional weatherization measures and services up to the production capability of the existing Utah LIWP services network, i.e. without additional administrative or weatherization crew staffing.	The maximum annual production capacity of the Utah Weatherization Assistance Program for natural gas heated homes is currently 1,409 homes (1,578 X 89.3%). There are several vacant field technician positions (in the WAP program) throughout the state that are in the process of being filled. When the local agencies fill those positions, the statewide production capacity will increase to a total of 1,858 units annually and 1,659 annual natural gas units at full production capacity. Thus, at full production capacity of 1,659 homes per year, 250 (this is 1,659 minus 1,409) additional low-income homes with natural gas could be served, at a cost of $2,506 per home. The additional funds needed annually are $626,500, based on these 250 additional homes and the average cost to serve a home.

Cost Effectiveness Findings

Finally, this report documents that an expanded low-income weatherization program targeted at low-income housing units using natural gas space heat can be very cost effective. Section 12 of this report provides benefit/cost data for the Program, and provides the magnitude of net present value savings to the State of Utah for a range of optimal funding levels for this program assuming that the remaining cost effective savings potential is captured over the next twenty years.

Recommendation for Optimal Level of Funding

This report examined a range of possible optimal funding scenarios based upon an examination of detailed and up-to-date information on the remaining maximum achievable cost effective natural gas and electricity savings potential in low-income housing units in Utah. This report finds, for example, that the current annual funding level of the program would need to be increased by $4.3 million a year over the current budget of $4.8 million in order to capture the remaining cost effective energy savings potential in the low-income market over a twenty-year time frame. This allows for a pace of delivery that can be accommodated by the current energy services infrastructure in Utah. The findings summarized in this report provide a range of data that the Utah Gas DSM Advisory Group can draw from in recommending an optimal level of funding for the program to be included in the rates charged by Questar Gas Company.

2.0 The Utah Low Income Weatherization Program

In 1976, in response to the national energy crisis of the 1973-4 period, the U.S. Department of Energy initiated the Weatherization Assistance Program (WAP). The goal of this program is to assist low-income households, particularly the elderly and disabled, to reduce their energy consumption. The WAP helps reduce the impact of utility costs on limited household budgets and helps stimulate self-sufficiency. Since 1976 the State of Utah has implemented this program and it coordinates these efforts with many other public and private programs to improve the lives of low-income Utah residents. The Utah Division of Housing & Community Development administers the Weatherization Assistance Program statewide through eight government and non-profit agencies. According to the program's web site[2], benefits are provided in the form of a non-cash grant to eligible households for making energy efficient improvements to their homes. According to the Program's web site participating households are currently averaging nearly 33 percent in savings (or approximately $285 per year for space heating, space cooling and electric baseload energy savings) after the completion of the Weatherization work (based on electric and gas rates in effect in 2004).

2.1 Program Eligibility

Individuals, families, the elderly (60 years of age or older), persons with disabilities and others who have incomes that are at or below 125 percent of the current federal poverty income guidelines are eligible for Weatherization services. However, additional priority is given to the elderly and disabled, households with high-energy consumption, emergency situations, and where pre-school children are present. Eligibility is determined by income as listed below in Table 2-1.

Table 2-1: Low Income Guidelines

# In Household	Yearly Income	Maximum Monthly Income
1	$11,638	$970
2	$15,613	$1,301
3	$19,588	$1,632
4	$23,563	$1,964
5	$27,538	$2,295
6	$31,513	$2,626
7	$35,488	$2,957
8	$39,463	$3,289

[2] See http://dced.utah.gov/community/weatherization.html.

For families with more than eight members, it is necessary to add $3,975 per person annually, or $331 per person monthly. Note that these figures are updated in mid-February of each year. Some medical bills and 20% of earned income may be allowed as a deduction.

Both owner-occupied and rental units are eligible for weatherization services. In the case of renter-occupied dwellings, however, the goal of the program is to reduce the utility costs of low-income tenants without excessive enrichment to the property owner. In renter-occupied dwellings, some energy saving measures will require a matching contribution by the building owner.

2.2 Services Offered

In carrying out Weatherization projects, a comprehensive energy audit and evaluation is completed on the home before any work begins. Once the audit is completed, first priority is usually given to stopping excessive air infiltration. Second priority is then given to installing a balanced combination of energy-saving home improvements including furnace tune-ups, repairs and replacements, insulation of attics, floors, walls, foundations, pipes, water heaters and exposed heating ducts, installation of replacement windows and doors, compact fluorescent bulbs, replacement refrigerators, etc. Local agency crews or contractors are used to complete all Weatherization work. Only measures that will pay for themselves in energy savings can be installed (based upon a computerized energy audit of each home).

2.3 Recent Highlights of the Program

State of Utah funding for the Weatherization program is leveraged with six additional private and federal grants at a ratio of approximately $340 from those sources to every one-dollar from the State of Utah. Such matches of funding help minimize state investments and allow increased services and program flexibility. Funding contributed by Questar Gas Company and Utah Power and Light has increased the scope of the program to include natural gas health and safety and electrical base load reduction measures. Table 2-2 below shows the Weatherization services that were provided in Fiscal Year 2003.

Table 2-2: Program Activity for Fiscal Year 2003			
Homes completed	1,609	Native-American units	234
Elderly units	494	People served	5,129
Disabled units	462	Homes in progress	505

The demographics of those households served in FY 2003 include the following:

- 65% are at or below 75% of poverty and/or have annual incomes of $8,000 or less
- 60% are on fixed incomes
- 36% are the working poor
- 40% have a disabled person
- 33% are receiving social security
- 31% are elderly households
- 45% are families with preschool age children in the home
- 15% are Native American households

Listed below in Table 2-3 are additional highlights of recent program activity.

Table 2-3: Utah Weatherization Assistance Program - Program Activity Statistics

Number	Program Activity Indicator	Statistic
1	Maximum current production capacity of program for natural gas homes	1,409
2	Maximum current production capacity of program for natural gas homes, after vacant postions are filled	1,659
3	Total applications approved 2002-2003	1,523
4	Total applications approved 2003-2004	1,623
5	Total backlog as of August 19, 2004	1,353
6	Total backlog for 2004-2005	1,660
7	Total backlog for 2003-2004	1,002
8	Total backlog for 2002-2003	934
9	Total backlog for 2001-2002	798
10	Total backlog for 2000-2001	756
11	Total backlog for 1999-2000	722
12	Number of natural gas homes that can be weatherized with current year funding	1,125

2.4 Economic Impact of Weatherization

The Utah Weatherization program web site lists the following economic impacts of the Program:

- The Program provides over 70 direct skilled jobs in Utah and many indirect jobs through the purchase of building materials and other goods and services.
- Public and private investment in the Weatherization program stimulates economic growth in Utah. Investment in Weatherization results in an

economic multiplier effect where the annual $5 million investment rolls over in the economy to where the economic impact to Utah increases to over $12.5 million annually.

- Weatherization supports local businesses, introduces cutting-edge energy conservation technologies to the state, conserves non-renewable energy resources, reduces pollution created through the burning of fossil fuels, and helps reduce the need of low-income households for government assistance programs. Further information on the non-energy benefits of this Weatherization Assistance Program are provided in Section 13 of this report.

