

# Program Status Report per CGS 16-243v(k)(6)



GDS Associates, Inc.  
ENGINEERS & CONSULTANTS



January, 2016

# MANDATE

This report is submitted in accordance with Connecticut General Statutes (CGS) Title 16, Section 16-243v(k)(6), as amended, which requires:

“On or before January 1, 2016 and on or before January 1, 2018, the Department of Energy and Environmental Protection and the Energy Conservation Management Board shall engage an independent third party to evaluate and submit a report, in accordance with section 11-4a, to the joint standing committees of the General Assembly having cognizance of matters relating to energy and finance, revenue and bonding on the status of the program. Such report shall also include an evaluation of the [Residential Furnace and Boiler Replacement] program developed pursuant to section 16a-40m [the Residential Clean Energy On-Bill Repayment Program]. The report shall include, but not be limited to, for each program, a review of (A) cost effectiveness of the program, (B) number of customers served and potential for growth, (C) the customer classes served, and (D) the fuel type of the financed equipment.”

NOTE:

GDS prepared this report on behalf of the Connecticut Department of Energy and Environmental Protection and the Connecticut Energy Conservation Management Board [Energy Efficiency Board] in fulfillment of their responsibilities pursuant to CGS 16-243v(k)(6). The statute required DEEP and the Energy Efficiency Board (EEB) to engage an independent third party to evaluate and prepare a report on the status of implementation of the Residential Furnace and Boiler Replacement Program and the Clean Energy On-Bill Repayment program. Please note that neither of these programs are administered as part of the Connecticut Energy Efficiency Fund's Conservation and Load Management Plan [CGS 16-245m]. Therefore the EEB has had limited involvement in the production or approval of the report.



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# SCOPE OF WORK

In accordance with CGS 16-243v(k)6 requirements, GDS Associates, Inc. was engaged as an independent third party to evaluate and prepare this report based on the following scope of work:

## **Residential Furnace & Boiler Replacement Program**

- ❑ This program has been in existence since January 1, 2014, and was evaluated to assess results in the following areas:
  - Cost Effectiveness of Program
  - Number of Applications (1/1/14 to 11/17/15)
  - Potential for Program Growth
  - Customer Classes Served
  - Fuel Type of Financed Equipment
  - CO<sub>2</sub> Emissions

## **Connecticut Green Bank On-Bill Repayment (OBR) Program**

- ❑ There are no results to summarize in this report regarding the Connecticut Green Bank's OBR program, as formal implementation is not anticipated until Quarter 1 of 2016.
- ❑ In place of results and analysis, this report summarizes on page 28 the timeline of the OBR program development process.



# RESIDENTIAL FURNACE & BOILER REPLACEMENT PROGRAM

- The Residential Furnace & Boiler Replacement Program began at the start of the 2014 calendar year.
- This program is available to all residential electric, gas or heating fuel customers of Connecticut’s Eversource or United Illuminating utility companies, regardless of heating source, who would like to replace heating furnace or boiler equipment. The equipment being replaced must be the primary heating equipment for space and hot water needs and meet or exceed federal ENERGY STAR® standards.
- To be eligible, customers must be the homeowner and have six consecutive months of timely utility payments and no more than two late payments in the past twelve months. Additionally, customers will not be eligible if they have any overdue balances to any electric distribution company (EDC) or gas company.
- Financed projects may receive up to \$15,000 and must have a loan term of the lesser of simple payback of the replacement funds plus two years OR ten years. The customer is required to contribute a minimum down payment of 10 percent.
- During the course of this evaluation, customer loans were at both 2.99% and 0% (with a majority of the volume at 0%). The average cost per loan over this term was approximately \$1,100/loan. Of this \$1,100 per loan the cost allocation is as follows: loan origination and servicing was approximately \$1,000/loan (92%); program administration and marketing was approximately \$63/loan (6%) and loan defaults was approximately \$20/ loan (2%). Note: Since November 1, 2015 the interest rate being charged to customers is 2.99% which will offset the loan origination and servicing costs of \$1,000/loan. The program administration and loan default costs are recovered from Connecticut’s electric ratepayers through the System Benefits Charge.
- The table below shows actual and budgeted loan amounts from program start through 2016. It is important to note that interest rates for loans started at 2.99% and were reduced to 0% beginning October, 2014. This rate returned to 2.99% effective November 1, 2015. Also, please note, future participation may not meet the 2016 estimates given recent fuel price reductions being experienced nationwide and the program’s increased interest rates (back to 2.99%) for furnace and boiler replacement loans. However the use of the 2.99% interest rate will better allow the alignment of current financing offerings in Connecticut, addressing some of the concerns aired by the Connecticut Green Bank – that a 0% rate subsidized by electric ratepayers may negatively affect uptake of private market participation in lending for energy upgrades, and concerns raised by the Energy Efficiency Board consultants -- that the use of a 0% interest rate could negatively affect the alignment of financing offerings in Connecticut.

	Eversource		United Illuminating		Total	
	# of Loans	Loan Amount	# of Loans	Loan Amount	# of Loans	Loan Amount
<b>2014 Actual</b>	403	\$3,131,928	187	\$1,460,480	590	\$4,592,408
<b>2015 10 mo Actual</b>	1,693	\$13,896,917	638	\$5,043,500	2,331	\$18,940,417
<b>2016 Budget Estimates</b>	1,500	\$12,346,500	425	\$3,500,000	1,925	\$15,846,500

Source: Raw data from dashboard for period 1/1/2014 through 11/17/2015 and EDC budget estimates for 2016

The above costs do not reflect the \$1,100 per loan as per Bullet 5 above.



# RESULTS SUMMARY - RESIDENTIAL FURNACE & BOILER REPLACEMENT PROGRAM

## □ Cost Effectiveness of Program\* (values equal to or greater than 1.0 ensure that savings equal or exceed costs)

- Total program cost effectiveness from program start through November 17, 2015 from participants' perspective only (excluding customer co-pays, rebates, etc.) is 1.44.
  - When broken down by improvement type, furnaces and boilers are the most cost effective (1.46 and 1.45), followed by air-to-air heat pumps (1.41), ductless heat pumps (1.40), and ground source heat pumps (1.34).
  - When broken down by fuel type, gas is the most cost effective fuel (1.47), followed by propane (1.46), oil (1.41), and electric (1.40).
- Total program cost effectiveness from program start through November 17, 2015 from a modified utility test benefit/cost perspective is 9.1.
  - When broken down by improvement type, ground source heat pumps (13.6) and ductless heat pumps (11.3) have the highest ratios, followed by furnaces (9.0), boilers (8.8), and air-to-air heat pumps (7.4).
  - When broken down by fuel type, gas (11.8) and electric (10.2) have the highest ratios, followed by propane (4.2) and oil (1.0).
- Total program cost effectiveness from program start through November 17, 2015 from a total program benefit/cost perspective is 2.64.
  - When broken down by improvement type, furnaces (2.83) and boilers (2.79) have the highest ratios, followed by air-to-air heat pumps (2.23), and ductless heat pumps (2.08).
  - When broken down by fuel type, gas (2.89) and propane (2.62) have the highest ratios, followed by oil (2.59) and electric (1.95).

## □ Number of Customers (1/1/14 to 11/17/15)

- Of the 8,003 customer application records within the program, 3,145 (39%) have already been funded over this nearly 2 full year study period, with 21% others approved or preapproved, 24% declined, 12% withdrawn, and 4% under review.
- Of the 2,921 funded projects where data is available for analysis, the majority (57%) are boiler improvements, followed by 26% furnace upgrades. The remaining 17% of funded projects are for a mix of ductless heat pumps, air-to-air heat pumps and ground source heat pumps.
- A majority of these funded projects are using gas as their fuel (59%), oil and electric come next at 19% and 17% respectively, and propane has the lowest distribution as fuel of funded projects at 5%.

## □ Potential for Program Growth

- Equipment-based potential: Of the total 1,394,888 combined Eversource and United Illuminating residential electric customers, an estimated remaining potential for additional participation in the Residential Furnace & Boiler Loan Program could range between 13,500 to 28,000 over the next five years (1.0% to 2.5% of the State's total eligible residential households population), this equates to 2,700 and 5,600 systems per year. These estimates are based solely on replacing aging (over 10 years old) systems, not on retrofitting newer units.
- Connecticut's ability to finance furnace and boiler replacements through this program is limited by ratepayer dollars available to capitalize loans, and also by customer interest in pursuing furnace and boiler replacement projects - which could be impacted by the price of existing home heating fuels and the interest rate associated with the program's equipment loans.
- Based off this estimated program potential for growth, annual contributions from electric ratepayers will be fully offset between the years 2022 and 2023 for all three projected low, mid and high loans-issued scenarios.

## □ Customer Classes Served

- 21% of the customers served through this program have annual household incomes at or below 60% of the State's median income (35% are at or below 80% of State median income)
- A majority of the residential customers served through this program fall within two annual household income ranges: \$25,000 to \$74,999 (37% of customers served) and \$75,000 to \$150,000 (38%).
- Within all of the income ranges served, Boilers are consistently the most common improvement type followed by Furnaces.
- Within all of the income ranges served, gas is consistently the most common fuel for the replaced equipment.
- For customers participating in the program with household incomes ranging from \$0 to \$249,999, oil is the second most common fuel for replaced equipment. Among customers with annual household incomes at or above \$250,000 the second most common equipment fuel type is electric (heat pumps).

## □ Fuel Type of Financed Equipment

- The boilers and furnaces funded through this program are most commonly fueled by gas. The air-to-air, ductless and ground source heat pumps all are commonly fueled by electricity.
- When funded furnace and boiler replacements require switching from one fuel to another, most of such fuel switches are with new boilers changing from oil to gas. The next most common is a switch from oil to electric heat pump for new air-to-air, ductless or ground source heat pump systems.

## □ CO<sub>2</sub> Emissions

- A projected total of 4,177 metric tons of CO<sub>2</sub> savings will be realized annually through projects already funded.
- The large number of funded improvements that are fueled by gas have resulted in the greatest total amount of annual CO<sub>2</sub> reductions (over 2,500 metric tons reduced per year), followed by electricity-fueled improvements (approximately 1,200 metric tons) and mainly driven by oil-to-gas and oil-to-electric heat pump conversions.
- The lesser number of improvements where the base and new equipment remain fueled by oil, have resulted in the least amount of CO<sub>2</sub> savings when viewed across the total number of program-funded improvements.

\* These benefit-cost results are presented for informational purposes only and should not be used to assess overall program success or failure. Additional research is needed to determine appropriate baseline conditions and/or quantify the impact of customer incentives that were received outside of this program.



# METHODOLOGY - RESIDENTIAL FURNACE & BOILER REPLACEMENT PROGRAM RESULTS STUDY

- Loan data from program start (January 1, 2014) to a cut-off date of November 17, 2015 were used to evaluate all projects in this study.
- All data were reviewed to identify only those projects with complete data sets for use in the study's remaining analyses – see Appendix A for the data review and cleaning process.
- Evaluation of cleaned data set proceeded to assess results in the following six study areas:
  - **Cost Effectiveness of Program\***
    - Total projected direct cost savings of eligible customers was divided by the total cost of replacement funds over term of loan to determine total program cost effectiveness from the loan portion of each participants' perspective (excluding customer co-pays, rebates, etc.).
    - Cost effectiveness was then calculated by improvement type (furnaces, boilers, heat pumps, etc.) and fuel type (gas, oil electricity, propane).
    - Finally, cost effectiveness was calculated using data sorted by type of fuel before and after equipment upgrade to determine the most cost effective group of program-funded fuel switch projects.
    - A modified utility cost test was used to assess cost effectiveness from a utility perspective (where avoided cost savings benefits were divided by the utilities' \$1,100 admin cost per loan).
    - An additional total program cost perspective test was used which added the \$1,100 admin cost per loan and upfront customer contribution to the total amount financed for the cost portion of the ratio. Customer savings over the measure life was also included (vs. the loan term)
  - **Number of Customers**
    - In addition to categorizing all 8,003 customer applications during the study period, all customers were separately sorted by loan rate, improvement type, fuel type, application status, loan term, and fuel switch to summarize program results by these other important reporting categories.
    - A map was then generated to show distribution across the state of all funded projects in the cleaned data set.
  - **Potential for Program Growth**
    - Potential for program growth was determined by starting with the State's total residential household counts and narrowing this population down to the number of residential customers eligible as program participants.
    - Two equipment-based remaining potential scenarios were then run, both of which started with eligible population. The 1<sup>st</sup> made adjustments, based on a recent study that included phone surveys with residential customers to estimate actual age of current systems and recognize customer behavior for replacing old equipment. The 2<sup>nd</sup> scenario used results from a CT-based residential weatherization study to estimate the percentage of furnace and boiler replacements each year occurring both within and outside of the Loan Program.
    - From this program potential for growth analysis, the number of annual loans was projected for low, mid, and high participation.
    - Loan amounts issued and the resulting loan repayments over time were compared for the three scenarios of low, mid, and high projected participation over the next ten years to find the points at which annual loan repayment amounts fully offset the annual outflow of new loans issued.
  - **Customer Classes Served**
    - All customers in the cleaned data set were sorted into six annual household income ranges and further broken down by the type of improvement financed, fuel type of financed equipment, and type of fuel switch. All income ranges were based solely on self-reported values.
    - Analysis was also conducted to show participation by customers with household incomes at or below 60% and 80% of State Median Income.
  - **Improvement Type by Fuel Type**
    - Data were sorted by financed improvement type and fuel type to identify the types of fuels predominantly used for new systems installed.
    - Data were also sorted by type of fuel switch from the base system to the new system to determine which improvement types were most commonly associated with the various fuel switch combinations.
  - **CO<sub>2</sub> Emissions**
    - CO<sub>2</sub> estimates were calculated from million British thermal units (MMBtu) savings per customer converted to metric tons using a factor specific to the fuel type. Results were presented in total, by fuel type, improvement type and by fuel switch combination.

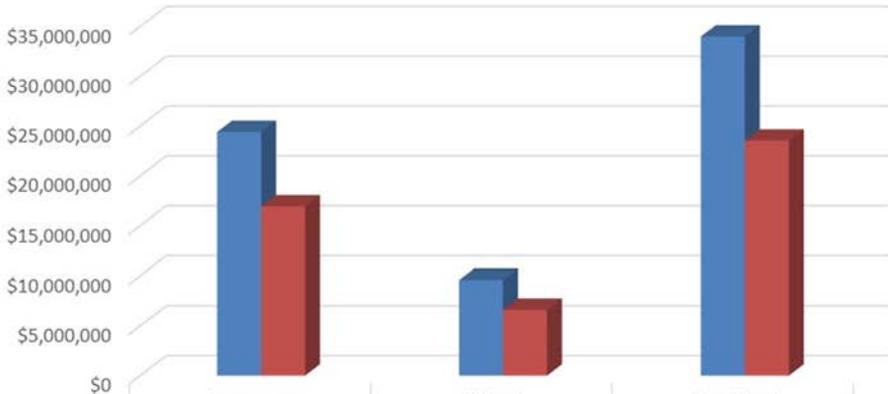
\* Benefit-cost results are presented for informational purposes only and should not be used to assess overall program success or failure. Additional research is needed to determine appropriate baseline conditions and/or quantify the impact of customer incentives that were received outside of this program.



