# SIEMENS

## ENERGY PERFORMANCE CONTRACT

### PERFORMANCE ASSURANCE REPORT

FOR THE

## Town of Gill

Performance Year 2: July 1, 2013 – June 30, 2014

Siemens Industry, Inc.
Canton, MA

SIEMENS

# PERFORMANCE SOLUTIONS AGREEMENT OVERVIEW

Client ..... Town of Gill

Effective Contract Date ..... June 6, 2011

Customer Contact .....Ray Purington, Town of Gill Administrative Assistant

Siemens Contact .....Colleen Fissette, Performance Assurance Engineer

Performance Guarantee Period..... July 1, 2012 to June 30, 2032

Contract Term ..... 20 Years

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# 1. Executive Summary

## Performance Year 2: July 1, 2013 – June 30, 2014

Siemens Industry (Siemens) is pleased to provide the Town of Gill with this Year 2 energy savings guarantee report. This report details the energy performance of the implemented project by comparing realized energy and cost savings for this annual period to the contract guaranteed savings. Your Energy Performance Contract with Siemens guaranteed $11,969 in annual cost savings. Total Year 2 cost savings for this annual period amounted to $13,672 and consisted of $12,943 in Measured and Verified Savings and $730 in Stipulated Energy Savings. Total Year 2 savings are $1,703 in excess of the guaranteed savings for this performance period.

Table 1. Summary of annual guaranteed and verified savings for the Town of Gill

| Annual Period | Measured and Verified Savings | Option D Stipulated Savings | Total Realized Annual Savings | Annual Guaranteed Savings | Savings Excess/ Shortfall |
|---|---|---|---|---|---|
| 1 | $14,002 | $708 | $14,711 | $11,620 | $3,091 |
| 2 | $12,943 | $730 | $13,672 | $11,969 | $1,703 |
| Total | $26,945 | $1,438 | $28,383 | $312,243 | $4,794 |

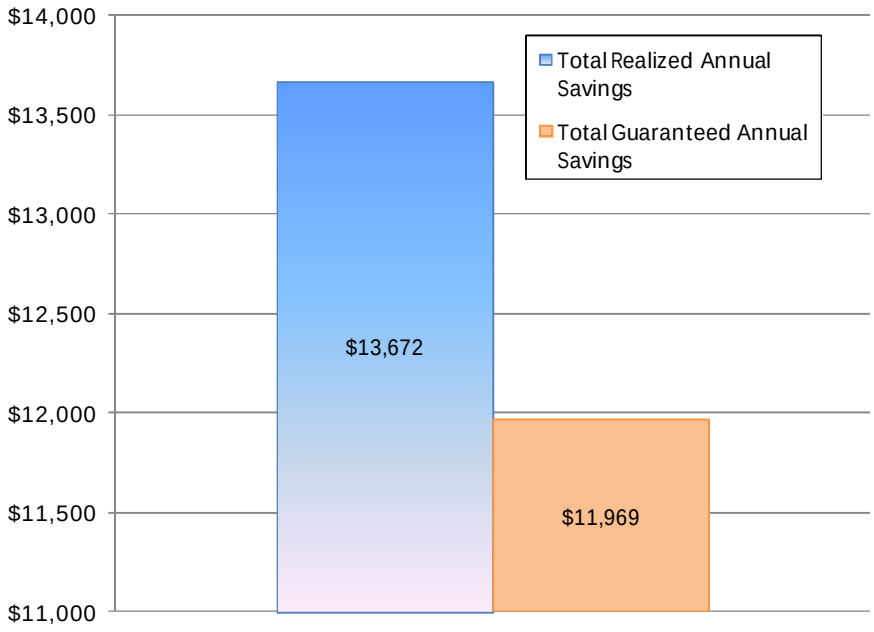



Figure 1. Year 2 Savings Comparison

Table 2. Year-to-Date Energy Savings (Units)

| Energy Savings | Electric Energy Saved (kWh/yr) | #2 Fuel Oil Saved (gal/yr) |
|---|---|---|
| Guaranteed | 24,605 | 3,168 |
| Year -1 | 36,653 | 3,595 |
| Year -2 | 36,653 | 2,972 |
| Total | 73,305 | 6,567 |

Table 3. Realized Energy Savings by FIM (Units)

| Facility Improvement Measure | Energy Saved (kWh/yr) | #2 Fuel Oil Saved (gal/yr) |
|---|---|---|
| Lighting & Controls | 36,653 | (329) |
| Boiler Replacement | | 1,784 |
| EMS | | 1,210 |
| Domestic Hot Water Upgrade (DHW) | | 33 |
| Building Envelope Improvement | | 274 |
| TOTALS | 36,653 | 2,972 |

# 2. Performance Assurance Overview

This section of the report provides an overview of the methodology and parameters used to measure and verify savings for this report and are based on the signed contract between the Town of Gill and Siemens Industry, Inc.

## 2.1 Measurement and Verification Methods

Realized savings were calculated using the methodology described in Attachment F of the energy performance contract. There are four guarantee options to measure and verify savings: Option A - Measured Capacity, Option B - Measured Consumption, Option C - Main Meter Comparison, and Option D - Stipulated.