3.0 The Market Potential for a Low Income Natural Gas DSM Program

The State of Utah Division of Community Development provided GDS with updated information on the market potential for a Natural Gas Energy Efficiency program for low-income customers in Utah. This data was provided to GDS by the State of Utah on September 2, 2004[3], and was gathered from several sources:

- actual data on the number of low-income households served to date by the WAP
- US Bureau of the Census Current Population Survey
- LIHEAP program administrators

Here are the key facts used to develop the estimate of the eligible market for this program:

- According to the US Bureau of the Census Current Population Survey for the years 2000 through 2002, in 2001 there were 87,831 households in Utah that were at or below the Utah 125% poverty level as defined by the Federal Government. This 2001 figure is the average of data for 2000, 2001 and 2002. The March 2004 Current Population Survey (Table POV46) shows that there are 312,000 persons in Utah who are at or below 125% of the Federal Poverty Level guideline.
- The Utah Weatherization Program Director estimates that the number of low-income households in Utah is increasing at 1.32% a year. Thus the total number of low-income households units in Utah in 2004 is now 91,355 households.[4]
- 14,229 low-income households have been weatherized by the State of Utah in the last 10 years. Due to the mobility rate of 23.875%, 10,385 of these 14,229 households are not eligible for additional weatherization, but 3,397 of the 14,229 participants are eligible. Thus only 80,970 low-income households remain to be weatherized.

[3] September 2, 2004 e-mail from Michael Johnson of the Utah Department of Community and Economic Development, Division of Housing and Community Development, to Dick Spellman of GDS Associates.

[4] Id. The figure of 91,355 was calculated by Michael Johnson by multiplying the 2001 figure of 87,831 by the growth rate of 1.32% a year for three years.

- 89.3% of these remaining low-income households use natural gas for space heating. Thus there are 72,306 low-income households that use natural gas for space heating that remain to be weatherized as of September 1, 2004.

4.0 Costs to Weatherize a Low Income Home in Utah

Listed below is the most recent data available on the cost per home for weatherization in the Utah WAP. This data was provided to GDS by the Utah Division of Housing and Community Development.[5]

- $2,931.64 – This is the average cost per home for all fieldwork in natural gas homes. This figure includes all costs, including electric and gas energy efficiency measures, health and safety measures, and other incidental expenses. It is necessary to subtract from the $2,931.64 figure an amount of $425.23 for incidental repairs and other electric baseload measures. Thus the average cost per home for natural gas energy efficiency measures is $2,506.42. This is the cost per home that is used in the GDS benefit/cost analysis of the program.

- $418.50 – Average Questar Gas program expenditure per home (health & safety measures)

- $348.01 – Average Utah Power and Light program expenditure per home (electrical base load measures)

5.0 Production Capacity and Budget for the Current Weatherization Program

According to the Utah Division of Housing and Community Development, the maximum current production capacity per year with the current FY 2004 budget and staffing levels is 1,578 homes. The maximum annual production capacity for natural gas homes is currently 1,409 homes (1,578 X 89.3%). There are several vacant field technician positions (in the WAP program) throughout the state that are in the process of being filled. When the local agencies fill those positions, the statewide production capacity will increase to a total of 1,858 units annually and **1,659** annual natural gas units at full production capacity.

The annual budget for the Utah Weatherization Assistance Program is $4.8 million, and the sources of this funding are listed below in Table 5-1.

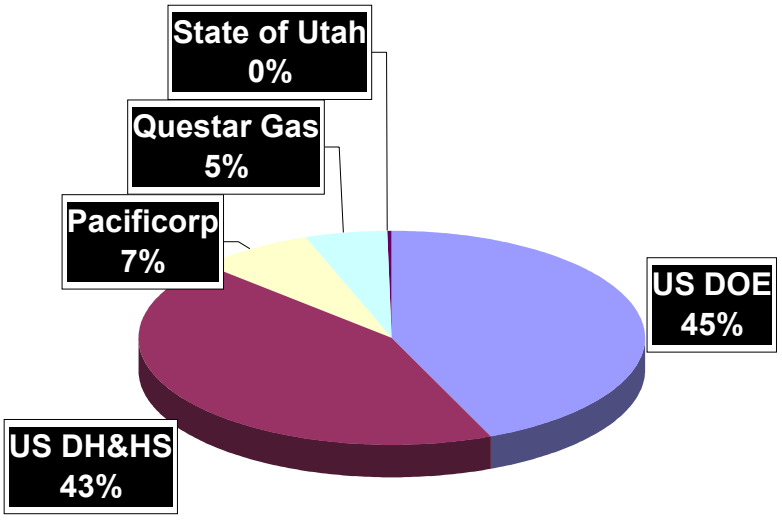
[5] August 30, 2004 e-mail from Michael Johnson of the Utah Department of Community and Economic Development, Division of Housing and Community Development, to Dick Spellman of GDS Associates.

Table 5-1: 2004-2005 State of Utah Weatherization Budget

$2,077,161	U.S. Department of Energy – General Weatherization
$2,066,000	U.S. Dept. Health & Human Services/LIHEAP–General Weatherization
$ 350,000	PacifiCorp/Utah Power – Electric base load reduction measures only (effective as of 12/1/2004)
$ 250,000	Questar Gas – Natural gas appliance replacements, tune-ups and repairs
$ 15,800	State of Utah – General Funds – State Administration
$4,758,961	Total Funds Available for Current Fiscal Year

Figure 5-1 below provides the funding source data in pie chart format and shows the breakdown of the overall $4.8 million budget by funding source, and the percent of funding provided by each source.

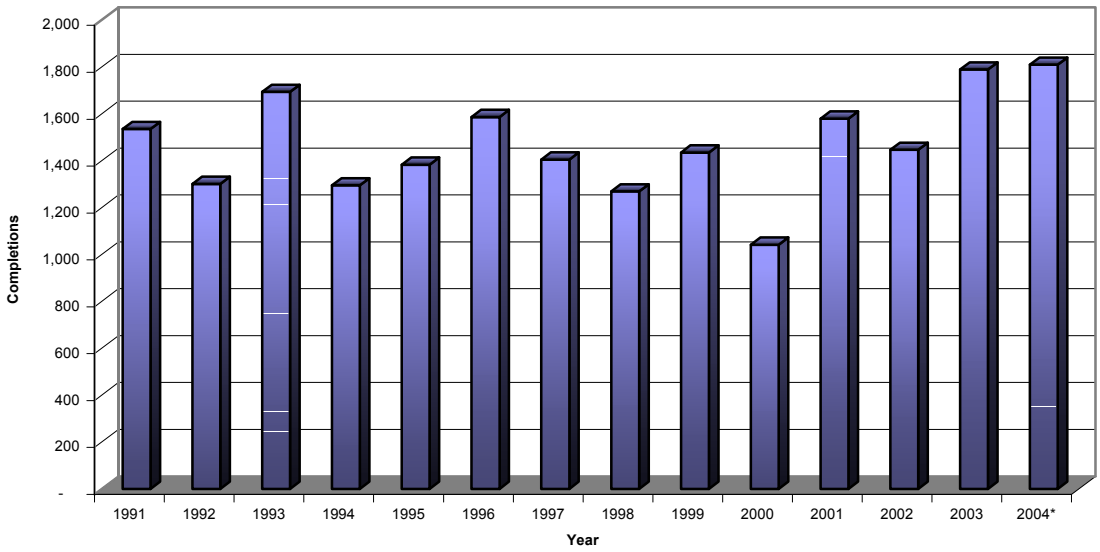
Figure 5-1: 2005 Utah WAP Sources of Funding (Based on Total Budget of $4.8 million)