# COST EFFECTIVENESS OF PROGRAM – PARTICIPANT PERSPECTIVE\*

- As seen in the chart to the right, for the 2,921 total funded projects assessed, the overall program cost effectiveness is 1.44 (1.44 for Eversource, 1.45 for UD).
- Over \$23.5 million will have been paid by funded participants over their loan periods resulting in nearly \$34 million in projected direct cost savings benefits (based on the cost of existing and replacement fuels at the time each loan was approved).
- See Appendix B for detailed tables on this study’s cost effectiveness analysis effort.

Cost Effectiveness by Utility - Participant Perspective



Total Number of Funded Applications (n)	2,096	825	2,921
Total Projected Direct Cost Savings	\$24,402,153	\$9,581,078	\$33,983,231
Total Cost	\$16,929,762	\$6,603,063	\$23,532,825
Average Program Cost Effectiveness	1.44	1.45	1.44

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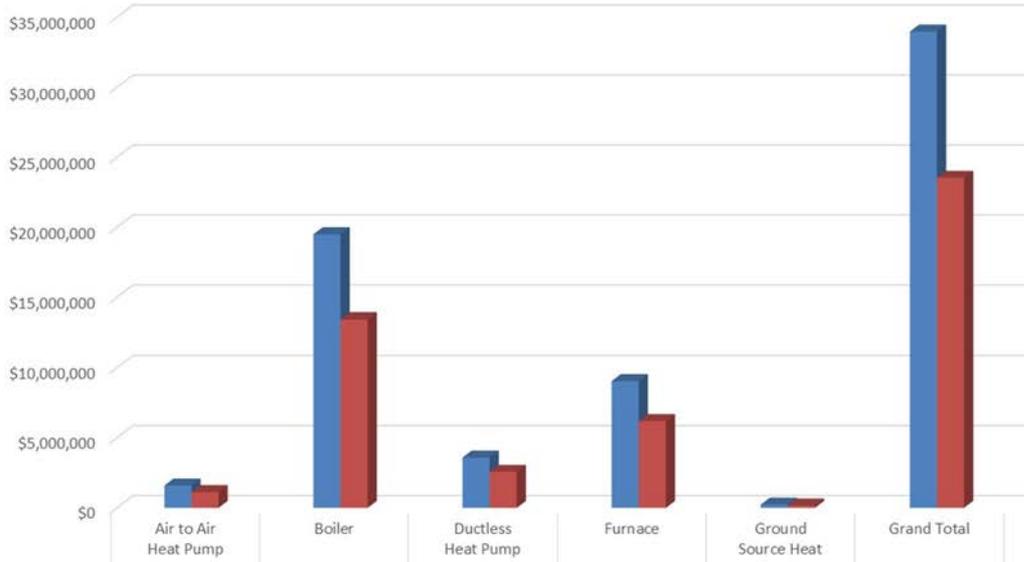


# COST EFFECTIVENESS OF PROGRAM\* - BY IMPROVEMENT TYPE (PARTICIPANT & UTILITY PERSPECTIVES)

- From a participant’s perspective only, the cost effectiveness ratio calculates to 1.44 across all improvement types.
  - Furnaces and boilers are the most cost effective improvement types funded (1.46 and 1.45 respectively).
  - Boilers are the most frequent improvement type funded (1,666) followed by furnaces (772).
- From a modified utility test benefit/cost perspective, the ratio calculates to 9.1 across all improvement types (based on an estimated utility cost per loan of approximately \$1,100).\*\*
  - Ground source heat pumps (13.6) and ductless heat pumps (11.3) have the highest ratios, followed by furnaces (9.0), boilers (8.8), and air-to-air heat pumps (7.4).

\*\* Going forward the benefit/cost ratio will be higher because customers will be picking up most of the cost due to the interest rate change to 2.99%. However, the utilities maintain control over the level of the interest rate so it is possible that the interest rate could be adjusted downward again, negatively affecting the benefit/cost ratio.

Cost Effectiveness by Improvement Type - Participant Perspective



Total Number of Funded Applications (n)	139	1,666	322	772	22	2,921
Total Projected Direct Cost Savings	\$1,594,717	\$19,502,082	\$3,596,256	\$9,058,610	\$231,566	\$33,983,231
Total Cost	\$1,127,628	\$13,449,806	\$2,576,693	\$6,205,760	\$172,938	\$23,532,825
Average Program Cost Effectiveness	1.41	1.45	1.40	1.46	1.34	1.44

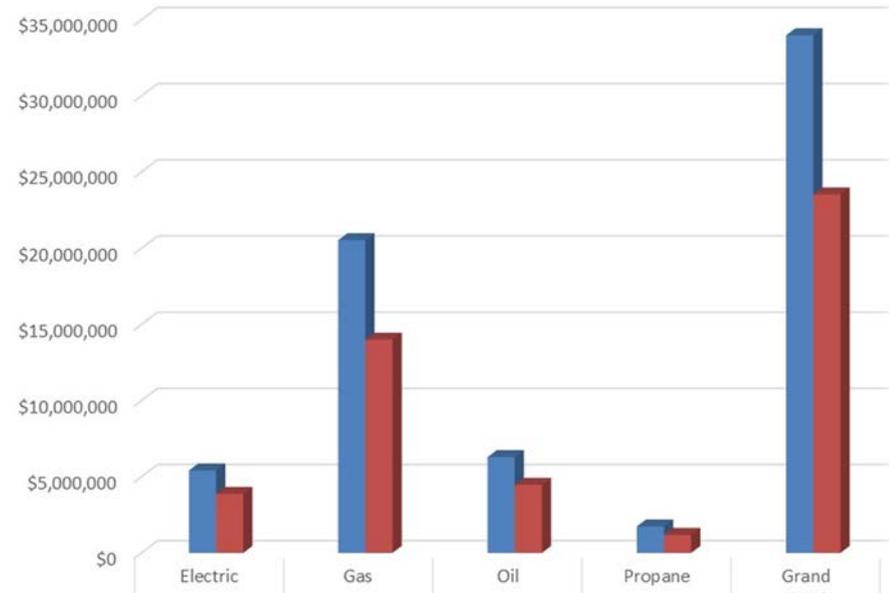
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# COST EFFECTIVENESS OF PROGRAM\* – BY FUEL TYPE (PARTICIPANT & UTILITY PERSPECTIVES)

- From a participant’s perspective only, the cost effectiveness ratio calculates to 1.44 across all fuel types.
  - Of the 2,921 funded projects having complete data available for analysis, improvements fueled by gas are by far the most common (n=1,738), and also the most cost effective at 1.47.
  - Funded projects fueled by propane are the second most cost effective at 1.46, though only 5% of projects use this fuel.
  - Oil- and electric-fueled projects have cost effectiveness ratios slightly lower at 1.41 and 1.40 respectively.
- From a modified utility test benefit/cost perspective, the ratio calculates to 9.1 across all fuel types (based on an estimated utility cost per loan of approximately \$1,100).
  - Gas (11.8) and electric (10.2) have the highest ratios.

Cost Effectiveness by Fuel Type - Participant Perspective



Total Number of Funded Applications (n)	482	1,738	555	146	2,921
Total Projected Direct Cost Savings	\$5,417,719	\$20,535,523	\$6,292,385	\$1,737,604	\$33,983,231
Total Cost	\$3,872,439	\$14,000,113	\$4,474,166	\$1,186,107	\$23,532,825
Average Program Cost Effectiveness	1.40	1.47	1.41	1.46	1.44

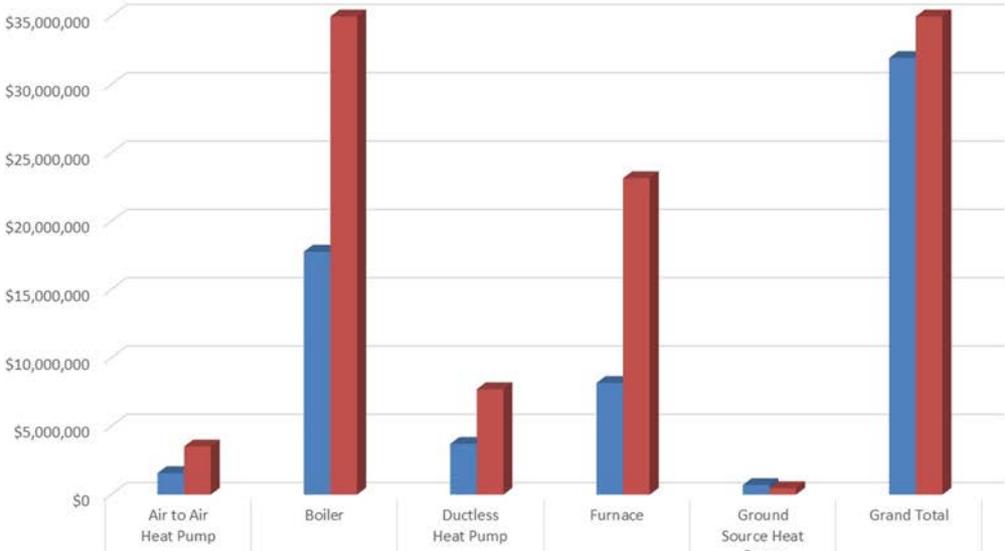
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# COST EFFECTIVENESS OF PROGRAM\* - BY IMPROVEMENT TYPE (TOTAL PROGRAM COST PERSPECTIVE)

- This total program benefit cost ratio differs from the participant cost effectiveness analysis in that the cost portion of the ratio is not only the total amount financed by the program, but adds in the upfront customer contribution and the \$1,100 that it costs the program per loan. The benefits side includes savings over the life of the measure (vs. life of the loan)
- From a total program cost perspective, the cost effectiveness ratio calculates to 2.64 across all improvement types.
  - Furnaces and boilers are the most cost effective, at 2.83 and 2.79 respectively.

Cost Effectiveness by Improvement Type - Total Program Cost Perspective



	Air to Air Heat Pump	Boiler	Ductless Heat Pump	Furnace	Ground Source Heat Pump	Grand Total
Total Number of Funded Applications (n)	139	1,666	322	772	22	2,921
Total Cost	\$1,578,357	\$17,787,945	\$3,718,009	\$8,175,574	\$703,975	\$31,963,859
Total Savings	\$3,527,515	\$49,554,708	\$7,717,883	\$23,165,844	\$472,213	\$84,438,163
Program Cost Effectiveness	2.23	2.79	2.08	2.83	0.67	2.64



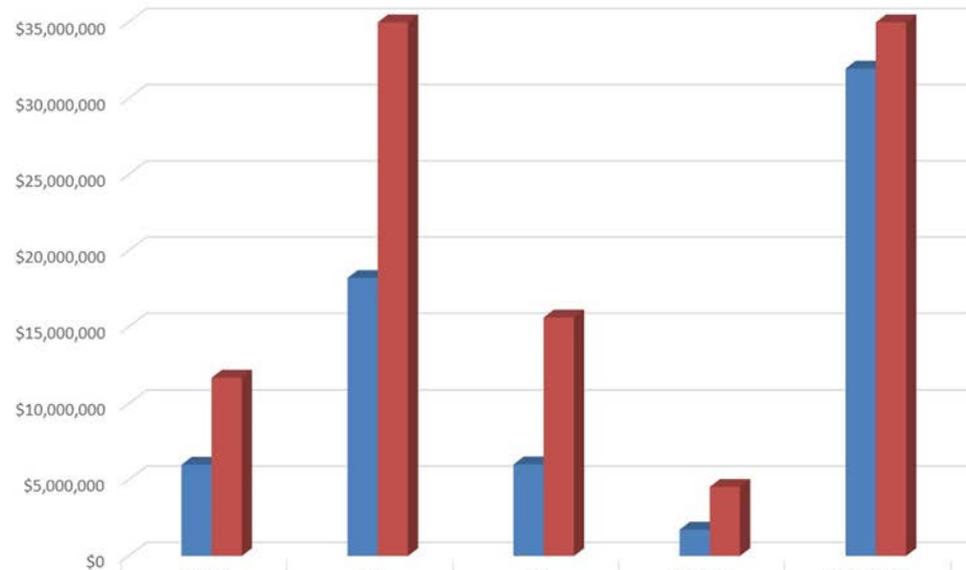
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# COST EFFECTIVENESS OF PROGRAM\* - BY FUEL TYPE (TOTAL PROGRAM COST PERSPECTIVE)

- This total program benefit cost ratio differs from the participant cost effectiveness analysis in that the cost portion of the ratio is not only the total amount financed by the program, but adds in the upfront customer contribution and the \$1,100 that it costs the program per loan. The benefits side includes savings over the life of the measure (vs. life of the loan)
- From a total program cost perspective, the cost effectiveness ratio calculates to 2.64 across all fuel types.
  - Gas-fuel funded projects are the most cost effective at 2.89, with propane next at 2.62.

Cost Effectiveness by Fuel Type - Total Program Cost Perspective



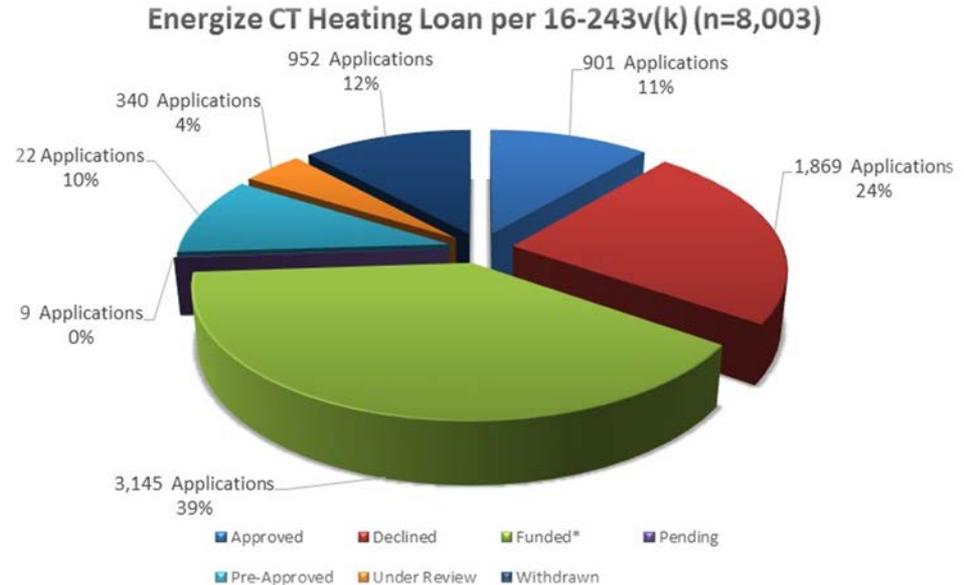
	Electric	Gas	Oil	Propane	Grand Total
Total Number of Funded Applications (n)	482	1,738	555	146	2,921
Total Cost	\$5,993,985	\$18,216,583	\$6,019,378	\$1,733,913	\$31,963,859
Total Savings	\$11,708,934	\$52,572,996	\$15,617,516	\$4,538,717	\$84,438,163
Program Cost Effectiveness	1.95	2.89	2.59	2.62	2.64

\* These benefit-cost results are presented for informational purposes only and should not be used to assess overall program success or failure. Additional research is needed to determine appropriate baseline conditions and/or quantify the impact of customer incentives that were received outside of this program.