6.0 Data on Program Completions and Backlogs

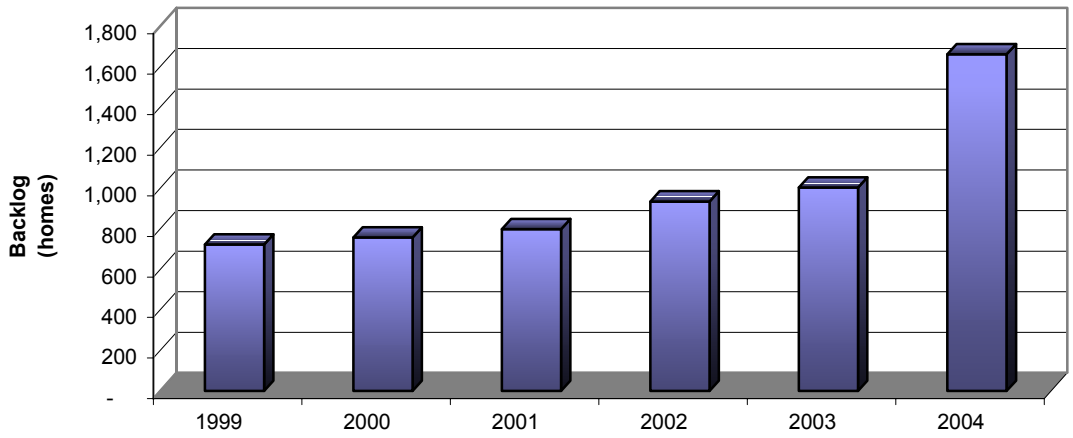
Over the past five fiscal years (1999 to 2003), the WAP program provided weatherization services to approximately 1,500 homes a year. Figure 6-1 below shows the annual numbers of homes served for fiscal years 1991 to 2004.

Figure 6-1 - Utah HWAP Annual Completions for FY 1991 to 2004



Currently the number of applications to the program by Low Income households exceeds the annual production capacity of the Utah WAP. Figure 6-2 shows how the program backlog has increased since June 1999 from a level of 722 unserved applicants to over 1,660 unserved applicants as of June 2004.

Figure 6-2: Total Backlog for the Utah Weatherization Assistance Program - 1999 to 2004



Note: Backlog as of June 30 of each year

7.0 Analysis of Budget Needed to Maximize Current Production Capacity

The number of natural gas homes that can be weatherized with the current year WAP funding is as follows:

The total general weatherization funds available to the State of Utah without Utah Power and Light Funding is $3,300,410.[6] This budget of $3,300,410 can serve the completion of 1,317 homes with natural gas, based on an average cost per home served of $2,506.

According to the Division of Housing and Community Development, the maximum production capacity of the WAP is 1,409 at the current funding level. As noted in Section 5 above, the statewide production capacity will increase to a total of 1,858 units annually and **1,659** annual natural gas units at full production capacity and with additional funding.[7] To fully utilize the existing production capacity, 250 additional low-income homes with natural gas could be served, at a cost of $2,506 per home. The additional funds needed annually to fully utilize the existing production capacity are $626,500, based on these 250 additional homes and the average cost to serve a home.

[6] This is calculated by starting with the $3,695,868 total general weatherization funds that are available without Utah Power and Light funding, and multiplying times the percent of homes with gas space heat (89.3%).

[7] There are several vacant field technician positions (in the WAP program) throughout the state that are in the process of being filled. When the local agencies fill those positions, the statewide production capacity will increase to a total of 1,858 units annually and **1,659** annual natural gas units at full production capacity.

The amount of additional funding needed to address the current (as of August 19, 2004) backlog of 1,208 natural gas heated low-income homes is $3,027,822. This figure is based upon 1,353 low-income homes times 89.3% with natural gas space heat times the average cost per home of $2,506.

8.0 Funds Needed to Address 100% of the Backlog and To Acquire 100% of the Technical Potential

Table 8-1 below provides calculations of the required funding level for the program if 100% of the remaining 72,306 low-income homes (having gas space heating) that need weatherization services were served by the program. The annual funding requirement is shown based on assumptions on the number of years over which these homes are served. For purposes of this Table, the duration of the program ranges from 1 to 20 years, and the corresponding funding amount is listed for each program duration period. The shorter the program duration, the higher is the required funding level. If one assumes that it will take ten years to serve all 72,306 eligible homes, then the annual funding level needed is $18.1 million. If one assumes that it will take twenty years to serve all 72,306 eligible low-income homes, then the annual funding level needed is $9.1 million.

The findings summarized in Table 8-1 provide a range of data that the Utah Gas DSM Advisory Group can draw from in recommending an optimal level of funding for the program to be included in the rates charged by Questar Gas Company.

The levels of additional funding shown above would allow 100% of low-income homes to be served and would eliminate the current backlog. This additional funding would allow outreach to target high-energy users and those households at risk that are among the remaining 72,306 eligible homes. This type of program marketing has not been done in recent history since it would increase an already unmanageable backlog. A majority of applications have been received as a result of word-of-mouth. According to Michael Johnson, only one local agency has done active outreach lately, which was necessary due to their restrictive application process. The problems with this application process have been corrected and approved applications have now doubled.

Table 8-1: Annual Optimal Funding Level By Program Duration

Program Duration to Serve 100% of Eligible Homes	Cost to Serve One Home	Number of Low Income Homes Remaining to be Served	Number of Homes Served Per Year	Optimal Funding Level
1	$2,506.42	72,306	72,306	$181,229,205
2	$2,506.42	72,306	36,153	$90,614,602
3	$2,506.42	72,306	24,102	$60,409,735
4	$2,506.42	72,306	18,077	$45,307,301
5	$2,506.42	72,306	14,461	$36,245,841
6	$2,506.42	72,306	12,051	$30,204,867
7	$2,506.42	72,306	10,329	$25,889,886
8	$2,506.42	72,306	9,038	$22,653,651
9	$2,506.42	72,306	8,034	$20,136,578
10	$2,506.42	72,306	7,231	$18,122,920
11	$2,506.42	72,306	6,573	$16,475,382
12	$2,506.42	72,306	6,026	$15,102,434
13	$2,506.42	72,306	5,562	$13,940,708
14	$2,506.42	72,306	5,165	$12,944,943
15	$2,506.42	72,306	4,820	$12,081,947
16	$2,506.42	72,306	4,519	$11,326,825
17	$2,506.42	72,306	4,253	$10,660,541
18	$2,506.42	72,306	4,017	$10,068,289
19	$2,506.42	72,306	3,806	$9,538,379
20	$2,506.42	72,306	3,615	$9,061,460

9.0 Description of Health and Safety Activities of the Utah WAP

There are a number of health and safety components of the Utah WAP. For example, the Utah WAP is expending nearly $1 million annually in the furnace program component and these funds are being spent almost entirely on health and safety issues that may or may not have a payback or energy savings.[8] The

[8] Although most components of the Utah WAP furnace program are health and safety related, these components also have efficiency, environmental and resource conservation benefits as well. Although the required gas appliance inspection and testing on every unit in and of itself does not directly contribute to any of these four areas, it almost always identifies activities and

WAP program is replacing about one in four natural gas furnaces that it encounters. The replaced units are usually 61% AFUE units and the new units are equally split between 80% and 90% efficiency. Currently Questar provides the Utah WAP with $250,000 in funding annually, with the remaining $750,000 for these health and safety measures coming from DOE and LIHEAP funds. Ensuring the safety of low-income residents who cannot afford to maintain, repair or replace their heating systems is something that needs to be considered by the Utah DSM Advisory Group in this optimal funding level analysis. There is obviously more to a successful and cost effective program than energy savings alone.

10.0 Characteristics of WAP Program Participants

Using a database obtained from the State of Utah WAP program, GDS developed a profile of the characteristics of program participants having natural gas space heat. This database contained program records on 1,048 weatherization program participants. Participating homes received a mix of the following measures that save natural gas:

- air infiltration
- attic, wall and floor insulation
- heating system repair or replacement
- high efficiency windows
- incidental repairs (holes or leaks in heated envelope, etc.)

It is important to note that the average home also receives eight compact fluorescent bulbs (CFL's) that reduce electric usage by a total of 117 kWh annually. The total cost of these eight bulbs is approximately $17 ($2.14 for each CFL). In addition, old refrigerators are replaced in about 300 low-income housing units a year. Eighty percent of the old refrigerators are 18.2 cubic foot units, and the new replacement refrigerator costs $400 each. Twenty percent of the old refrigerators are 20.9 cubic foot units and the new replacement refrigerator costs $549 each. The average annual electricity savings per old refrigerator replaced is 1,510 kWh.

Listed below are key characteristics of these 1,048 program participants:

measures to be completed that do have such benefits. Upon completion of inspection and testing, a furnace that has been tuned-up has proven to reduce natural gas consumption by up to 13%. If a furnace is replaced for health and safety reasons rather than receiving a tune-up, efficiency increases range from 20% to 50% or more, averaging 25%. Electronic set-back thermostats offer 5%-10% reduction in fuel consumption. Duct sealing and insulation further increase system efficiencies to and produce savings of 30% or more. As natural gas consumption is reduced by the various mechanical measures completed by the weatherization program, there is a corresponding reduction in combustion byproducts that are harmful to the environment and fewer non-renewable energy resources are used. Another significant byproduct is increased comfort of the residence that is difficult to measure quantitatively but still is an important benefit to the clients served.

- The average square footage of these 1,048 homes is 1,432 square feet (based on participating low income households where square footage data was recorded).[9]
- The average number of persons per low-income household is 3.3 persons.
- The average cost of gas heating equipment measures and labor was $641 per household ($468 is the cost of the materials only)
- The average cost of insulation measures and labor was $316 per home ($146 for the materials only).
- The average cost of air infiltration measures was $341 per home ($145 for the materials only).

11.0 Annual Energy Savings Per Home for the Utah WAP

The Utah WAP provides a balanced combination of energy-saving home improvements to eligible low-income households. These energy efficiency improvements include air sealing, furnace tune-ups, repairs and replacements, insulation of attics, floors, walls, foundations, pipes, water heaters and exposed heating ducts, installation of replacement windows and doors, compact fluorescent bulbs, replacement refrigerators, etc.

There are three readily available estimates of annual energy savings per participant attributable to the Utah low-income weatherization program.

1. The first estimate of savings is an estimate of the **maximum achievable cost effective savings potential per home**. This estimate was completed by GDS on September 10th, 2004. This GDS estimate is based upon the mix of energy efficiency measures installed (insulation, air infiltration measures, new high efficiency gas space heating equipment, etc.) and the actual average square footage per participating low-income natural gas household of 1,432 square feet. GDS developed the maximum achievable cost effective annual energy savings estimate for the Low Income Weatherization Program using the REM/Rate building energy simulation model. This savings estimate is based on five energy efficiency upgrade scenarios, and includes savings of natural gas and electricity due to the energy efficiency measures installed in homes with natural gas space heat. For all five scenarios, the baseline AFUE for natural gas furnaces is 61% (pre-program), and the AFUE for a high efficiency natural gas furnace is 90%.[10] The REM/Rate analyses indicate that the maximum achievable annual natural gas space heating usage savings averages

[9] In a September 15, 2004 e-mail to Dick Spellman of GDS, Michael Johnson of the Utah Division of Housing and Community Development reported that the average square footage of the homes of recent program participants is 1,197 square feet, slightly lower than the 1,432 square feet listed here. GDS Associates has used the average square footage estimate of 1,432 square feet because it is based on a recent sample of homes that have natural gas as a main source of space heating. This is the target market for this component of the program.

[10] The baseline natural gas furnace AFUE of 61% and the high efficiency furnace AFUE of 90% were provided by from Michael Johnson of the Utah Department of Community and Economic Development to Dick Spellman of GDS Associates on September 9, 2004.

53.3 percent of pre-installation natural gas usage for space heating (due to insulation, air infiltration reduction measures, new gas space heating equipment). According to new data provided by Questar staff[11], the average residential low-income natural gas customer uses approximately 493 therms per year for space heating. Based upon average space heating usage (pre-installation) of 493 therms per customer per year, and average savings of 53.3% of space heating usage due to the WAP program, the maximum achievable cost effective space heating savings per low-income household/participant are thus 262.8 therms per year. This savings figure of 262.8 therms is 26.6% of the pre-weatherization annual gas usage of 987.8 therms per program participant.

GDS also calculated the maximum achievable cost effective electricity savings per home for reduced space cooling requirements. These savings are 358 kWh per home per year. The Utah Weatherization Assistance Program also replaces about 300 old refrigerators a year. These refrigerator replacements save 1,510 kWh/per year on average. The results of the building simulation analysis to determine space heating energy savings are shown in Table 11-1 below. The results of the building simulation analysis to determine space cooling energy savings are shown in Table 11-2 below.

2. The second estimate of natural gas savings per home was also developed by GDS and is based upon a February 2003 Oak Ridge National Laboratory Report titled "Metaevaluation of National Weatherization Assistance Program Based On State Studies".[12] This report documents the findings of a recent metaevaluation of the State Weatherization Assistance Programs conducted by staff at Oak Ridge National Laboratory (ORNL). A metaevaluation is a study that uses as its data points the findings from a number of individual studies on the topic of interest. In this case, the performance of the national Weatherization Assistance Program was the focus, and the data points were the findings from 37 state-level evaluations of weatherization efforts completed between 1993 and 2002.