# NUMBER OF CUSTOMERS

- ❑ The chart to the right shows the breakdown of all loan applications received between January 1, 2014 and November 17, 2015 and their associated status.
- ❑ Of the 8,003 total applications, 39% have already been funded (3,145 in total - including 2,921 having complete data available for analyses conducted in this study).
- ❑ Another 21% have been either approved or pre-approved, and 4% were still under review as of November 17, 2015.
- ❑ The remaining 36% of applications have been declined or withdrawn.
- ❑ See Appendix C for detailed tables associated with this study's Number of Customers analyses.

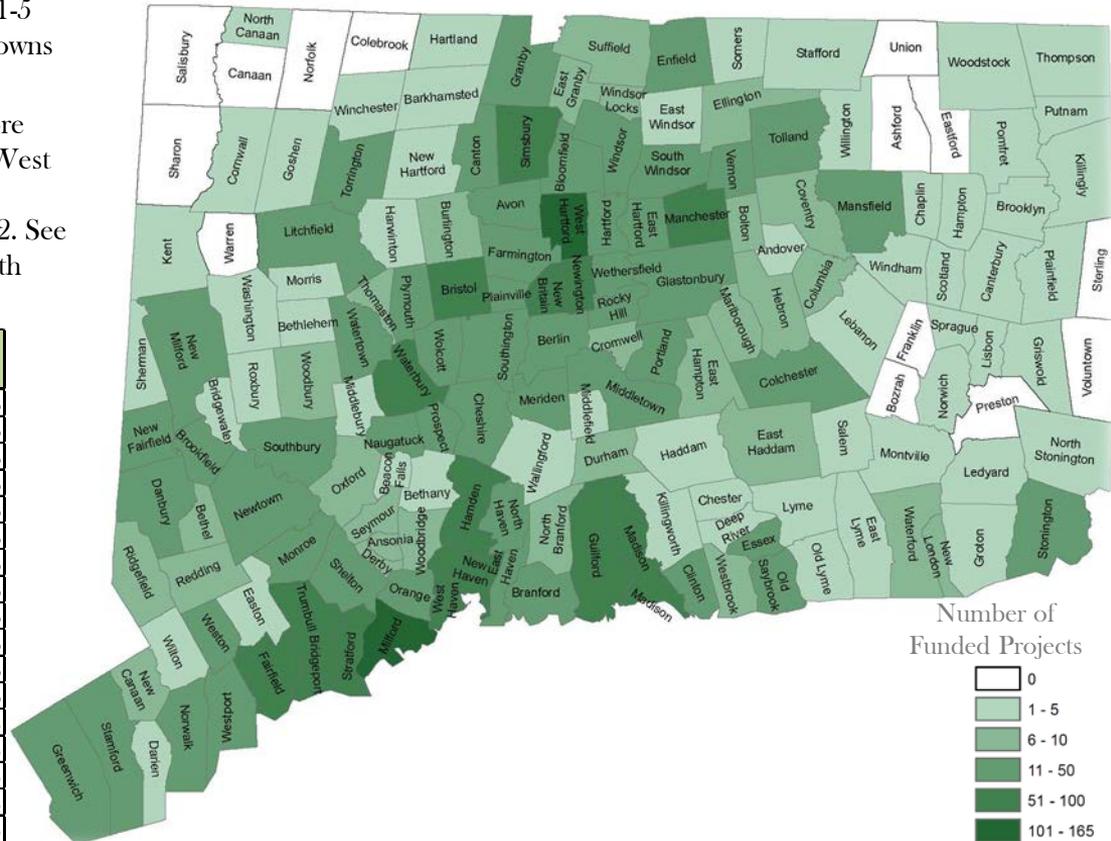


# NUMBER OF CUSTOMERS – GEOGRAPHIC DISTRIBUTION

- 155 towns in the clean data set have at least one funded project, including 57 towns with only 1-5 funded projects, 29 towns with 6-10, and 52 towns having 11-50 funded projects.
- As seen in the table below, 17 towns have more than 50 funded projects. Of these 17 towns, West Hartford has the most projects with 165 and Milford has the second most projects with 112. See Appendix C for tables containing all towns with funded projects.

Town	# of Funded Projects	% of Funded Projects
West Hartford	165	5.65%
Milford	112	3.83%
Hamden	95	3.25%
New Haven	94	3.22%
Fairfield	92	3.15%
Bridgeport	85	2.91%
Stratford	85	2.91%
West Haven	69	2.36%
Manchester	66	2.26%
Bristol	62	2.12%
Trumbull	62	2.12%
Waterbury	62	2.12%
Madison	60	2.05%
Guilford	57	1.95%
Newington	57	1.95%
New Britain	51	1.75%
Simsbury	51	1.75%

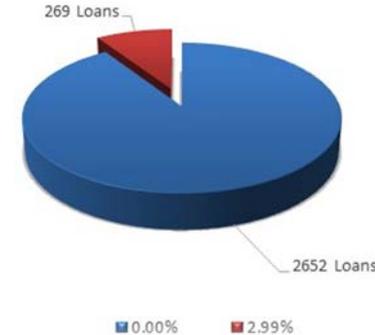
## Number of Funded Projects by Town (n=2,921)



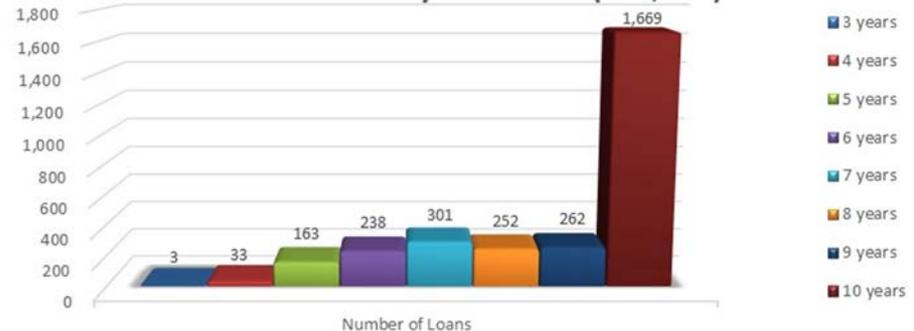
# NUMBER OF CUSTOMERS – BY INTEREST RATE AND LOAN TERM

- ❑ The interest rate for loans offered through this program first began at 2.99%. The rate was reduced to 0.00% starting in October, 2014 but was returned to 2.99% effective November 1, 2015.
- ❑ The top chart on the right shows a breakdown of funded projects with 0.00% loan rates and 2.99% loan rates. The majority (91%) of loans are at 0.00% and 9% are at a rate of 2.99%.
- ❑ The bottom chart on the right shows a distribution of funded projects by loan term length. The majority of loans have a term length of 10 years (57%), with 36% of funded projects having loan terms of 6 to 9 years.

Funded Loans by Interest Rate (n=2,921)



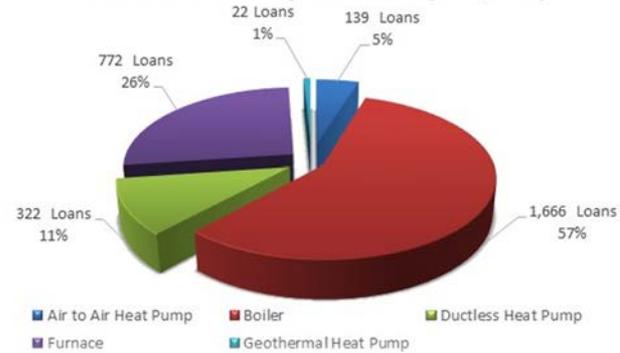
Number of Loans by Loan Term (n=2,921)



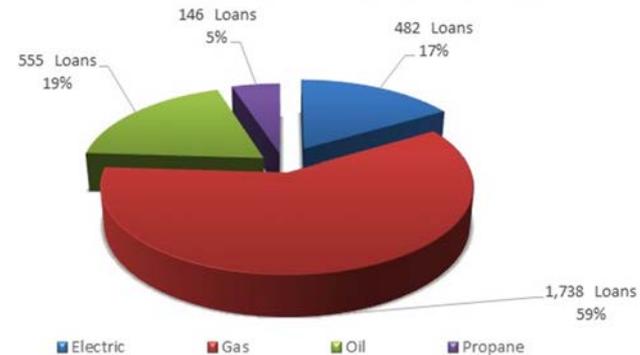
# NUMBER OF CUSTOMERS – BY IMPROVEMENT TYPE AND FUEL TYPE

- As seen to the right in the top pie chart of funded projects by improvement type, a majority of improvements (57%) are boiler upgrades, with the next most common upgrade being furnace replacements (26%).
- The bottom chart shows a majority of the funded projects use gas as their fuel (59%). Oil and electric come next with 19% and 17% respectively, with funded projects fueled by propane having the lowest percentage (5%).

Funded Loans by Measure (n=2,921)



Funded Loans by Fuel Type (n=2,921)



# POTENTIAL FOR PROGRAM GROWTH \*

As shown in the scenarios to the right, of the total 1,394,888 combined Eversource and United Illuminating residential electric customers, an estimated remaining potential for additional participation in the Residential Furnace & Boiler Loan Program could range from between 13,500 to 28,000 over the next five years (1.0% to 2.5% of eligible residential household population) – this equates to 2,700 and 5,600 systems per year.

LIKELY OBTAINABLE POTENTIAL - SCENARIO 1	
Total Eversource Residential Customers	1,111,467
Total UI Residential Customers	283,421
Total Combined Eversource/UI Residential Customers	1,394,888
Estimated # of Owner-Occupied Households	1,255,399
<b>Total in Data Set</b>	<b>8,003</b>
Funded	3,145
Approved/Pre-Approved	1,688
Pending/Under Review	349
Declined/Withdrawn	2,821
Remaining Non-Participating Residential Customers	1,250,217
Achievable Potential based on Units > 10 Years Old	422,371
Achievable Potential of units > 10 years old that customers state they plan to replace within the next 5 years	173,917
Estimated percent of units > 10 years old that will be replaced within the next 5 years <u>outside of the loan program</u>	84%
<b>Remaining Likely Achievable Potential for Residential Furnace &amp; Boiler Loan Program</b>	<b>28,018</b>
<b>Remaining Likely Achievable Potential for Residential Furnace &amp; Boiler Loan Program - as a percent of total CT residential households</b>	<b>2.5%</b>

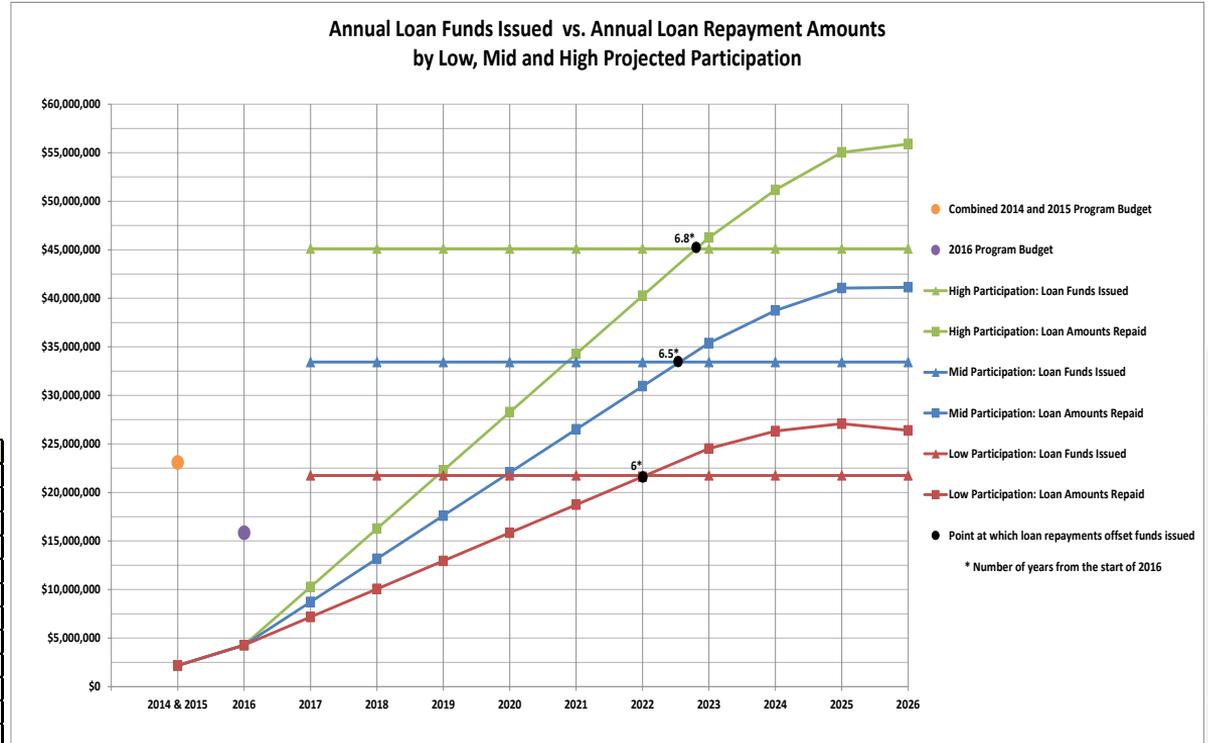
LIKELY OBTAINABLE POTENTIAL - SCENARIO 2	
Total Eversource Residential Customers	1,111,467
Total UI Residential Customers	283,421
Total Combined Eversource/UI Residential Customers	1,394,888
Percent of eligible customers	81.6%
Eligible population	1,138,461
Estimated System Replacements per Year (natural replacements)	36,725
Number of participants per month	225
Participants per year	2,698
Likely Obtainable Potential (n)	173,917
Mature program participation	2,698
Percent replaced outside of the loan program	92.65%
5 year potential	13,489
Percent of all residential households	<b>1.0%</b>

It is important to note that actual future participation will be greatly impacted by the price of fuel and the interest rate of loans at time of approval.



# POTENTIAL FOR PROGRAM GROWTH – ELECTRIC RATEPAYER IMPACT

- From the program potential for growth analysis on the previous page, the number of annual loans was projected for low, mid, and high participation (see Analysis Inputs table below).
- Using the analysis inputs from the table below, the loan funds issued and the loan amounts repaid to the program were charted for the three scenarios of low, mid, and high projected participation over the next ten years.
- In the chart on the right, it can be seen that the annual contributions from electric ratepayers (loan funds issued) will be fully offset through annual loan repayment amounts between the years 2022 and 2023 for all three of the scenario projections (less than 7 years from a start of 2016).