   In this ORNL study, mean values for pre-weatherization energy consumption and for weatherization-induced energy savings, as reported in the 28 state studies of gas-heated residences, were used as inputs for the development of a simple linear regression model. The results of the regression analysis revealed a strong positive relationship between pre-weatherization energy consumption and weatherization-induced energy savings (R-Square = 0.671; p=0.0001). This means that, consistent with the findings from many previous studies, households with higher pre-weatherization energy use will typically save more energy when they are weatherized. The R-Square of 0.671 means that 67.1% of the variance in

[11] September 9, 2004 E-mail from Blake Smith of Questar to Dick Spellman of GDS.

[12] Oak Ridge National Laboratory, "Metaevaluation of National Weatherization Assistance Program Based On State Studies", Report Number ORNL/CON-488, 19 pages, February 2003.

energy savings is explained by pre-weatherization levels of natural gas consumption. The descriptive equation produced by ORNL's simple regression analysis mentioned above has an intercept value of -11.29 and a slope value of 0.3035. The average pre-weatherization consumption of natural gas in Program homes that heat with natural gas is 133 million BTUs per year (Brown, Berry, Balzer, and Faby 1993). Using these parameters and inputs, the estimate of average household savings is 29.1 million BTUs annually, or 291 therms per year. This represents 21.9% of the average pre-weatherization consumption of natural gas for all end uses and 30.8% of pre-weatherization space heating consumption.

3. The third estimate was developed by Questar staff, and is based on data available on 365 of the 1,048 recent program participants. This estimate was developed by Questar, and it represents average natural gas savings per home achieved by the Weatherization Program. GDS did not use this savings estimate to determine the maximum achievable cost effective potential for a low income natural gas weatherization program or to determine the optimal level of funding for the program.[13]

   Questar developed this savings estimate by examining the difference in weather-normalized pre-program and post program natural gas usage for those 365 recent program participants where 12 months of pre-installation and post-installation natural gas usage data were available.[14] Questar staff determined from this analysis that annual natural gas savings per participant were approximately 143.3 therms (14.33 Dth). This Questar savings estimate is only 14.5% of the pre-weatherization annual gas usage of 987.8 therms per program participant. This percentage is much lower than the 21.9 percent savings per home estimate developed by ORNL. Questar staff did not develop an estimate of the other likely electric energy savings (electric air conditioning, furnace fan savings, etc.) due to the program.

[13] Blake Smith of Questar noted in a November 2, 2004 e-mail to GDS that "Many of the customers in our sample had very minimal things done (furnace tune-ups, weather stripping, set-back thermostat installed, etc.) Had all things been done at an optimal level (windows replaced, insulation installed, a furnace replaced, a water heater converted from electric to gas, etc.), I am sure we would have seen a much larger drop in usage per customer."

[14] This analysis by Questar did not include an assessment of household changes before and after measures were installed.

TABLE 11-1: CALCULATION OF NATURAL GAS END USE SAVINGS PER HOME FOR UTAH LOW INCOME WEATHERIZATION PROGRAM								
Measures	Base Annual Heating Consumption (therms)	Improved Annual Heating Consumption (therms) with upgraded heat system to AFUE 90	Space Heating Savings per home (therms) with upgraded heat system to AFUE 90	Space Cooling Savings per home (kWh)	Cost Per Home	Savings-Weighted Measure Life	% Savings from REM/rate using AFUE 90	Therm Savings Based on Questar Avg Residential Space Heating Usage for Low Income Customers of 493 Therms Per Year
Insulation / Weatherization Scenario 1	1671	618	1053	557	$2,351	24	63.0%	310.67
Insulation / Weatherization Scenario 2	1188	558	630	528	$1,804	22	53.0%	261.44
Insulation / Weatherization Scenario 3	1406	565	841	205	$741	24	59.8%	294.89
Insulation / Weatherization Scenario 4	1597	565	1032	557	$1,787	24	64.6%	318.58
Insulation / Weatherization Scenario 5	899	666	233	-59	$194	10	25.9%	127.77
				357.55			*53.3%*	***262.6707848***

TABLE 11-2: CALCULATION OF ANNUAL SPACE COOLING SAVINGS PER HOME			
Measures	**Base Annual Cooling Consumption (kWh)**	**Improved Annual Cooling Consumption (kWh)**	**Savings per home (kWh)**
Insulation / Weatherization Scenario 1	2139	1583	557
Insulation / Weatherization Scenario 2	1964	1436	528
Insulation / Weatherization Scenario 3	1671	1465	205
Insulation / Weatherization Scenario 4	2022	1465	557
Insulation / Weatherization Scenario 5	1465	1524	-59
Average Annual kWh Savings Per Home=			357.55

12.0 Benefit/Cost Analysis Results

This section of the report summarizes the cost effectiveness of the Utah Weatherization Program for natural gas heated homes for four optimal funding scenarios, and provides a summary of key input data assumptions.

12.1 Key Data Assumptions

Listed below is a summary of the key data assumptions used in the updated weatherization program benefit/cost analysis:

- program costs per low income participant - $2,506 per home
- energy savings per participant – 262.8 therms annually for space heat savings; 358 kWh annually for space cooling savings
- the useful life of energy savings per participant – 20 years
- the number of low income households in Utah that remain to be weatherized – 72,306
- the base case forecast of natural gas avoided costs used in this study for the year 2004 was provided to GDS Associates by Questar Gas Company on February 20, 2004. This study assumes that avoided costs of natural gas remain constant in real dollars over the study period (2004 to 2013).
- Current production capacity of the weatherization network staff

12.2 Optimal Level of Funding Scenarios Examined and Benefit/Cost Ratios

For this study, the GDS examined the cost effectiveness of four optimal funding scenarios over a ten-year planning horizon:

1. Scenario 1: Utilization of 100% of the current production capacity (without filling staff vacancies that currently exist) of the Utah Weatherization Program - but the current program backlog is not addressed. This means that 1,659 homes with natural gas space heat would be served per year for 10 years.

2. Scenario 2: Utilization of 100% of the current production capacity of the Utah Weatherization Program and the current backlog is addressed. This means that 1,659 homes with natural gas space heat are served per year for 10 years. Also, in Year 1, 100% of the current backlog of 1,353 units is served. Serving the current backlog is included in Scenario 2, but is not included in Scenario 1.

3. Scenario 3: Achieve 100% of the maximum achievable cost effective potential of the remaining potential for this program over 10 years, and serve the current backlog of 1,353 units. This means that 7,231 homes with natural gas space heat would be served per year for 10 years as well as the current backlog.

4. Scenario 4: Achieve 100% of the maximum achievable cost effective potential of the remaining market for this program over 20 years, and also address the current backlog of 1,353 units. This means that 3,615 homes with natural gas space heat would be served per year for 20 years as well as the current backlog.

5. Scenario 5: This scenario assumes that the number of low-income housing units in 2004 of 72,606 increases at the forecast rate of population growth (0.9% per year) for Utah as projected by the US Bureau of the Census for the twenty-year period from 2005 to 2025. This last scenario assumes that the State will achieve 100% of the maximum achievable cost effective potential of the remaining market for this program over 20 years, and also address the current backlog of 1,353 units. This means that homes with natural gas space heat would be served per year for 20 years as well as the current backlog. This means that 4,343 low-income homes with natural gas space heat would be served per year for 20 years as well as the current backlog of 1,353 units.

Tables 12-1 to 12-4 below present the four required benefit/cost ratios for each of the five funding scenarios. Appendix B presents similar benefit/cost analysis results for a scenario where the program savings are based upon the Questar derived annual savings estimate of 140 therms per participating low-income home.

Table 12-1: Total Resource Cost Test Benefit/Cost Ratios for the Low Income Program

Program Description	Present Value of Savings	Present Value of Costs	Net Present Value Savings	B/C Ratio
Scenario 1	$ 39,351,498.16	$ 34,949,275.78	$ 4,402,222.38	1.13
Scenario 2	$ 43,017,705.67	$ 38,339,893.78	$ 4,677,811.89	1.12
Scenario 3	$ 177,320,407.65	$ 157,618,253.91	$ 19,702,153.74	1.12
Scenario 4	$ 89,414,047.08	$ 79,545,911.51	$ 9,868,135.57	1.12
Scenario 5	$ 106,682,215.05	$ 94,882,302.57	$ 11,799,912.48	1.12

Notes:
1. TRC benefits include the value of the avoided costs for electricity and gas.
2. TRC costs include utility plus participant costs

Table 12-2: Utility Cost Test Benefit/Cost Ratios for the Low Income Program

Program Description	Present Value of Savings	Present Value of Costs	Net Present Value Savings	B/C Ratio
Scenario 1	$ 31,850,378.31	$ 34,949,275.78	$ (3,098,897.47)	0.91
Scenario 2	$ 34,829,350.86	$ 38,339,893.78	$ (3,510,542.92)	0.91
Scenario 3	$ 143,531,485.89	$ 157,618,253.91	$ (14,086,768.02)	0.91
Scenario 4	$ 72,381,695.64	$ 79,545,911.51	$ (7,164,215.88)	0.91
Scenario 5	$ 86,358,232.95	$ 94,882,302.57	$ (8,524,069.62)	0.91

Notes:
1. The gas utility test benefits include the value of the avoided costs for gas and excludes the electricity savings.
2. For the utility test for a gas utility, the costs include total utility costs (and exclude participant costs).

Table 12-3: Participant Test Benefit/Cost Ratios for the Low Income Program				
Program Description	**Present Value of Savings**	**Present Value of Costs**	**Net Present Value Savings**	**B/C Ratio**
Scenario 1	N/A	N/A	N/A	N/A
Scenario 2	N/A	N/A	N/A	N/A
Scenario 3	N/A	N/A	N/A	N/A
Scenario 4	N/A	N/A	N/A	N/A
Scenario 5	N/A	N/A	N/A	N/A

Notes:
1. For this program the participant test is undefined because there are no participant costs.
2. The participant test benefits include the value of the reduced retail bills for gas, electricity and water..
3. For the participant test, the costs includes just the participants out of pocket costs (the net cost of the efficiency measure.

Table 12-4: Rate Impact Measure Test Benefit/Cost Ratios for the Low Income Program				
Program Description	**Present Value of Savings**	**Present Value of Costs**	**Net Present Value Savings**	**B/C Ratio**
Scenario 1	$ 31,850,378.31	$ 78,280,649.25	$ (46,430,270.94)	0.41
Scenario 2	$ 34,829,350.86	$ 85,765,142.76	$ (50,935,791.90)	0.41
Scenario 3	$ 143,531,485.89	$ 352,929,118.68	$ (209,397,632.79)	0.41
Scenario 4	$ 72,381,695.64	$ 178,059,868.46	$ (105,678,172.82)	0.41
Scenario 5	$ 86,358,232.95	$ 212,410,870.66	$ (126,052,637.70)	0.41

Notes:
1. The Rate Impact Measure test for a gas utility, benefits include the value of the avoided costs of natural gas.
2. For the Rate Impact Measure Test, the costs includes just the total Utility Costs plus the calculation of lost retail revenues.

12.3 Definitions of Benefit/Cost Tests

Total Resource Cost Test

The Total Resource Cost Test measures the net costs of a demand-side management program as a resource option based on the total costs of the program, including both the participants' and the utility's costs. The test is applicable to conservation, load management, and fuel substitution programs. For fuel substitution programs, the test measures the net effect of the impacts from the fuel not chosen versus the impacts from the fuel that is chosen as a result of the program. TRC test results for fuel substitution programs should be viewed as a measure of the economic efficiency implications of the total energy supply system (gas and electric).

A variant on the TRC test is the Societal Test. The Societal Test differs from the TRC test in that it includes the effects of externalities (e.g., environmental, national security), excludes tax credit benefits, and uses a different (societal) discount rate. Benefits and Costs: The TRC test represents the combination of the effects of a program on both the customers participating and those not participating in a program. In a sense, it is the summation of the benefit and cost terms in the Participant and the Ratepayer Impact Measure tests, where the revenue (bill) change and the incentive terms intuitively cancel (except for the differences in net and gross savings).

The benefits calculated in the Total Resource Cost Test include the avoided natural gas supply costs for the periods when there is a gas load reduction. The avoided supply costs are calculated using net program savings, savings net of changes in energy use that would have happened in the absence of the program. For fuel substitution programs, benefits include the avoided device costs and avoided supply costs for the energy using equipment not chosen by the program participant. Also included in the benefits are any electric and/or water avoided costs based on net savings due to the influence of the program.

Participant Test

The Participant Test is the measure of the quantifiable benefits and costs to the customer due to participation in a program. Since many customers do not base their decision to participate in a program entirely on quantifiable variables, this test cannot be a complete measure of the benefits and costs of a program to a customer.

The benefits of participation in a demand-side program include the reduction in the customer's utility bill(s), any incentive paid by the utility or other third parties, and any federal, state, or local tax credit received. The reductions to the utility bill(s) should be calculated using the actual retail rates that would have been charged for the energy service provided (electric demand or energy or gas).

Savings estimates should be based on gross savings, as opposed to net energy savings.

In the case of fuel substitution programs, benefits to the participant also include the avoided capital and operating costs of the equipment/appliance not chosen. For load building programs, participant benefits include an increase in productivity and/or service, which is presumably equal to or greater than the productivity/service without participating. The inclusion of these benefits is not required for this test, but if they are included then the societal test should also be performed.

The costs to a customer of program participation are all out-of-pocket expenses incurred as a result of participating in a program, plus any increases in the customer's utility bill(s). The out-of-pocket expenses include the cost of any equipment or materials purchased, including sales tax and installation; any ongoing operation and maintenance costs; any removal costs (less salvage value); and the value of the customer's time in arranging for the installation of the measure, if significant.

Definition of the Ratepayer Impact Measure Test

The Ratepayer Impact Measure (RIM) test measures what happens to customer bills or rates due to changes in utility revenues and operating costs caused by the program. Rates will go down if the change in revenues from the program is greater than the change in utility costs. Conversely, rates or bills will go up if revenues collected after program implementation are less than the total costs incurred by the utility in implementing the program. This test indicates the direction and magnitude of the expected change in customer bills or rate levels.