# CUSTOMER CLASSES SERVED

- Note: All income values are from customer self-reports and could over- or under-state actual household incomes.
- As shown in the chart to the right, a majority of the residential customers served through this program fall within two annual household income ranges: \$25,000 to \$74,999 (37% of customers served) and \$75,000 to \$149,999 (38%).
- The table below shows the number and percentage of residential customers who fall at or below the 60% and 80% median income level, broken down by utility.
- From this table it can be seen that 21% of customers served through the program are at or below 60% of the state median income level (35% are at or below 80%).
- See Appendix E for detailed tables of the Customer Classes Served analysis.

Overall Customer Classes Served



60% State Median Income	Utility		Grand Total (n)	Percentage Breakdown			80% State Median Income	Utility		Grand Total (n)	Percentage Breakdown		
	Eversource	United Illuminating		Eversource	United Illuminating	Combined		Eversource	United Illuminating		Eversource	United Illuminating	Combined
At or Below	410	208	<b>618</b>	20%	25%	<b>21%</b>	At or Below	689	323	<b>1,012</b>	33%	39%	<b>35%</b>
Above	1,686	617	<b>2,303</b>	80%	75%	<b>79%</b>	Above	1,407	502	<b>1,909</b>	67%	61%	<b>65%</b>
<b>Grand Total (n)</b>	<b>2,096</b>	<b>825</b>	<b>2,921</b>	100%	100%	<b>100%</b>	<b>Grand Total (n)</b>	<b>2,096</b>	<b>825</b>	<b>2,921</b>	100%	100%	<b>100%</b>



# CUSTOMER CLASSES SERVED – BY IMPROVEMENT TYPE

- As shown in the chart on the right, within all of the income ranges served, boilers are consistently the most common improvement type followed by furnaces.
- The tables below provide detailed breakdowns of participation rates among households at or below [or above] 60% and 80% of State Median income levels. As seen in these tables, furnaces and boilers are the most commonly funded projects at a combined 47% and 74% of the 60% and 80% of state median income levels respectively.
- The percent of participants at or below (or above) the 60% and 80% of state median income levels are noted in the columns, broken out by company.

Customer Classes Served by Improvement Type



60% State Median Income	Percent of Projects Funded - by Improvement Type														
	Air to Air Heat Pump			Boiler			Ductless Heat Pump			Furnace			Ground Source Heat Pump		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	11%	11%	11%	20%	26%	22%	13%	21%	14%	25%	25%	25%	0%	0%	0%
Above	89%	89%	89%	80%	74%	78%	87%	79%	86%	75%	75%	75%	100%	100%	100%
<b>Grand Total (n=2,921)</b>	<b>130</b>	<b>9</b>	<b>139</b>	<b>1,178</b>	<b>488</b>	<b>1,666</b>	<b>294</b>	<b>28</b>	<b>322</b>	<b>473</b>	<b>299</b>	<b>772</b>	<b>21</b>	<b>1</b>	<b>22</b>

80% State Median Income	Percent of Projects Funded - by Improvement Type														
	Air to Air Heat Pump			Boiler			Ductless Heat Pump			Furnace			Ground Source Heat Pump		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	28%	11%	27%	34%	39%	36%	24%	36%	25%	37%	40%	38%	10%	0%	9%
Above	72%	89%	73%	66%	61%	64%	76%	64%	75%	63%	60%	62%	90%	100%	91%
<b>Grand Total (n=2,921)</b>	<b>130</b>	<b>9</b>	<b>139</b>	<b>1,178</b>	<b>488</b>	<b>1,666</b>	<b>294</b>	<b>28</b>	<b>322</b>	<b>473</b>	<b>299</b>	<b>772</b>	<b>21</b>	<b>1</b>	<b>22</b>



# CUSTOMER CLASSES SERVED – BY FUEL TYPE

- As shown on the chart to the right, within all of the income ranges served, gas is consistently the most common fuel.
- For customers with household incomes ranging from \$0 to \$249,999, oil is the second most common fuel. Among customers with annual household incomes at or above \$250,000 the second most common fuel type is electric.
- The tables below provide a more detailed breakdown of project fuel types funded for customers at or below 60% and 80% of State Median income levels.

Customer Classes Served by Fuel Type



60% State Median Income	Percent of Projects Funded - by Fuel Type											
	Electric			Gas			Oil			Propane		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	12%	18%	12%	23%	25%	24%	21%	26%	21%	13%	29%	15%
Above	88%	82%	88%	77%	75%	76%	79%	74%	79%	87%	71%	85%
<b>Grand Total (n=2,921)</b>	<b>444</b>	<b>38</b>	<b>482</b>	<b>1,044</b>	<b>694</b>	<b>1,738</b>	<b>483</b>	<b>72</b>	<b>555</b>	<b>125</b>	<b>21</b>	<b>146</b>

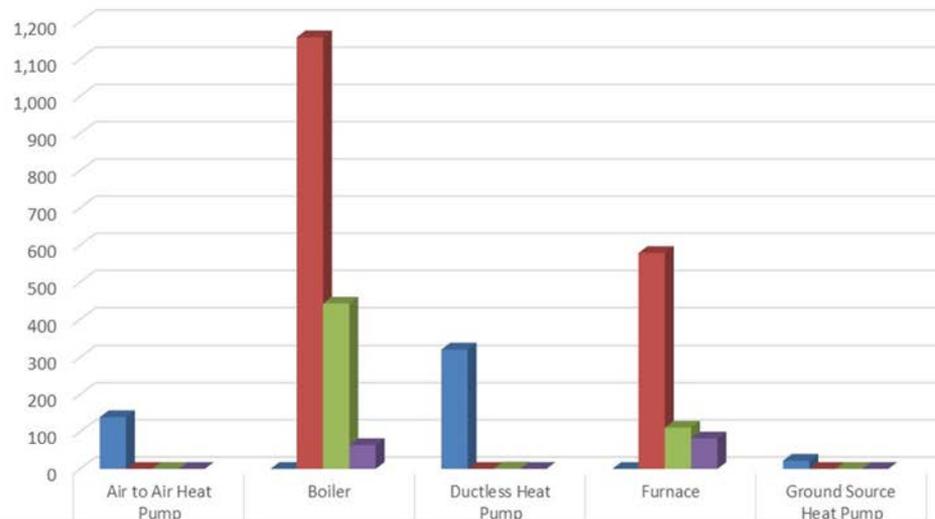
80% State Median Income	Percent of Projects Funded - by Fuel Type											
	Electric			Gas			Oil			Propane		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	25%	29%	25%	37%	39%	38%	35%	42%	36%	23%	38%	25%
Above	75%	71%	75%	63%	61%	62%	65%	58%	64%	77%	62%	75%
<b>Grand Total (n=2,921)</b>	<b>444</b>	<b>38</b>	<b>482</b>	<b>1,044</b>	<b>694</b>	<b>1,738</b>	<b>483</b>	<b>72</b>	<b>555</b>	<b>125</b>	<b>21</b>	<b>146</b>



# FUEL TYPE OF FINANCED EQUIPMENT

- As shown in this chart, boilers and furnaces funded through this program are most commonly fueled by gas. The air-to-air, ductless and ground source heat pumps all are most commonly fueled by electricity.
- When funded furnace and boiler replacements require switching from one fuel to another, most of such fuel switches are with new boilers changing from oil to gas. The next most common is a switch from oil to electric heat pump for new air-to-air, ductless or ground source heat pump systems.
- See Appendix F for detailed tables of the Fuel Type of Financed Equipment analysis.

Improvement Type Installed by Fuel Type



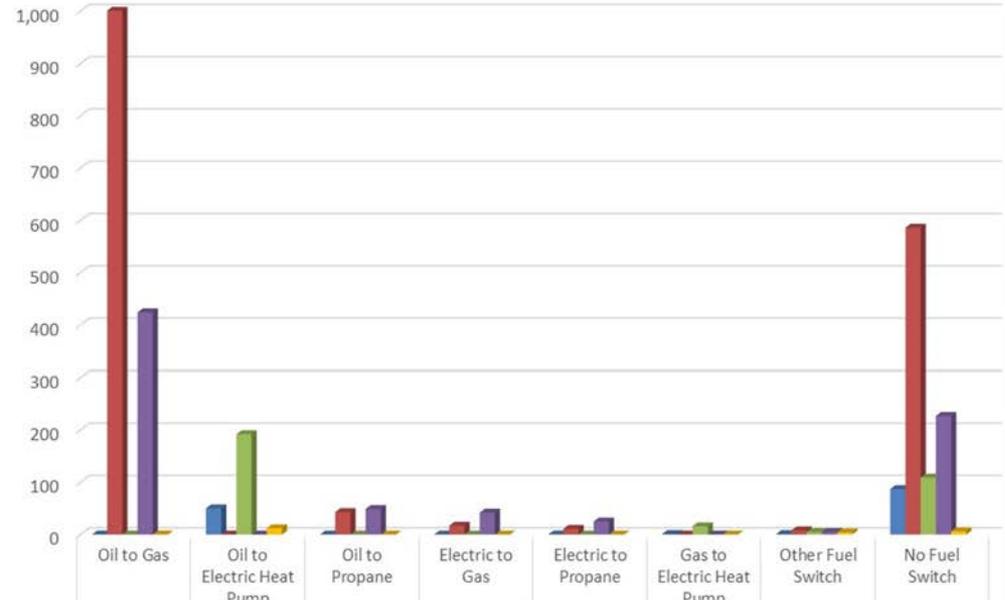
■ Electric	139	0	321	0	22
■ Gas	0	1,159	0	579	0
■ Oil	0	443	1	111	0
■ Propane	0	64	0	82	0
Total Number of Funded Projects (n=2,921)	139	1,666	322	772	22



# FUEL TYPE OF FINANCED EQUIPMENT - FUEL SWITCH

- When funded furnace and boiler replacements require switching from one fuel to another, most of such fuel switches are with new boilers changing from oil to gas.
- The next most common is a switch from oil to electric heat pump for new air-to-air, ductless or ground source heat pump systems.

Improvement Type Installed by Fuel Switch



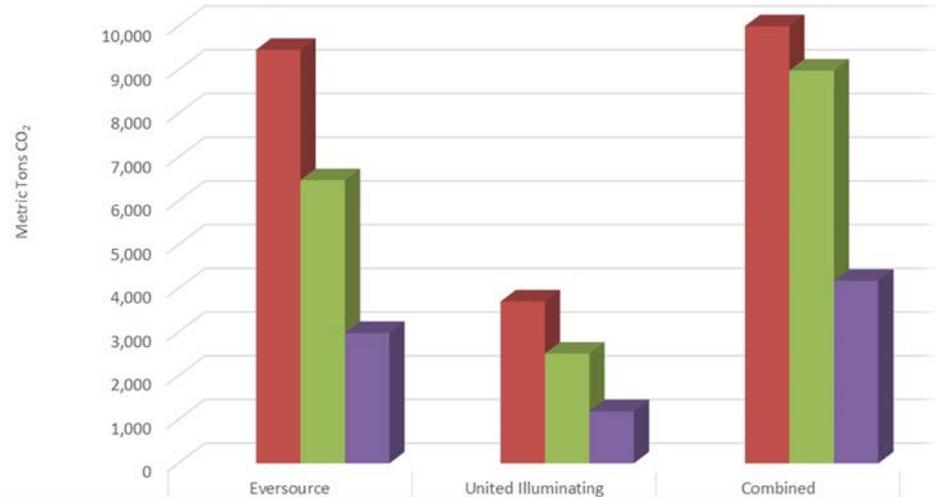
Air to Air Heat Pump	0	50	0	0	0	1	1	87
Boiler	1,001	0	43	17	11	0	8	586
Ductless Heat Pump	0	192	0	0	0	16	5	109
Furnace	424	0	49	42	25	0	5	227
Ground Source Heat Pump	0	12	0	0	0	0	4	6
Total Number of Funded Projects (n=2,921)	1,425	254	92	59	36	17	23	1,015



# CO<sub>2</sub> EMISSIONS\*

- The CO<sub>2</sub> estimates are calculated from the MMBtu savings per customer converted to metric tons of CO<sub>2</sub> using a conversion factor specific to the fuel type.
- The chart to the right shows the projected annual metric tons of CO<sub>2</sub> emitted without the improvement, after the improvement, and the difference of the two representing the total annual savings. Results are also broken down by utility.
- As can be seen from this chart, the metric tons CO<sub>2</sub> saved per utility is proportional to the number of funded applications (n) for each utility.
- See Appendix G for detailed tables of the CO<sub>2</sub> Emissions analysis.

Annual CO<sub>2</sub> Emissions by Utility



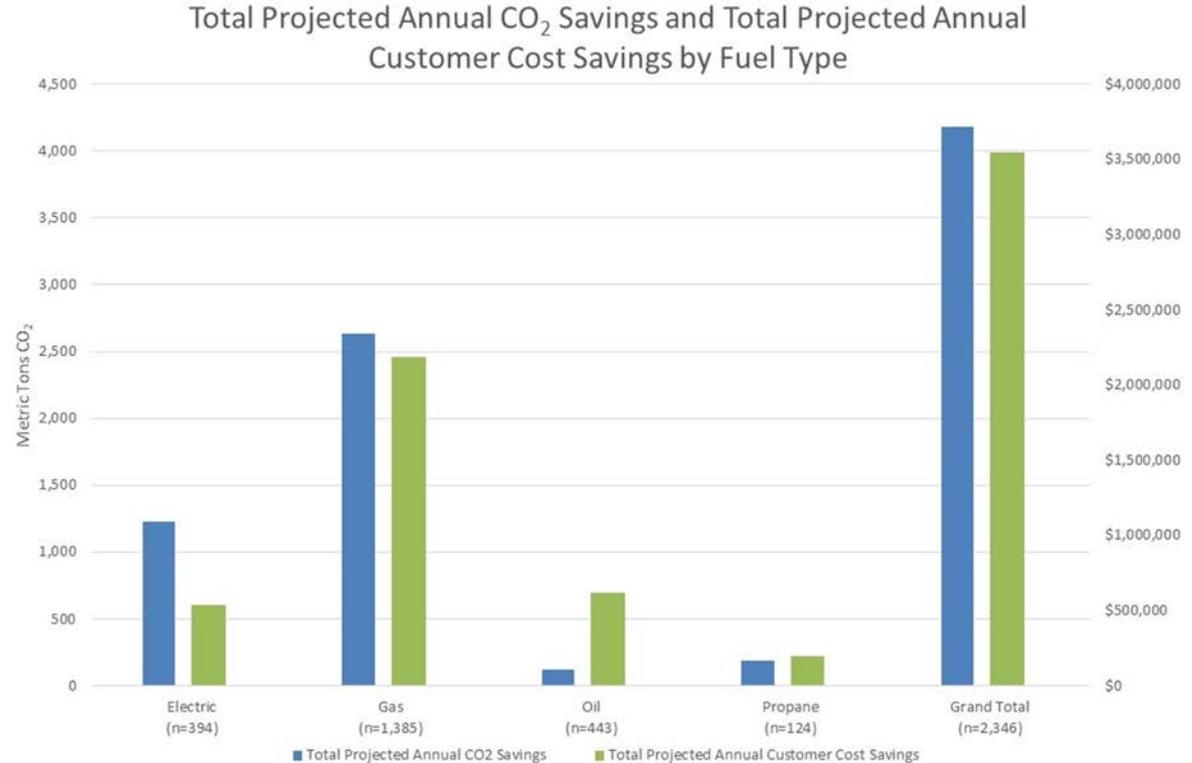
	Eversource	United Illuminating	Combined
Total Number of Funded Applications with CO2 Data Available (n)	1,699	647	2,346
Total Projected Annual CO2 Emitted without Improvement (Metric Tons)	9,462	3,703	13,165
Total Projected Annual CO2 Emitted after Improvement (Metric Tons)	6,478	2,510	8,988
Total Projected Annual CO2 Savings (Metric Tons)	2,984	1,193	4,177



\*CO<sub>2</sub> Emissions were calculated using the ISO-NE Marginal Emissions report.