The benefits calculated in the RIM test are the savings from avoided supply costs. These avoided costs include the reduction in transmission, distribution, generation, and capacity costs for periods when load has been reduced and the increase in revenues for any periods in which load has been increased. The avoided supply costs are a reduction in total costs or revenue requirements and are included for both fuels for a fuel substitution program. The increases in revenues are also included for both fuels for fuel substitution programs. Both the reductions in supply costs and the revenue increases should be calculated using net energy savings.

The costs for this test are the program costs incurred by the utility, *and/or other entities incurring costs and creating or administering the program,* the incentives paid to the participant, decreased revenues for any periods in which load has been decreased and increased supply costs for any periods when load has been increased. The utility program costs include initial and annual costs, such as the cost of equipment, operation and maintenance, installation, program administration, and customer dropout and removal of equipment (less salvage value). The decreases in revenues and the increases in the supply costs should be calculated for both fuels for fuel substitution programs using net savings.

Program Administrator Cost Test (formerly the Utility Cost Test)

The Program Administrator Cost Test measures the net costs of a demand-side management program as a resource option based on the costs incurred by the program administrator (including incentive costs) and excluding any net costs incurred by the participant. The benefits are similar to the TRC benefits. Costs are defined more narrowly.

The benefits for the Program Administrator Cost Test are the avoided supply costs of natural gas only and exclude savings of electricity. The avoided supply costs should be calculated using net program savings, savings net of changes in energy use that would have happened in the absence of the program. For fuel substitution programs, benefits include the avoided supply costs for the energy-using equipment not chosen by the program participant only in the case of a combination utility where the utility provides both fuels.

The costs for the Program Administrator Cost Test are the program costs incurred by the administrator, the incentives paid to the customers, and the increased supply costs for the periods in which load is increased. Administrator program costs include initial and annual costs, such as the cost of utility equipment, operation and maintenance, installation, program administration, and customer dropout and removal of equipment (less salvage value). For fuel substitution programs, costs include the increased supply costs for the energy using equipment chosen by the program participant only in the case of a combination utility, as above.

In this test, revenue shifts are viewed as a transfer payment between participants and all ratepayers. Though a shift in revenue affects rates, it does not affect revenue requirements, which are defined as the difference between the net marginal energy and capacity costs avoided and program costs. Thus, if NPVpa > 0 and NPVRIM < 0, the administrator's overall total costs will decrease, although rates may increase because the sales base over which revenue requirements are spread has decreased.

13.0 Discussion of Non-Energy Benefits

GDS conducted a literature search on the non-energy benefits of energy efficiency programs targeted at low-income households. Non-energy benefits of low-income housing weatherization programs can be very significant. The most comprehensive study of low-income program non-energy benefits was recently completed for five investor-owned utilities in California. The two documents listed below provide documentation of these non-energy benefits:

1. TecMRKT Works, Skumatz Economic Research Associates, and Megdal & Associates, Low-income Public Purpose Test, (The LIPPT), Final Report, Up-Dated for LIPPT Version 2.0, A Report Prepared for the RRM Working Group'sCost Effectiveness Committee, April 2001. This report provides a description of each non-energy benefit included in the KeySpan analysis of non-energy benefits, and provides the methodology for calculating the value of each category of non-energy benefits.

2. TecMRKT Works, Skumatz Economic Research Associates, and Megdal & Associates, User's Guide for California Utility's Low-Income Program Cost Effectiveness Model, The Low-Income Public Purpose Test, Version 2.0, A Microsoft Excel Based Model, Prepared for The RRM Cost Effectiveness Subcommittee, May 25, 2001

Table 13-1 below provides examples of non-energy benefits that are applicable to weatherization and insulation programs targeted at low income customers.

Table 13-1

Summary of Low Income Program Non-Energy Benefits

Benefit Number in LIPPT Model	Name of Non Energy Benefit	Non-Energy Benefit Description
	Utility Perspective	
7A	Carrying cost on arrearages	Energy Efficiency Programs reduce customer bills, improving the likelihood that customers will be able to keep up with payments
7B	Lower bad debt write-offs	Makes energy bills more manageable for program participants, potentially reducing the bad debt for these customers
7C	Fewer shut-offs	As a result of the customers ability to pay their bills, a similar reduction in the number of customers with service disconnects is expected
7D	Fewer reconnects	As a result of the reduction in the number of shut-offs, the number of reconnects needed would also decline.

7E	Fewer notices	More affordable energy bills leads to more on-time payments and fewer notices from the utility
7F	Fewer customer calls	More affordable energy bills leads to more on-time payments and fewer customer calls
7H	Red'n in emergency gas service calls	
7J	Transmission and/or distribution savings (distribution only)	
	Societal Perspective	
8A	Economic impact	Estimate of economic impact to regional economy based upon using local labor for energy efficiency services instead of importing energy, and using bill savings being spent into local economy.
8B	Environmental benefits	Provides environmental benefits to the region and to society, particularly due to their role as a pollution abatement strategy. These include assisting in meeting Clean Air Act requirements, reduction in acid rain, and a variety of other benefits.
	Participant Perspective	
9B	Fewer Shutoffs	Providing customers with services and education that reduces energy use also helps customers reduce bills and presumably improves their payment record. As a result, participants experience fewer arrearages and are less likely to be disconnected.
9C	Fewer Calls to the utility	Without payment problems the customer is less likely to make calls to the utility concerning payments.
9D	Fewer reconnects	Reconnections are reduced in response to the lower shutoff numbers.
9H	Moving costs/mobility	High energy costs can make it difficult for residential customers to keep up with all of their household bills, including rent or mortgage payments. By keeping their bills down, this will reduce non-payment on living expenses
9I	Fewer Illnesses and lost days from work/school	Households with sufficient and continuous heating may experience changes in the number of colds and other illnesses per year
9K	Net Household Benefits from More Comfort, Less Noise, net of negatives	Weatherization of homes allows these homes to be kept warmer at lower costs, reduces drafts, and insulates them from noise and weather outside their homes.
9K	Net Household Benefits from Additional Hardship Benefits	The additional hardship benefits are those associated non-dollar benefits from reduced disconnects, reconnects, and bill collection, such as reduced stress as perceived and valued by participant.

Finally, recent studies by ORNL conclude that most efforts to estimate the non-energy benefits of weatherization programs have reported that these non-energy benefits are at least as large as the energy savings benefits (Schweitzer and Tonn 2002; Reed et al. 1997).

Finally, listed below are examples of other non-energy benefits that will result from implementation of the natural gas energy efficiency measures included in the portfolio of gas DSM programs recommend by this study for the Weatherization Assistance Program:

- Gas DSM programs can help reduce emissions of air pollutants[15] and greenhouse gases
    - Saving one therm of natural gas saves 11.7 lbs. of C02
    - Saving one therm of natural gas saves .01 lbs. of NOX
    - Saving one therm of natural gas saves .00006 lbs. of SO2
- Gas DSM programs can be more reliable than increasing the infrastructure of the natural gas pipeline system because gas DSM measures can be located in every home and business, and may not be as vulnerable to supply interruptions and price spikes
- Gas DSM can make low-income homes comfortable - less drafty, etc.
- Gas DSM can help low-income households reduce operating costs. As a result, there are economic multiplier effects, such as increased productivity and increased jobs. In the Wisconsin Focus on Energy Program, for example, the Program Evaluation contractor reports that 46 new full-time jobs are created in the State for every $1 million invested in energy efficiency programs.