# CO<sub>2</sub> EMISSIONS\* - BY FUEL TYPE

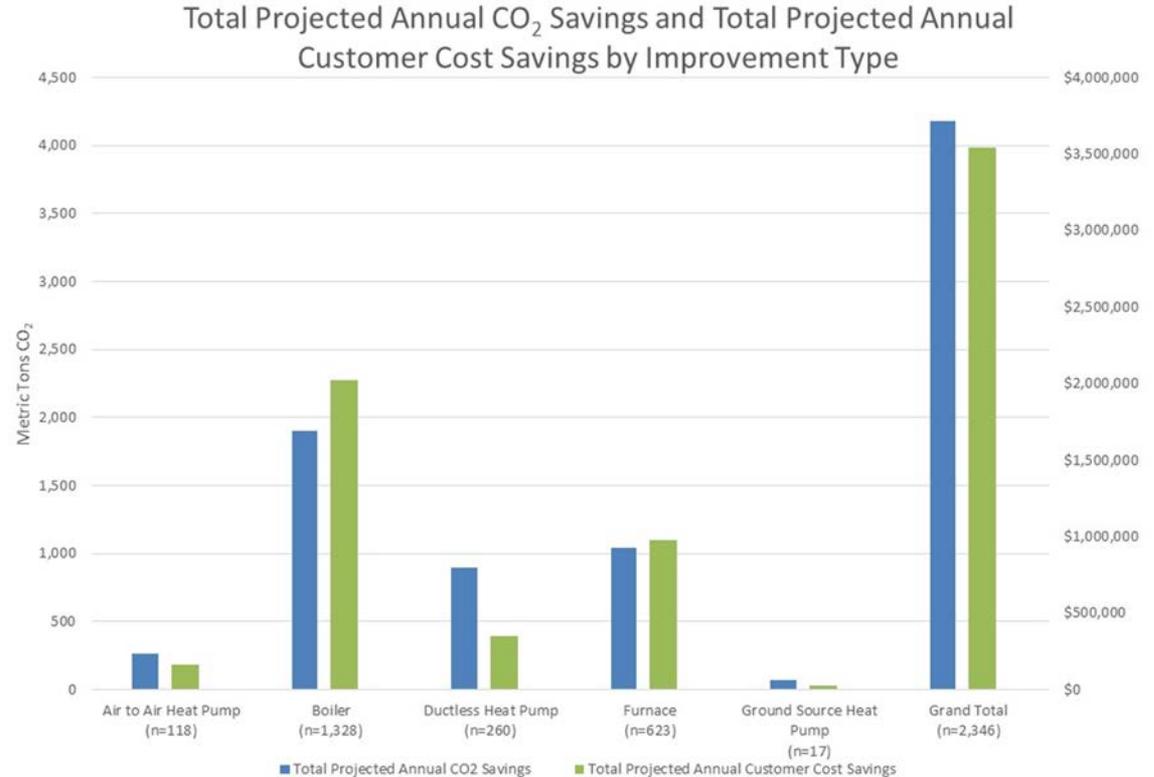
- The chart to the right shows the annual projected CO<sub>2</sub> savings compared to the annual projected customer cost savings, broken down by fuel type.
- As seen in this chart, a majority of annual CO<sub>2</sub> and cost savings comes from the large number of funded improvements that are fueled by gas.
- The lesser number of improvements, where the base and new equipment remained fueled by oil, have resulted in the least amount annual CO<sub>2</sub> savings (when viewed across the total number of program-funded improvements), while having the second highest annual projected customer cost savings.
- See Appendix G for detailed tables of the CO<sub>2</sub> Emissions analysis.



\*CO<sub>2</sub> Emissions were calculated using the ISO-NE Marginal Emissions report.

## CO<sub>2</sub> EMISSIONS\* - BY IMPROVEMENT TYPE

- ❑ The chart to the right shows the annual projected CO<sub>2</sub> savings compared and annual projected customer cost savings, broken down by improvement type.
- ❑ Boiler improvements show the greatest annual CO<sub>2</sub> and projected customer cost savings, followed by furnace replacement projects and ductless heat pumps.
- ❑ Savings from ground source heat pumps are relatively minimal due to the small number (n=17) of systems installed through the program during this study period.
- ❑ See Appendix G for detailed tables of the CO<sub>2</sub> Emissions analysis.

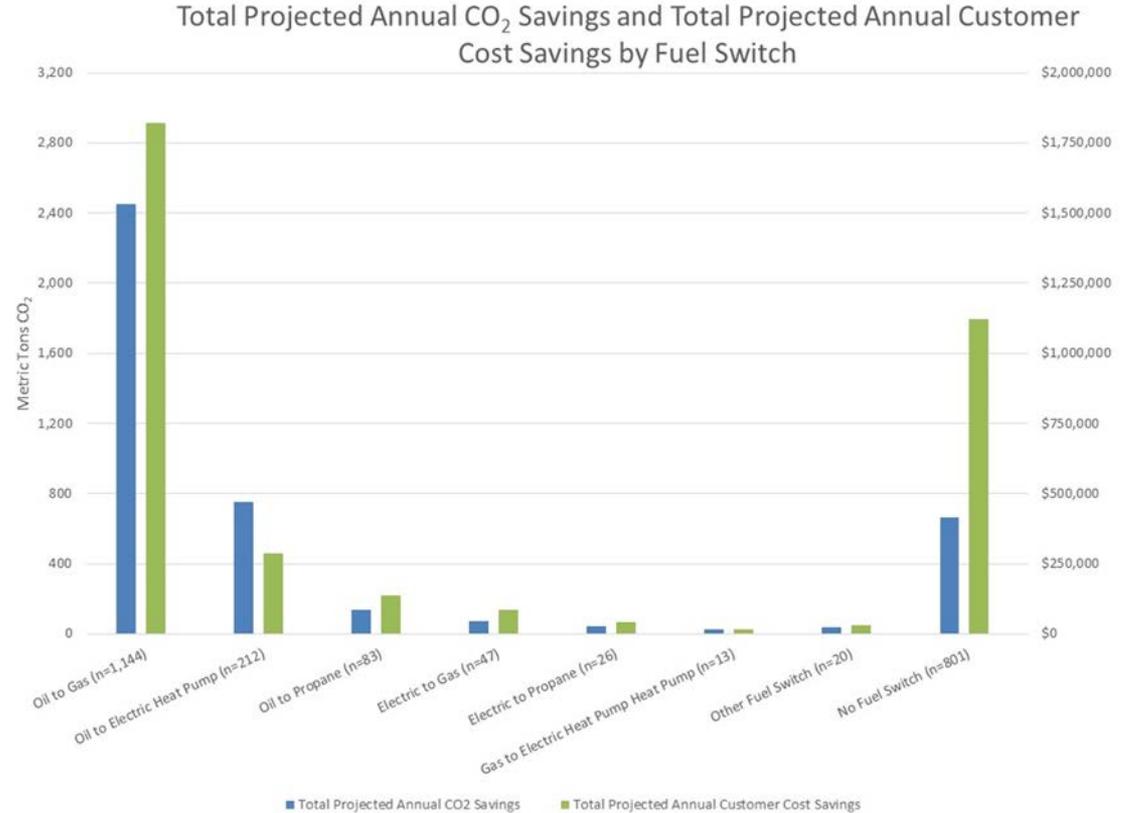


\*CO<sub>2</sub> Emissions were calculated using the ISO-NE Marginal Emissions report.



# CO<sub>2</sub> EMISSIONS\* - BY FUEL SWITCH

- The chart to the right shows the annual projected CO<sub>2</sub> savings and projected customer cost savings, broken down by fuel switch type.
- As seen in this chart, the large number of funded improvements that ultimately were fueled by gas (1,144 projects) have resulted in the greatest total amount of annual CO<sub>2</sub> reductions and customer cost savings, followed by electricity-fueled improvements (mainly driven by oil-to-gas and oil-to-electric heat pump conversions).
- See Appendix G for detailed tables of the CO<sub>2</sub> Emissions analysis.



\*CO<sub>2</sub> Emissions were calculated using the ISO-NE Marginal Emissions report.

# RESIDENTIAL CLEAN ENERGY ON-BILL REPAYMENT PROGRAM

The Connecticut Green Bank On-Bill Repayment (OBR) Program, first authorized in June of 2013, focuses on providing financing options for customers looking to install energy efficient equipment, as well as supporting the household conversion to more efficient fuels. OBR allows residential utility customers to repay loans for qualifying energy efficiency and clean energy improvements through a line item charge on their monthly utility bill.

There are no results to summarize in this report regarding the Connecticut Green Bank's OBR program, as formal implementation is not anticipated until Quarter 1 of 2016. Following is a time-line overview of the OBR development process:

## Time-Line of Connecticut Green Bank On-Bill Repayment Program Development

- ❑ June 2013 - State of Connecticut General Assembly authorized On-Bill Repayment (OBR) - Section 58 of Public Act 13-298 (Section 60a-40m)
- ❑ Over many subsequent months, the Companies and Green Bank began working to develop a written document regarding the OBR process and how it would work on each side.
  - OBR process requires IT changes and how the costs would be handled.
- ❑ April 2014 - Connecticut Energy Efficiency Board voted against using utility shut-off provision for non-payment.
- ❑ May 23, 2014 - Connecticut Green Bank and Connecticut Energy Efficiency Board submitted a joint application to the Public Utilities Regulatory Authority (PURA) for review and approval of the On-Bill Repayment Program (Docket 14-05-40).
- ❑ July 2014 - Amended Application submitted by Connecticut Green Bank and Connecticut Energy Efficiency Board.
- ❑ August 18, 2014 - PURA draft decision issued.
- ❑ August 22, 2014 - CL&P, UI, OCC and Green Bank written exceptions filed.
- ❑ August 27, 2014 - PURA Final Decision issued.
- ❑ April 2015 - Agreement between CL&P and UI and the Green Bank was signed.
- ❑ July 2015 - MOU between the Servicing Agent and Eversource was signed.
- ❑ October 2015 - MOU between Servicing Agent and UI was signed with ability to begin exchanging files in November 2015.
- ❑ Green Bank quarterly update to the Residential Committee of the Connecticut Energy Efficiency Board indicates they have begun speaking to lenders regarding OBR and expect to kick process off in Quarter 1 of 2016.



# APPENDICES

Appendix A - Data Set Development

Appendix B - Cost Effectiveness of Program

Appendix C - Number of Customers

Appendix D - Potential for Program Growth

Appendix E - Customer Classes Served

Appendix F - Fuel Type of Financed Equipment

Appendix G - CO<sub>2</sub> Emissions



# Appendix A - Data Set Development

## Data Set Review and Cleaning

**Total Records from Raw Data** **8,003**

**Records removed:**

- From **Status** Column, Removed all "Declined" 1,869
  - From **Status** Column, Removed all "Withdrawn" 952
  - From **Status** Column, Removed all "Under Review" 340
  - From **Status** Column, Removed all "Pending" 9
  - From **Status** Column, Removed all "Pre Approved" 787
  - From **Status** Column, Removed all "Approved" 901
- Total "Funded" Projects through 11/17/2015: **3,145**

No savings information present  
 As these were pre approved but not yet funded, no savings information was present  
 As these were approved but not yet funded, no savings information was present

**Additional Records removed - due to lack of data**

- From **Monthly Savings** Column, Removed all "Blanks" 224

Lack of Application Information

**Total "Funded" Records with Sufficient Data for Analysis** **2,921**

This is made up of all "funded" applications minus those lacking savings information

Total Data Set for Analysis	Electric Company		Grand Total
	Eversource	United Illuminating	
Number of Funded Projects	2,096	825	<b>2,921</b>

## Appendix B - Cost Effectiveness of Program\*

### Cost Effectiveness - Overview (Participant Perspective)

	Utility		Combined
	Eversource	United Illuminating	
Total Number of Funded Applications (n)	2,096	825	2,921
Total Projected Direct Cost Savings of all Customers	\$24,402,153	\$9,581,078	\$33,983,231
Total Cost	\$16,929,762	\$6,603,063	\$23,532,825
Average Program Cost Effectiveness	1.44	1.45	1.44

### Cost Effectiveness by Improvement Type (Participant Perspective)

Improvement Type	Cost Effectiveness													
	Total Projected Direct Cost Savings of all Customers			Total Cost			Average Program Cost Effectiveness					Percentage Breakdown (n)		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	(n)	United Illuminating	(n)	Combined	Eversource	United Illuminating	Combined (n)
Air to Air Heat Pump	\$1,470,834	\$123,883	\$1,594,717	\$1,050,488	\$77,140	\$1,127,628	1.40	130	1.61	9	1.41	6%	1%	139
Boiler	\$13,768,701	\$5,733,381	\$19,502,082	\$9,539,725	\$3,910,081	\$13,449,806	1.44	1,178	1.47	488	1.45	56%	59%	1,666
Ductless Heat Pump	\$3,263,183	\$333,073	\$3,596,256	\$2,349,646	\$227,047	\$2,576,693	1.39	294	1.47	28	1.40	14%	3%	322
Furnace	\$5,682,916	\$3,375,694	\$9,058,610	\$3,825,808	\$2,379,952	\$6,205,760	1.49	473	1.42	299	1.46	23%	36%	772
Ground Source Heat Pump	\$216,519	\$15,047	\$231,566	\$164,095	\$8,843	\$172,938	1.32	21	1.70	1	1.34	1%	0%	22
<b>Grand Total</b>	<b>\$24,402,153</b>	<b>\$9,581,078</b>	<b>\$33,983,231</b>	<b>\$16,929,762</b>	<b>\$6,603,063</b>	<b>\$23,532,825</b>	<b>1.44</b>	<b>2,096</b>	<b>1.45</b>	<b>825</b>	<b>1.44</b>	<b>100%</b>	<b>100%</b>	<b>2,921</b>

### Cost Effectiveness by Fuel Type (Participant Perspective)

Fuel Type	Cost Effectiveness													
	Total Projected Direct Cost Savings of all Customers			Total Cost			Average Program Cost Effectiveness					Percentage Breakdown (n)		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	(n)	United Illuminating	(n)	Combined	Eversource	United Illuminating	Combined (n)
Electric	\$4,945,716	\$472,003	\$5,417,719	\$3,559,409	\$313,030	\$3,872,439	1.39	444	1.51	38	1.40	21%	5%	482
Gas	\$12,571,918	\$7,963,605	\$20,535,523	\$8,517,039	\$5,483,074	\$14,000,113	1.48	1,044	1.45	694	1.47	50%	84%	1,738
Oil	\$5,430,783	\$861,602	\$6,292,385	\$3,847,545	\$626,621	\$4,474,166	1.41	483	1.37	72	1.41	23%	9%	555
Propane	\$1,453,736	\$283,868	\$1,737,604	\$1,005,769	\$180,338	\$1,186,107	1.45	125	1.57	21	1.46	6%	3%	146
<b>Grand Total</b>	<b>\$24,402,153</b>	<b>\$9,581,078</b>	<b>\$33,983,231</b>	<b>\$16,929,762</b>	<b>\$6,603,063</b>	<b>\$23,532,825</b>	<b>1.44</b>	<b>2,096</b>	<b>1.45</b>	<b>825</b>	<b>1.44</b>	<b>100%</b>	<b>100%</b>	<b>2,921</b>

### Cost Effectiveness by Fuel Switch (Participant Perspective)

Fuel Switch	Cost Effectiveness													
	Total Projected Direct Cost Savings of all Customers			Total Cost			Average Program Cost Effectiveness					Percentage Breakdown (n)		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	(n)	United Illuminating	(n)	Combined	Eversource	United Illuminating	Combined (n)
Oil to Gas	\$9,918,388	\$6,964,392	\$16,882,779	\$6,688,219	\$4,764,090	\$11,452,309	1.48	822	1.46	603	1.47	39%	73%	1,425
Oil to Electric Heat Pump	\$2,568,434	\$291,878	\$2,860,312	\$1,854,836	\$196,043	\$2,050,879	1.38	231	1.49	23	1.39	11%	3%	254
Oil to Propane	\$881,322	\$222,361	\$1,103,682	\$577,534	\$139,899	\$717,433	1.53	75	1.59	17	1.54	4%	2%	92
Electric to Gas	\$618,167	\$105,777	\$723,944	\$400,003	\$69,569	\$469,572	1.55	50	1.52	9	1.54	2%	1%	59
Electric to Propane	\$362,457	\$61,507	\$423,964	\$276,284	\$40,439	\$316,723	1.31	32	1.52	4	1.34	2%	0%	36
Gas to Electric Heat Pump	\$108,057	\$71,859	\$179,915	\$79,413	\$48,439	\$127,852	1.36	10	1.48	7	1.41	0%	1%	17
Propane to Electric	\$102,368	\$20,154	\$122,522	\$72,171	\$15,000	\$87,171	1.42	8	1.34	1	1.41	0%	0%	9
Electric to Oil	\$77,813	\$0	\$77,813	\$47,986	\$0	\$47,986	1.62	6	-	0	1.62	0%	0%	6
Propane to Gas	\$48,540	\$22,044	\$70,584	\$33,331	\$18,078	\$51,409	1.46	4	1.22	2	1.37	0%	0%	6
Kerosene to Gas	\$7,916	\$0	\$7,916	\$6,705	\$0	\$6,705	1.18	1	-	0	1.18	0%	0%	1
Propane to Oil	\$8,999	\$0	\$8,999	\$8,009	\$0	\$8,009	1.12	1	-	0	1.12	0%	0%	1
No Fuel Switch	\$9,699,693	\$1,821,107	\$11,520,800	\$6,885,271	\$1,311,506	\$8,196,777	1.41	856	1.39	159	1.41	41%	19%	1,015
<b>Grand Total</b>	<b>\$24,402,153</b>	<b>\$9,581,078</b>	<b>\$33,983,231</b>	<b>\$16,929,762</b>	<b>\$6,603,063</b>	<b>\$23,532,825</b>	<b>1.44</b>	<b>2,096</b>	<b>1.45</b>	<b>825</b>	<b>1.44</b>	<b>100%</b>	<b>100%</b>	<b>2,921</b>

\*These benefit-cost results are presented for informational purposes only and should not be used to assess overall program success or failure. Additional research is needed to determine appropriate baseline conditions and/or quantify the impact of customer incentives that were received outside of this program.

## Appendix B - Cost Effectiveness of Program\*

### Cost Effectiveness by Improvement Type (Utility Perspective)

Improvement Type	Count of Net Benefit	Sum of Cost	Sum of Net Benefit	BC Ratio
Air to Air Heat Pump	118	\$130,272	\$962,822	7.4
Boiler	1,328	\$1,466,112	\$12,939,588	8.8
Ductless Heat Pump	260	\$287,040	\$3,238,418	11.3
Furnace	622	\$686,688	\$6,188,175	9.0
Ground Source Heat Pump	17	\$18,768	\$255,271	13.6
<b>Grand Total</b>	<b>2,345</b>	<b>\$2,588,880</b>	<b>\$23,584,274</b>	<b>9.1</b>

### Cost Effectiveness by Fuel Type (Utility Perspective)

Fuel Type	Count of Net Benefit	Sum of Cost	Sum of Net Benefit	BC Ratio
Electric	394	\$434,976	\$4,434,230	10.2
Gas	1,384	\$1,527,936	\$18,071,650	11.8
Oil	443	\$489,072	\$506,089	1.0
Propane	124	\$136,896	\$572,306	4.2
<b>Grand Total</b>	<b>2,345</b>	<b>2588880</b>	<b>23584273.96</b>	<b>9.1</b>

### Cost Effectiveness by Improvement Type (Total Program Cost Perspective)

Improvement Type	Cost Effectiveness										
	Total Cost			Total Savings			Program Cost Effectiveness				
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	(n)	United Illuminating	(n)	Combined
Air to Air Heat Pump	\$1,479,219	\$99,138	<b>\$1,578,357</b>	\$3,222,828	\$304,687	<b>\$3,527,515</b>	<b>2.18</b>	130	<b>3.07</b>	9	<b>2.23</b>
Boiler	\$12,677,178	\$5,110,767	<b>\$17,787,945</b>	\$34,766,909	\$14,787,799	<b>\$49,554,708</b>	<b>2.74</b>	1,178	<b>2.89</b>	488	<b>2.79</b>
Ductless Heat Pump	\$3,414,688	\$303,321	<b>\$3,718,009</b>	\$6,975,759	\$742,124	<b>\$7,717,883</b>	<b>2.04</b>	294	<b>2.45</b>	28	<b>2.08</b>
Furnace	\$5,032,708	\$3,142,866	<b>\$8,175,574</b>	\$14,855,765	\$8,310,079	<b>\$23,165,844</b>	<b>2.95</b>	473	<b>2.64</b>	299	<b>2.83</b>
Ground Source Heat Pump	\$681,862	\$22,113	<b>\$703,975</b>	\$433,521	\$38,692	<b>\$472,213</b>	<b>0.64</b>	21	<b>1.75</b>	1	<b>0.67</b>
<b>Grand Total</b>	<b>\$23,285,655</b>	<b>\$8,678,204</b>	<b>\$31,963,859</b>	<b>\$60,254,781</b>	<b>\$24,183,382</b>	<b>\$84,438,163</b>	<b>2.59</b>	<b>2,096</b>	<b>2.79</b>	<b>825</b>	<b>2.64</b>

### Cost Effectiveness by Fuel Type (Total Program Cost Perspective)

Fuel Type	Cost Effectiveness										
	Total Cost			Total Savings			Program Cost Effectiveness				
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	(n)	United Illuminating	(n)	Combined
Electric	\$5,569,413	\$424,572	<b>\$5,993,985</b>	\$10,623,431	\$1,085,504	<b>\$11,708,934</b>	<b>1.91</b>	444	<b>2.56</b>	38	<b>1.95</b>
Gas	\$11,052,056	\$7,164,528	<b>\$18,216,583</b>	\$32,399,042	\$20,173,954	<b>\$52,572,996</b>	<b>2.93</b>	1,044	<b>2.82</b>	694	<b>2.89</b>
Oil	\$5,203,552	\$815,826	<b>\$6,019,378</b>	\$13,482,308	\$2,135,208	<b>\$15,617,516</b>	<b>2.59</b>	483	<b>2.62</b>	72	<b>2.59</b>
Propane	\$1,460,634	\$273,279	<b>\$1,733,913</b>	\$3,750,000	\$788,717	<b>\$4,538,717</b>	<b>2.57</b>	125	<b>2.89</b>	21	<b>2.62</b>
<b>Grand Total</b>	<b>\$23,285,655</b>	<b>\$8,678,204</b>	<b>\$31,963,859</b>	<b>\$60,254,781</b>	<b>\$24,183,382</b>	<b>\$84,438,163</b>	<b>2.59</b>	<b>2,096</b>	<b>2.79</b>	<b>825</b>	<b>2.64</b>

\*These benefit-cost results are presented for informational purposes only and should not be used to assess overall program success or failure. Additional research is needed to determine appropriate baseline conditions and/or quantify the impact of customer incentives that were received outside of this program.

# Appendix C-1 - Number of Customers

## Number of Customers by Application Status

Application Status	Number of Applications	Total Amount Financed
Approved	901	\$7,628,275
Declined	1,869	\$18,540,071
Funded*	3,145	\$25,222,546
Pending	9	\$139,604
Pre-Approved	787	\$8,216,516
Under Review	340	\$3,887,977
Withdrawn	952	\$8,755,918
<b>Grand Total</b>	<b>8,003</b>	<b>\$72,390,907</b>

\* Of the 3,145 "funded" projects, 224 were removed due to lack of data, resulting in 2,921 customers for analysis.

## Number of Customers by Loan Rate

Loan Rate	Number of Loans	Total Amount Financed
0.00%	2,652	\$21,422,767
2.99%	269	\$2,110,058
<b>Grand Total</b>	<b>2,921</b>	<b>\$23,532,825</b>

## Number of Customers by Loan Term

Loan Term	Number of Loans	Total Amount Financed
3 years	3	\$27,512
4 years	33	\$258,315
5 years	163	\$1,278,849
6 years	238	\$1,860,679
7 years	301	\$2,431,232
8 years	252	\$2,011,651
9 years	262	\$2,119,647
10 years	1,669	\$13,544,940
<b>Grand Total</b>	<b>2,921</b>	<b>\$23,532,825</b>

## Number of Customers by Fuel Type

Fuel Type	Number of Loans	Total Amount Financed
Electric	482	\$3,872,439
Gas	1,738	\$14,000,113
Oil	555	\$4,474,166
Propane	146	\$1,186,107
<b>Grand Total</b>	<b>2,921</b>	<b>\$23,532,825</b>

## Number of Customers by Improvement Type

Measure	Number of Loans	Total Amount Financed
Air to Air Heat Pump	139	\$1,127,628
Boiler	1,666	\$13,449,806
Ductless Heat Pump	322	\$2,576,693
Furnace	772	\$6,205,760
Ground Source Heat Pump	22	\$172,938
<b>Grand Total</b>	<b>2,921</b>	<b>\$23,532,825</b>

## Number of Customers by Fuel Switch

Conversion Type	Number of Loans	Total Amount Financed
Oil to Gas	1,425	\$11,452,309
Oil to Electric Heat Pump	254	\$2,050,879
Oil to Propane	92	\$717,433
Electric to Gas	59	\$469,572
Electric to Propane	36	\$316,723
Gas to Electric Heat Pump	17	\$127,852
Propane to Electric	9	\$87,171
Electric to Oil	6	\$47,986
Propane to Gas	6	\$51,409
Kerosene to Gas	1	\$6,705
Propane to Oil	1	\$8,009
No Fuel Switch	1,015	\$8,196,777
<b>Grand Total</b>	<b>2,921</b>	<b>\$23,532,825</b>

## Appendix C-2 - Number of Customers

Town	# of Funded Projects	% of Funded Projects
West Hartford	165	5.65%
Milford	112	3.83%
Hamden	95	3.25%
New Haven	94	3.22%
Fairfield	92	3.15%
Bridgeport	85	2.91%
Stratford	85	2.91%
West Haven	69	2.36%
Manchester	66	2.26%
Bristol	62	2.12%
Trumbull	62	2.12%
Waterbury	62	2.12%
Madison	60	2.05%
Guilford	57	1.95%
Newington	57	1.95%
New Britain	51	1.75%
Simsbury	51	1.75%
Middletown	47	1.61%
Windsor	41	1.40%
Meriden	40	1.37%
North Haven	40	1.37%
Branford	39	1.34%
Glastonbury	39	1.34%
East Hartford	38	1.30%
Hartford	38	1.30%
Southington	37	1.27%
Stamford	37	1.27%
Westport	35	1.20%
Vernon	33	1.13%
Bloomfield	31	1.06%
Enfield	31	1.06%
Norwalk	31	1.06%
Farmington	30	1.03%
Torrington	30	1.03%
Cheshire	28	0.96%
Naugatuck	28	0.96%
Avon	27	0.92%
Watertown	25	0.86%
Wethersfield	25	0.86%
East Haven	22	0.75%
Granby	22	0.75%
Rocky Hill	22	0.75%
Danbury	21	0.72%
South Windsor	21	0.72%
Southbury	21	0.72%
Shelton	20	0.68%
Wolcott	19	0.65%
Orange	18	0.62%
Berlin	17	0.58%
Clinton	16	0.55%
Plainville	16	0.55%
New Milford	15	0.51%
Old Saybrook	15	0.51%
Canton	14	0.48%
Greenwich	14	0.48%
Plymouth	14	0.48%
Litchfield	13	0.45%
New Fairfield	13	0.45%
Newtown	13	0.45%
Prospect	13	0.45%

Town	# of Funded Projects	% of Funded Projects
Colchester	12	0.41%
Portland	12	0.41%
Tolland	12	0.41%
Weston	12	0.41%
Brookfield	11	0.38%
Essex	11	0.38%
Mansfield	11	0.38%
Monroe	11	0.38%
Stonington	11	0.38%
Ansonia	10	0.34%
Cromwell	10	0.34%
Ellington	10	0.34%
Oxford	10	0.34%
Windsor Locks	10	0.34%
Woodbury	10	0.34%
Bethel	9	0.31%
Coventry	9	0.31%
New London	9	0.31%
Ridgefield	9	0.31%
Waterford	9	0.31%
East Haddam	8	0.27%
Hebron	8	0.27%
North Branford	8	0.27%
Westbrook	8	0.27%
Bolton	7	0.24%
Durham	7	0.24%
Seymour	7	0.24%
Suffield	7	0.24%
Thomaston	7	0.24%
Burlington	6	0.21%
Columbia	6	0.21%
Derby	6	0.21%
East Granby	6	0.21%
East Hampton	6	0.21%
Marlborough	6	0.21%
New Canaan	6	0.21%
Redding	6	0.21%
Woodbridge	6	0.21%
Darien	5	0.17%
Deep River	5	0.17%
Haddam	5	0.17%
Ledyard	5	0.17%
Lisbon	5	0.17%
Plainfield	5	0.17%
Somers	5	0.17%
Wilton	5	0.17%
Windham	5	0.17%
Beacon Falls	4	0.14%
Bethany	4	0.14%
Chester	4	0.14%
East Lyme	4	0.14%
Easton	4	0.14%
Killingly	4	0.14%
Middlebury	4	0.14%
Montville	4	0.14%
Old Lyme	4	0.14%
Washington	4	0.14%
Willington	4	0.14%
Brooklyn	3	0.10%
East Windsor	3	0.10%