[15] The Wasatch Clean Air Coalition provided GDS with the following definitions or emissions: CO2 is the major green house gas; NOx contributes to ground level ozone, particulate matter, acid rain, visibility impairment and nitrogen deposition; and SO2 contributes visibility impairment, acid rain, and particulate matter.

APPENDIX A - INPUT DATA FOR PROGRAM BENEFIT-COST ANALYSIS - UTAH LOWINCOME WEATHERIZATION PROGRAM FOR HOMES WITH NATURAL GAS SPACE HEAT - OPTIMAL LEVEL OF FUNDING STUDY - October 2004

1	2	3	4	5	6	7	8	9	10	11
Measure # from GDS Gas DSM Data Base	**Measure Description**	**Units**	**Total Installed Cost Per Low Income Home**	**Cost Type: Incremental = 0 Full = 1**	**Measure Life**	**Average Annual MMBTU Natural Gas Savings Per Low Income Home**	**Average Annual Therm Savings Per Unit Installed**	**Annual Amortized Cost Per Unit**	**Levelized Cost Per Therm Saved**	**Annual Gallons of water saved**
1	**Low Income Program**	Home	$2,506.42	1	20	26.28	262.8	$236.59	$0.9003	0
Source of Input Assumption			State of Utah, Division of Housing and Community Development-Weatherization Assistance Program		State of Utah, Division of Housing and Community Development, Weatherization Assistance Program	REM/Rate analysis conducted by Bruce Bennett of GDS in September 2004. Assumes program participants receive air infiltration reduction measures, insulation, and high efficiency gas heating equipment. Savings of 53.3% of natural gas space heating usage can be obtained. Pre-installation use per customer is 493 therms per year.	REM/Rate model simulation results applied to estimate of space heating usage	GDS calculation	GDS calculation	

APPENDIX A - INPUT DATA FOR PROGRAM BENEFIT-COST ANALYSIS - UTAH LOWINCOME WEATHERIZATION PROGRAM FOR HOMES WITH NATURAL GAS SPACE HEAT - OPTIMAL LEVEL OF FUNDING STUDY - October 2004

1	2	12	13	14	15	16	17	18	19
Measure # from GDS Gas DSM Data Base	**Measure Description**	**Annual kWh savings for space cooling**	**Gas End Use Affected**	**Implementation Type 1 = 1 Time 2 = ROB**	**Number of Households in Utah in 2004 at or below 125% of Federal Poverty Income Guideline**	**Base Case Factor of Gas Space Heat Installed in Low Income Homes (Saturation)**	**Number of Low Income Homes Already Weatherized (adjusted for Mobility Factor)**	**Type of home where applicable**	**Number of applicable homes in 2004 in Utah with natural gas space heat remaining to be weatherized**
1	**Low Income Program**	358	Space Heating	1	91,355	89.30%	10,385	Low Income homes in Utah with natural gas	72,306
Source of Input Assumption		REM/Rate model simulations			State of Utah, Division of Housing and Community Development, Weatherization Assistance Program	State of Utah, Division of Housing and Community Development, Weatherization Assistance Program	State of Utah, Division of Housing and Community Development, Weatherization Assistance Program		State of Utah, Division of Housing and Community Development, Weatherization Assistance Program

APPENDIX B

Benefit/Cost Scenario Based on Questar Annual Savings Estimate
Per Home of 140 Therms

Table B-1: Total Resource Cost Test Benefit/Cost Ratios for the Low Income Program				
Program Description	**Present Value of Savings**	**Present Value of Costs**	**Net Present Value Savings**	**B/C Ratio**
Scenario 1	$ 24,468,596.88	$ 33,488,965.06	$ (9,020,368.18)	0.73
Scenario 2	$ 43,017,705.67	$ 36,737,910.43	$ (9,995,106.91)	0.73
Scenario 3	$ 110,251,661.58	$ 151,032,377.07	$ (40,780,715.49)	0.73
Scenario 4	$ 55,591,854.45	$ 76,222,187.49	$ (20,630,333.05)	0.73
Scenario 5	$ 66,329,129.03	$ 90,917,767.10	$ (24,588,638.07)	0.73

Notes:
1. TRC benefits include the value of the avoided costs for electricity and gas.
2. TRC costs include utility plus participant costs

Table B-2: Utility Cost Test Benefit/Cost Ratios for the Low Income Program				
Program Description	**Present Value of Savings**	**Present Value of Costs**	**Net Present Value Savings**	**B/C Ratio**
Scenario 1	$ 16,967,477.03	$ 33,488,965.06	$ (16,521,488.03)	0.51
Scenario 2	$ 18,554,448.71	$ 36,737,910.43	$ (18,183,461.72)	0.51
Scenario 3	$ 76,462,739.82	$ 151,032,377.07	$ (74,569,637.25)	0.51
Scenario 4	$ 38,559,503.00	$ 76,222,187.49	$ (37,662,684.49)	0.51
Scenario 5	$ 46,005,146.93	$ 90,917,767.10	$ (44,912,620.16)	0.51

Notes:
1. The gas utility test benefits include the value of the avoided costs for gas and excludes the electricity savings.
2. For the utility test for a gas utility, the costs include total utility costs (and exclude participant costs).

Table B-3: Participant Test Benefit/Cost Ratios for the Low Income Program				
Program Description	**Present Value of Savings**	**Present Value of Costs**	**Net Present Value Savings**	**B/C Ratio**
Scenario 1	N/A	N/A	N/A	N/A
Scenario 2	N/A	N/A	N/A	N/A
Scenario 3	N/A	N/A	N/A	N/A
Scenario 4	N/A	N/A	N/A	N/A
Scenario 5	N/A	N/A	N/A	N/A

Notes:
1. For this program the participant test is undefined because there are no participant costs.
2. The participant test benefits include the value of the reduced retail bills for gas, electricity and water..
3. For the participant test, the costs includes just the participants out of pocket costs (the net cost of the efficiency measure.

Table B-4: Rate Impact Measure Test Benefit/Cost Ratios for the Low Income Program				
Program Description	**Present Value of Savings**	**Present Value of Costs**	**Net Present Value Savings**	**B/C Ratio**
Scenario 1	$ 16,967,477.03	$ 60,077,739.04	$ (43,110,262.01)	0.28
Scenario 2	$ 18,554,448.71	$ 65,828,720.27	$ (47,274,271.56)	0.28
Scenario 3	$ 76,462,739.82	$ 270,867,996.02	$ (194,405,256.20)	0.28
Scenario 4	$ 38,559,503.00	$ 136,661,786.92	$ (98,102,283.92)	0.28
Scenario 5	$ 46,005,146.93	$ 163,025,014.18	$ (117,019,867.25)	0.28

Notes:
1. The Rate Impact Measure test for a gas utility, benefits include the value of the avoided costs of natural gas.
2. For the Rate Impact Measure Test, the costs includes just the total Utility Costs plus the calculation of lost retail revenues.