Town	# of Funded Projects	% of Funded Projects
Griswold	3	0.10%
Hartland	3	0.10%
Lebanon	3	0.10%
Middlefield	3	0.10%
New Hartford	3	0.10%
North Stonington	3	0.10%
Pomfret	3	0.10%
Woodstock	3	0.10%
Andover	2	0.07%
Chaplin	2	0.07%
Cornwall	2	0.07%
Goshen	2	0.07%
Harwinton	2	0.07%
Killingworth	2	0.07%
Morris	2	0.07%
Putnam	2	0.07%
Sherman	2	0.07%
Sprague	2	0.07%
Stafford	2	0.07%
Thompson	2	0.07%
Barkhamsted	1	0.03%
Bethlehem	1	0.03%
Bridgewater	1	0.03%
Canterbury	1	0.03%
Groton	1	0.03%
Hampton	1	0.03%
Kent	1	0.03%
Lyme	1	0.03%
North Canaan	1	0.03%
Norwich	1	0.03%
Roxbury	1	0.03%
Salem	1	0.03%
Scotland	1	0.03%
Wallingford	1	0.03%
Winchester	1	0.03%
Ashford	0	0.00%
Bozrah	0	0.00%
Canaan	0	0.00%
Colebrook	0	0.00%
Eastford	0	0.00%
Franklin	0	0.00%
Norfolk	0	0.00%
Preston	0	0.00%
Salisbury	0	0.00%
Sharon	0	0.00%
Sterling	0	0.00%
Union	0	0.00%
Voluntown	0	0.00%
Warren	0	0.00%

## Appendix D-1 - Potential for Program Growth

LIKELY OBTAINABLE POTENTIAL - SCENARIO 1		
Total Eversource Residential Customers	1,111,467	FERC Form 1, Page 301
Total UI Residential Customers	283,421	FERC Form 1, Page 301
Total Combined Eversource/UI Residential Customers	1,394,888	
Estimated # of Owner-Occupied Households	1,255,399	Estimated percent of households that are eligible (90% owner-occupied)
<b>Total in Data Set</b>	<b>8,003</b>	
Funded	3,145	
Approved/Pre-Approved	1,688	
Pending/Under Review	349	
Declined/Withdrawn	2,821	
Remaining Non-Participating Residential Customers	1,250,217	Excluding those customers whose applications were declined or withdrawn
Achievable Potential based on Units > 10 Years Old	422,371	Source: Unitil Electric Remaining Potential Study % of residential customers with furnaces & boilers >10 years old (34%)
Achievable Potential of units > 10 years old that customers state they plan to replace within the next 5 years	173,917	Source: Unitil Electric Remaining Potential Study survey responses from homeowners with systems > 10 years old (41%)
Estimated percent of units > 10 years old that will be replaced within the next 5 years <u>outside of the loan program</u>	84%	1 - (# of furnaces & boilers funded or approved through loan program / estimated of the total # of residential furnaces & boilers installed in CT)
<b>Remaining Likely Achievable Potential for Residential Furnace &amp; Boiler Loan Program</b>	<b>28,018</b>	
<b>Remaining Likely Achievable Potential for Residential Furnace &amp; Boiler Loan Program - as a percent of total CT residential households</b>	<b>2.5%</b>	

LIKELY OBTAINABLE POTENTIAL - SCENARIO 2		
Total Eversource Residential Customers	1,111,467	
Total UI Residential Customers	283,421	
Total Combined Eversource/UI Residential Customers	1,394,888	
Percent of eligible customers	81.6%	Assuming 1- 4 units as a proxy --- based on US Census Data
Eligible population	1,138,461	
Estimated System Replacements per Year (natural replacements)	36,725	Based on the SF Weatherization Study
Number of participants per month	225	Average from December 2014-October 2015 from Program Raw Data
Participants per year	2,698	Monthly average x 12 months/year
Likely Obtainable Potential (n)	173,917	
Mature program participation	2,698	
Percent replaced outside of the loan program	92.65%	Compare to 84% from Scenario 1
5 year potential	13,489	
Percent of all residential households	1.0%	

## Appendix D-2 - Potential for Program Growth

Analysis Inputs	
Loan Funds Issued in 2014 & 2015	\$23,082,825
Loan Funds Issued in 2016	\$15,846,500
Interest Rate	2.99%
Program Admin/Marketing/Loan Default Amount (Net of Interest)	\$83
Average Loan Amount	\$8,056
Average Term of Loan (Years)	8.7
Average Repayment per Year	\$1,071
Number of Loans in 2014 & 2015	3,145
Number of Loans in 2016	1,967
Projected Number of Loans per Year (Low Participation)	2,700
Projected Number of Loans per Year (Mid Participation)	4,150
Projected Number of Loans per Year (High Participation)	5,600

Analysis Results Summary		
Scenario	Break Even Year	Number of Years from the Start of 2016 to Offset of Funds Issued
Low Participation	2022	6
Mid Participation	2023	6.5
High Participation	2023	6.8

Year		2014 & 2015	2016	2017	2018	2019	2020
Low Participation	Loan Funds Issued	\$23,082,825.00	\$15,846,500.00	\$21,752,361.00	\$21,752,361.00	\$21,752,361.00	\$21,752,361.00
	Loan Amounts Repayed	\$2,169,110.00	\$4,275,844.93	\$7,167,742.74	\$10,059,640.54	\$12,951,538.35	\$15,843,436.16
	Program Net Flow	-\$20,913,715.00	-\$11,570,655.07	-\$14,584,618.26	-\$11,692,720.46	-\$8,800,822.65	-\$5,908,924.84
Mid Participation	Loan Funds Issued	\$23,082,825.00	\$15,846,500.00	\$33,434,184.50	\$33,434,184.50	\$33,434,184.50	\$33,434,184.50
	Loan Amounts Repayed	\$2,169,110.00	\$4,275,844.93	\$8,720,798.97	\$13,165,753.01	\$17,610,707.05	\$22,055,661.09
	Program Net Flow	-\$20,913,715.00	-\$11,570,655.07	-\$24,713,385.53	-\$20,268,431.49	-\$15,823,477.45	-\$11,378,523.41
High Participation	Loan Funds Issued	\$23,082,825.00	\$15,846,500.00	\$45,116,008.00	\$45,116,008.00	\$45,116,008.00	\$45,116,008.00
	Loan Amounts Repayed	\$2,169,110.00	\$4,275,844.93	\$10,273,855.20	\$16,271,865.47	\$22,269,875.74	\$28,267,886.01
	Program Net Flow	-\$20,913,715.00	-\$11,570,655.07	-\$34,842,152.80	-\$28,844,142.53	-\$22,846,132.26	-\$16,848,121.99

Year		2021	2022	2023	2024	2025	2026
Low Participation	Loan Funds Issued	\$21,752,361.00	\$21,752,361.00	\$21,752,361.00	\$21,752,361.00	\$21,752,361.00	\$21,752,361.00
	Loan Amounts Repayed	\$18,735,333.97	\$21,627,231.78	\$24,519,129.59	\$26,326,472.40	\$27,080,447.75	\$26,388,474.19
	Program Net Flow	-\$3,017,027.03	-\$125,129.22	\$2,766,768.59	\$4,574,111.40	\$5,328,086.75	\$4,636,113.19
Mid Participation	Loan Funds Issued	\$33,434,184.50	\$33,434,184.50	\$33,434,184.50	\$33,434,184.50	\$33,434,184.50	\$33,434,184.50
	Loan Amounts Repayed	\$26,500,615.13	\$30,945,569.17	\$35,390,523.21	\$38,750,922.25	\$41,057,953.83	\$41,142,508.38
	Program Net Flow	-\$6,933,569.37	-\$2,488,615.33	\$1,956,338.71	\$5,316,737.75	\$7,623,769.33	\$7,708,323.88
High Participation	Loan Funds Issued	\$45,116,008.00	\$45,116,008.00	\$45,116,008.00	\$45,116,008.00	\$45,116,008.00	\$45,116,008.00
	Loan Amounts Repayed	\$34,265,896.28	\$40,263,906.55	\$46,261,916.82	\$51,175,372.10	\$55,035,459.90	\$55,896,542.58
	Program Net Flow	-\$10,850,111.72	-\$4,852,101.45	\$1,145,908.82	\$6,059,364.10	\$9,919,451.90	\$10,780,534.58

## Appendix E-1 - Customer Classes Served

### Customer Classes Served - Overview

Income Level	Utility		Grand Total (n)	Percentage Breakdown		
	Eversource	United Illuminating		Eversource	United Illuminating	Combined
\$0 to \$24,999	74	42	116	4%	5%	4%
\$25,000 to \$74,999	763	318	1,081	36%	39%	37%
\$75,000 to \$149,999	815	298	1,113	39%	36%	38%
\$150,000 to \$249,999	297	110	407	14%	13%	14%
\$250,000 to \$499,999	69	21	90	3%	3%	3%
\$500,000 or higher	78	36	114	4%	4%	4%
<b>Grand Total (n)</b>	<b>2,096</b>	<b>825</b>	<b>2,921</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

### Income Level by Improvement Type

Income Level	Improvement Type														
	Air to Air Heat Pump			Boiler			Ductless Heat Pump			Furnace			Ground Source Heat Pump		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
\$0 to \$24,999	5	0	5	39	23	62	3	1	4	27	18	45	0	0	0
\$25,000 to \$74,999	54	4	58	428	184	612	90	10	100	189	120	309	2	0	2
\$75,000 to \$149,999	40	2	42	469	179	648	140	11	151	154	106	260	12	0	12
\$150,000 to \$249,999	16	2	18	174	66	240	38	2	40	64	39	103	5	1	6
\$250,000 to \$499,999	7	0	7	30	17	47	7	0	7	23	4	27	2	0	2
\$500,000 or higher	8	1	9	38	19	57	16	4	20	16	12	28	0	0	0
<b>Grand Total (n=2,921)</b>	<b>130</b>	<b>9</b>	<b>139</b>	<b>1,178</b>	<b>488</b>	<b>1,666</b>	<b>294</b>	<b>28</b>	<b>322</b>	<b>473</b>	<b>299</b>	<b>772</b>	<b>21</b>	<b>1</b>	<b>22</b>

### Income Level by Fuel Type

Income Level	Fuel Type											
	Electric			Gas			Oil			Propane		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
\$0 to \$24,999	8	1	9	39	33	72	25	6	31	2	2	4
\$25,000 to \$74,999	146	14	160	413	275	688	167	25	192	37	4	41
\$75,000 to \$149,999	192	13	205	376	249	625	197	29	226	50	7	57
\$150,000 to \$249,999	58	5	63	147	90	237	65	9	74	27	6	33
\$250,000 to \$499,999	16	0	16	38	18	56	11	1	12	4	2	6
\$500,000 or higher	24	5	29	31	29	60	18	2	20	5	0	5
<b>Grand Total (n=2,921)</b>	<b>444</b>	<b>38</b>	<b>482</b>	<b>1,044</b>	<b>694</b>	<b>1,738</b>	<b>483</b>	<b>72</b>	<b>555</b>	<b>125</b>	<b>21</b>	<b>146</b>

### Income Level by Fuel Switch

Income Level	Fuel Switch														
	Oil to Gas			Oil to Electric Heat Pump			Oil to Propane			Electric to Gas			Electric to Propane		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
\$0 to \$24,999	31	28	59	0	0	0	1	2	3	1	0	1	0	0	0
\$25,000 to \$74,999	326	239	565	64	8	72	20	4	24	25	2	27	11	0	11
\$75,000 to \$149,999	290	212	502	114	10	124	32	4	36	12	6	18	10	3	13
\$150,000 to \$249,999	118	79	197	31	3	34	20	5	25	7	1	8	7	1	8
\$250,000 to \$499,999	31	18	49	10	0	10	1	2	3	4	0	4	2	0	2
\$500,000 or higher	26	27	53	12	2	14	1	0	1	1	0	1	2	0	2
<b>Grand Total (n=2,921)</b>	<b>822</b>	<b>603</b>	<b>1,425</b>	<b>231</b>	<b>23</b>	<b>254</b>	<b>75</b>	<b>17</b>	<b>92</b>	<b>50</b>	<b>9</b>	<b>59</b>	<b>32</b>	<b>4</b>	<b>36</b>

Income Level	Fuel Switch Continued								
	Gas to Electric Heat Pump			Other Fuel Switch*			No Fuel Switch		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
\$0 to \$24,999	1	0	1	0	0	0	40	12	52
\$25,000 to \$74,999	3	4	7	5	2	7	309	59	368
\$75,000 to \$149,999	6	0	6	7	1	8	344	62	406
\$150,000 to \$249,999	0	2	2	5	0	5	109	19	128
\$250,000 to \$499,999	0	0	0	1	0	1	20	1	21
\$500,000 or higher	0	1	1	2	0	2	34	6	40
<b>Grand Total (n=2,921)</b>	<b>10</b>	<b>7</b>	<b>17</b>	<b>20</b>	<b>3</b>	<b>23</b>	<b>856</b>	<b>159</b>	<b>1,015</b>

\*Other Fuel Switches include Propane to Electric (n=9), Electric to Oil (n=6), Propane to Gas (n=6), Kerosene to Gas (n=1), Propane to Oil (n=1)

## Appendix E-2 - Customer Classes Served

### 60% State Median Income Level - Overview

60% State Median Income	Utility		Grand Total (n)	Percentage Breakdown		
	Eversource	United Illuminating		Eversource	United Illuminating	Combined
At or Below	410	208	618	20%	25%	21%
Above	1,686	617	2,303	80%	75%	79%
<b>Grand Total (n)</b>	<b>2,096</b>	<b>825</b>	<b>2,921</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

### 60% State Median Income Level by Improvement Type

60% State Median Income	Percent of Projects Funded - by Improvement Type														
	Air to Air Heat Pump			Boiler			Ductless Heat Pump			Furnace			Ground Source Heat Pump		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	11%	11%	11%	20%	26%	22%	13%	21%	14%	25%	25%	25%	0%	0%	0%
Above	89%	89%	89%	80%	74%	78%	87%	79%	86%	75%	75%	75%	100%	100%	100%
<b>Grand Total (n=2,921)</b>	<b>130</b>	<b>9</b>	<b>139</b>	<b>1,178</b>	<b>488</b>	<b>1,666</b>	<b>294</b>	<b>28</b>	<b>322</b>	<b>473</b>	<b>299</b>	<b>772</b>	<b>21</b>	<b>1</b>	<b>22</b>

### 60% State Median Income Level by Fuel Type

60% State Median Income	Percent of Projects Funded - by Fuel Type											
	Electric			Gas			Oil			Propane		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	12%	18%	12%	23%	25%	24%	21%	26%	21%	13%	29%	15%
Above	88%	82%	88%	77%	75%	76%	79%	74%	79%	87%	71%	85%
<b>Grand Total (n=2,921)</b>	<b>444</b>	<b>38</b>	<b>482</b>	<b>1,044</b>	<b>694</b>	<b>1,738</b>	<b>483</b>	<b>72</b>	<b>555</b>	<b>125</b>	<b>21</b>	<b>146</b>

### 60% State Median Income Level by Fuel Switch

60% State Median Income	Percent of Projects Funded - by Fuel Switch														
	Oil to Gas			Oil to Electric Heat Pump			Oil to Propane			Electric to Gas			Electric to Propane		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	24%	26%	25%	9%	9%	9%	11%	35%	15%	18%	11%	17%	16%	0%	14%
Above	76%	74%	75%	91%	91%	91%	89%	65%	85%	82%	89%	83%	84%	100%	86%
<b>Grand Total (n=2,921)</b>	<b>822</b>	<b>603</b>	<b>1,425</b>	<b>231</b>	<b>23</b>	<b>254</b>	<b>75</b>	<b>17</b>	<b>92</b>	<b>50</b>	<b>9</b>	<b>59</b>	<b>32</b>	<b>4</b>	<b>36</b>

60% State Median Income	Fuel Switch Continued								
	Gas to Electric Heat Pump			Other Fuel Switch*			No Fuel Switch		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	40%	43%	41%	10%	0%	9%	20%	25%	20%
Above	60%	57%	59%	90%	100%	91%	80%	75%	80%
<b>Grand Total (n=2,921)</b>	<b>10</b>	<b>7</b>	<b>17</b>	<b>20</b>	<b>3</b>	<b>23</b>	<b>856</b>	<b>159</b>	<b>1,015</b>

\*Other Fuel Switches include Propane to Electric (n=9), Electric to Oil (n=6), Propane to Gas (n=6), Kerosene to Gas (n=1), Propane to Oil (n=1)

## Appendix E-3 - Customer Classes Served

### 80% State Median Income Level - Overview

80% State Median Income	Utility		Grand Total (n)	Percentage Breakdown		
	Eversource	United Illuminating		Eversource	United Illuminating	Combined
At or Below	689	323	1,012	33%	39%	35%
Above	1,407	502	1,909	67%	61%	65%
<b>Grand Total (n)</b>	<b>2,096</b>	<b>825</b>	<b>2,921</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

### 80% State Median Income Level by Improvement Type

80% State Median Income	Percent of Projects Funded - by Improvement Type														
	Air to Air Heat Pump			Boiler			Ductless Heat Pump			Furnace			Ground Source Heat Pump		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	28%	11%	27%	34%	39%	36%	24%	36%	25%	37%	40%	38%	10%	0%	9%
Above	72%	89%	73%	66%	61%	64%	76%	64%	75%	63%	60%	62%	90%	100%	91%
<b>Grand Total (n=2,921)</b>	<b>130</b>	<b>9</b>	<b>139</b>	<b>1,178</b>	<b>488</b>	<b>1,666</b>	<b>294</b>	<b>28</b>	<b>322</b>	<b>473</b>	<b>299</b>	<b>772</b>	<b>21</b>	<b>1</b>	<b>22</b>

### 80% State Median Income Level by Fuel Type

80% State Median Income	Percent of Projects Funded - by Fuel Type											
	Electric			Gas			Oil			Propane		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	25%	29%	25%	37%	39%	38%	35%	42%	36%	23%	38%	25%
Above	75%	71%	75%	63%	61%	62%	65%	58%	64%	77%	62%	75%
<b>Grand Total (n=2,921)</b>	<b>444</b>	<b>38</b>	<b>482</b>	<b>1,044</b>	<b>694</b>	<b>1,738</b>	<b>483</b>	<b>72</b>	<b>555</b>	<b>125</b>	<b>21</b>	<b>146</b>

### 80% State Median Income Level by Fuel Switch

80% State Median Income	Percent of Projects Funded - by Fuel Switch														
	Oil to Gas			Oil to Electric Heat Pump			Oil to Propane			Electric to Gas			Electric to Propane		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	38%	41%	39%	23%	17%	22%	19%	1190%	23%	34%	22%	32%	31%	25%	31%
Above	62%	59%	61%	77%	83%	78%	81%	59%	77%	66%	78%	68%	69%	75%	69%
<b>Grand Total (n=2,921)</b>	<b>822</b>	<b>603</b>	<b>1,425</b>	<b>231</b>	<b>23</b>	<b>254</b>	<b>75</b>	<b>17</b>	<b>92</b>	<b>50</b>	<b>9</b>	<b>59</b>	<b>32</b>	<b>4</b>	<b>36</b>

80% State Median Income	Fuel Switch Continued								
	Gas to Electric Heat Pump			Other Fuel Switch*			No Fuel Switch		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
At or Below	50%	57%	53%	15%	33%	17%	32%	36%	33%
Above	50%	43%	47%	85%	67%	83%	68%	64%	67%
<b>Grand Total (n=2,921)</b>	<b>10</b>	<b>7</b>	<b>17</b>	<b>20</b>	<b>3</b>	<b>23</b>	<b>856</b>	<b>159</b>	<b>1,015</b>

\*Other Fuel Switches include Propane to Electric (n=9), Electric to Oil (n=6), Propane to Gas (n=6), Kerosene to Gas (n=1), Propane to Oil (n=1)

## Appendix F - Fuel Type of Financed Equipment

### Fuel Type by Installed Improvement Type

Fuel Type	Improvement Type															Grand Total			Percentage Breakdown		
	Air to Air Heat Pump			Boiler			Ductless Heat Pump			Furnace			Ground Source Heat Pump			Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined						
Electric	130	9	139	0	0	0	293	28	321	0	0	0	21	1	22	444	38	482	21%	5%	17%
Gas	0	0	0	736	423	1,159	0	0	0	308	271	579	0	0	0	1,044	694	1,738	50%	84%	60%
Oil	0	0	0	389	54	443	1	0	1	93	18	111	0	0	0	483	72	555	23%	9%	19%
Propane	0	0	0	53	11	64	0	0	0	72	10	82	0	0	0	125	21	146	6%	3%	5%
<b>Grand Total (n)</b>	<b>130</b>	<b>9</b>	<b>139</b>	<b>1,178</b>	<b>488</b>	<b>1,666</b>	<b>294</b>	<b>28</b>	<b>322</b>	<b>473</b>	<b>299</b>	<b>772</b>	<b>21</b>	<b>1</b>	<b>22</b>	<b>2,096</b>	<b>825</b>	<b>2,921</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

### Fuel Switch by Installed Improvement Type

Fuel Switch	Improvement Type															Grand Total			Percentage Breakdown		
	Air to Air Heat Pump			Boiler			Ductless Heat Pump			Furnace			Ground Source Heat Pump			Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined						
Oil to Gas	0	0	0	623	378	1,001	0	0	0	199	225	424	0	0	0	822	603	1,425	39%	73%	49%
Oil to Electric Heat Pump	45	5	50	0	0	0	175	17	192	0	0	0	11	1	12	231	23	254	11%	3%	9%
Oil to Propane	0	0	0	33	10	43	0	0	0	42	7	49	0	0	0	75	17	92	4%	2%	3%
Electric to Gas	0	0	0	13	4	17	0	0	0	37	5	42	0	0	0	50	9	59	2%	1%	2%
Electric to Propane	0	0	0	10	1	11	0	0	0	22	3	25	0	0	0	32	4	36	2%	0%	1%
Gas to Electric Heat Pump	0	1	1	0	0	0	10	6	16	0	0	0	0	0	0	10	7	17	0%	1%	1%
Propane to Electric	1	0	1	0	0	0	3	1	4	0	0	0	4	0	4	8	1	9	0%	0%	0%
Electric to Oil	0	0	0	3	0	3	1	0	1	2	0	2	0	0	0	6	0	6	0%	0%	0%
Propane to Gas	0	0	0	3	1	4	0	0	0	1	1	2	0	0	0	4	2	6	0%	0%	0%
Kerosene to Gas	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0%	0%	0%
Propane to Oil	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0%	0%	0%
No Fuel Switch	84	3	87	492	94	586	105	4	109	169	58	227	6	0	6	856	159	1,015	41%	19%	35%
<b>Grand Total (n)</b>	<b>130</b>	<b>9</b>	<b>139</b>	<b>1,178</b>	<b>488</b>	<b>1,666</b>	<b>294</b>	<b>28</b>	<b>322</b>	<b>473</b>	<b>299</b>	<b>772</b>	<b>21</b>	<b>1</b>	<b>22</b>	<b>2,096</b>	<b>825</b>	<b>2,921</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

## Appendix G - CO<sub>2</sub> Emissions

CO<sub>2</sub> Emissions were calculated using the ISO-NE Marginal Emissions report.

### CO<sub>2</sub> Overview

	Utility		Combined
	Eversource	United Illuminating	
Total Number of Funded Applications with CO <sub>2</sub> Data Available (n)*	1,699	647	2,346
Total Projected Annual CO <sub>2</sub> Emitted without Improvement (Metric Tons)	9,462	3,703	13,165
Total Projected Annual CO <sub>2</sub> Emitted after Improvement (Metric Tons)	6,478	2,510	8,988
Total Projected Annual CO <sub>2</sub> Savings (Metric Tons)	2,984	1,193	4,177

\* Of the 2,921 funded applications, 575 lack CO<sub>2</sub> Data and were removed, leaving a total of 2,346 applications for CO<sub>2</sub> analysis.

### CO<sub>2</sub> and Cost Savings by Fuel Type

Fuel Type	CO <sub>2</sub> Emissions and Total Projected Customer Cost Savings by Fuel Type														
	Number of Projects			Total Projected Annual CO <sub>2</sub> Emitted without Improvement (Metric Tons)			Total Projected Annual CO <sub>2</sub> Emitted after Improvement (Metric Tons)			Total Projected Annual CO <sub>2</sub> Savings (Metric Tons)			Total Projected Annual Customer Cost Savings		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
Electric	364	30	394	1,875	160	2,036	744	66	810	1,131	95	1,226	\$490,793	\$46,907	\$537,700
Gas	844	541	1,385	4,673	3,076	7,748	3,095	2,016	5,111	1,578	1,059	2,637	\$1,354,637	\$830,144	\$2,184,781
Oil	382	61	443	2,268	370	2,638	2,159	353	2,512	109	17	126	\$527,873	\$92,532	\$620,405
Propane	109	15	124	646	97	743	480	75	554	167	22	189	\$169,609	\$30,624	\$200,233
<b>Grand Total</b>	<b>1,699</b>	<b>647</b>	<b>2,346</b>	<b>9,462</b>	<b>3,703</b>	<b>13,165</b>	<b>6,478</b>	<b>2,510</b>	<b>8,988</b>	<b>2,984</b>	<b>1,193</b>	<b>4,177</b>	<b>\$2,542,912</b>	<b>\$1,000,207</b>	<b>\$3,543,119</b>

### CO<sub>2</sub> and Cost Savings by Improvement Type

Improvement Type	CO <sub>2</sub> Emissions and Total Projected Customer Cost Savings by Improvement Type														
	Number of Projects			Total Projected Annual CO <sub>2</sub> Emitted without Improvement (Metric Tons)			Total Projected Annual CO <sub>2</sub> Emitted after Improvement (Metric Tons)			Total Projected Annual CO <sub>2</sub> Savings (Metric Tons)			Total Projected Annual Customer Cost Savings		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
Air to Air Heat Pump	111	7	118	472	35	507	224	17	241	248	18	266	\$153,801	\$12,211	\$166,012
Boiler	943	385	1,328	5,387	2,222	7,609	4,137	1,566	5,703	1,250	656	1,906	\$1,407,979	\$617,155	\$2,025,133
Ductless Heat Pump	238	22	260	1,321	119	1,440	495	47	542	826	72	898	\$317,007	\$32,547	\$349,554
Furnace	391	232	623	2,191	1,321	3,512	1,594	879	2,473	597	442	1,039	\$643,659	\$336,145	\$979,803
Ground Source Heat Pump	16	1	17	90	7	97	27	2	29	63	5	68	\$20,468	\$2,150	\$22,617
<b>Grand Total</b>	<b>1,699</b>	<b>647</b>	<b>2,346</b>	<b>9,462</b>	<b>3,703</b>	<b>13,165</b>	<b>6,478</b>	<b>2,510</b>	<b>8,988</b>	<b>2,984</b>	<b>1,193</b>	<b>4,177</b>	<b>\$2,542,912</b>	<b>\$1,000,207</b>	<b>\$3,543,119</b>

### CO<sub>2</sub> and Cost Savings by Fuel Switch

Fuel Switch	CO <sub>2</sub> Emissions and Total Projected Customer Cost Savings by Fuel Switch														
	Number of Projects			Total Projected Annual CO <sub>2</sub> Emitted without Improvement (Metric Tons)			Total Projected Annual CO <sub>2</sub> Emitted after Improvement (Metric Tons)			Total Projected Annual CO <sub>2</sub> Savings (Metric Tons)			Total Projected Annual Customer Cost Savings		
	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined	Eversource	United Illuminating	Combined
Oil to Gas	671	473	1,144	3,928	2,778	6,706	2,484	1,772	4,256	1,444	1,006	2,450	\$1,081,020	\$739,957	\$1,820,977
Oil to Electric Heat Pump	194	18	212	1,120	96	1,216	430	37	467	690	60	749	\$259,499	\$27,550	\$287,049
Oil to Propane	70	13	83	418	88	507	308	65	372	111	23	134	\$110,021	\$25,847	\$135,868
Electric to Gas	39	8	47	164	40	204	109	23	132	55	17	72	\$73,681	\$13,696	\$87,377
Electric to Propane	24	2	26	151	9	160	107	10	117	45	-1	43	\$37,254	\$4,777	\$42,031
Gas to Electric Heat Pump	8	5	13	36	25	61	19	13	33	17	11	28	\$9,272	\$6,769	\$16,040
Propane to Electric	7	1	8	32	4	35	12	2	13	20	2	22	\$12,487	\$2,015	\$14,502
Electric to Oil	6	0	6	35	0	35	25	0	25	9	0	9	\$10,732	\$0	\$10,732
Propane to Gas	3	1	4	16	4	20	12	3	15	4	1	5	\$3,380	\$1,099	\$4,479
Kerosene to Gas	1	0	1	4	0	4	3	0	3	1	0	1	\$792	\$0	\$792
Propane to Oil	1	0	1	5	0	5	6	0	6	-1	0	-1	\$900	\$0	\$900
No Fuel Switch	675	126	801	3,552	660	4,212	2,964	586	3,550	588	74	662	\$943,875	\$178,497	\$1,122,372
<b>Grand Total</b>	<b>1,699</b>	<b>647</b>	<b>2,346</b>	<b>9,462</b>	<b>3,703</b>	<b>13,165</b>	<b>6,478</b>	<b>2,510</b>	<b>8,988</b>	<b>2,984</b>	<b>1,193</b>	<b>4,177</b>	<b>\$2,542,912</b>	<b>\$1,000,207</b>	<b>\$3,543,119</b>