Option A - Measured Capacity. This approach is intended for Facility Improvement Measures where a one-time measurement for specific equipment or systems instantaneous baseline energy use, and a one-time measurement for specific equipment or systems instantaneous post-implementation (Post) energy use can be measured. Baseline and Post energy consumption is calculated by multiplying the measured end use instantaneous capacity (i.e. – kW, Gal/hr, BTU/hr) by stipulated hours of operation for each mode of operation (i.e. – hours, week, month). The calculations for energy consumption will be defined in the Measurement and Verification article of Attachment F. The work sequence required for data collection, evaluation, and reporting will be defined in the Measurement and Verification article of Attachment A.

Option B - Measured Consumption. This approach is intended for Facility Improvement Measures where continuous periodic measurements for specific equipment or systems baseline energy use, and continuous periodic measurements for that equipment or systems post-implementation (Post) energy use can be measured. The calculations for energy consumption will be defined in the Measurement and Verification article of Attachment F. Periodic inspections and consumption measurements of the equipment or systems will be necessary to verify the on-going efficient operation of the equipment and saving attainment. The predetermined schedule for data collection, evaluation, and reporting will be defined in the Performance Assurance Technical Support Program article of Attachment A.

Option C - Main Meter Comparison. This approach is intended for measurements of the whole-facility or specific meter baseline energy use, and measurements of whole-facility or specific meter post-implementation (Post) energy use can be measured. The methodology to establish baseline and Post parameter identification, modeling approach and baseline or model adjustments will be defined in the Measurement and Verification article of Attachment F. Periodic inspections of baseline energy usage, operating practices, and facility and equipment, and meter measurements of the will be necessary to verify the on-going efficient operation of the equipment, systems, practices and facility, and saving attainment. The predetermined schedule for data collection, evaluation, and reporting will be defined in the Performance Assurance Technical Support Program article of Attachment A.

Option D - Stipulated. This approach is intended for Facility Improvement Measures where the end use capacity or operational efficiency; demand, energy consumption or power level; or manufacturer's measurements, industry standard efficiencies or operating hours are known in advance, and used in a calculation or analysis method that will stipulate the outcome. Both CLIENT and SIEMENS agree to the stipulated inputs and outcome(s) of the analysis methodology. Based on the established analytical methodology the savings stipulated will be achieved upon completion of the Facility Improvement Measures Work and that no further measurements or calculations will need to be performed. The methodology and calculations to establish savings value will be defined in the Measurement and Verification article of Attachment A.

## 2.2 Guaranteed Savings

Guaranteed cost savings are shown below in Tables 4 and 5.

Table 4. Realized and Guaranteed Annual Cost Savings.

| Facility Improvement Measure | M&V Option | Guaranteed Savings |
|---|---|---|
| Lighting & Controls | A | $3,910 |
| Boiler Replacement | B | $4,622 |
| EMS | B | $2,708 |
| Domestic Hot Water Upgrade (DHW) | D | $77 |
| Building Envelope Improvement | D | $652 |
| Totals | | $11,969 |

Table 5. Guaranteed Energy Savings by FIM (Units)

| Facility Improvement Measure | Electric Energy Saved (kWh/yr) | # 2 Fuel Oil Saved (gal/yr) |
|---|---|---|
| Lighting & Controls | 24,605 | (221) |
| Boiler Replacement | | 1,944 |
| EMS | | 1,139 |
| Domestic Hot Water Upgrade (DHW) | | 33 |
| Building Envelope Improvement | | 274 |
| TOTALS | 24,605 | 3,168 |

## 2.3 Utility Rate Structures and Escalation Rates

Utility rates used to calculate dollar savings for this report are based on the baseline year unit rates shown in Table 6. As per contract, an escalation rate of 3% will be applied to the baseline rate for each utility.

Table 6. Summary of Contract Utility Rates for Performance Year 2

| | #2 Fuel Oil ($/gal) | Electric Consumption ($/kWh) |
|---|---|---|
| Gill Elementary School | $2.3773 | $0.1803 |

## 2.4 Baseline Utility Data

Table 7 outlines the utility consumption that occurred during the Baseline period.

Table 7. Baseline Consumption

| Location | Electricity (kWH) | Fuel Oil (Gal) |
|---|---|---|
| Gill Elementary School | 89,062 | 11,201 |

## 2.5 Baseline Operating Data

The operating parameters during the Baseline period are used to determine the guaranteed savings, which are based on the efficiency improvements resulting from implementation of the facility improvement measures (Table 8).

Table 8. Baseline Operating Parameters

| Units | Occupied | Unoccupied | Occupied Hrs/Wk | Unoccupied Hrs/Wk |
|---|---|---|---|---|
| Gill Elementary School | 71 | 68 | 55 | 113 |

## 2.6 Contracted Baseline Operating Data

The guaranteed savings from the facility improvement measures provided under this contract are based on implementation of the following schedules and set points shown in Table 9.

Table 9. Post-Implementation Parameters

| Units | Occupied | Unoccupied | Occupied Hrs/Wk | Unoccupied Hrs/Wk |
|---|---|---|---|---|
| Gill Elementary School | 70 | 60 | 55 | 113 |

# 3. Performance Assurance Results

## 3.1. Summary of Guaranteed and Verified Savings

Total realized annual energy savings for this performance year were $13,672 and were comprised of $5,825 of Option A, $7,118 in Option B, $730 in Option D savings respectively. Total realized annual savings are in excess of the annual guaranteed energy savings of $11,969 by $1,704. The following sections detail the Option A, B, and D savings.

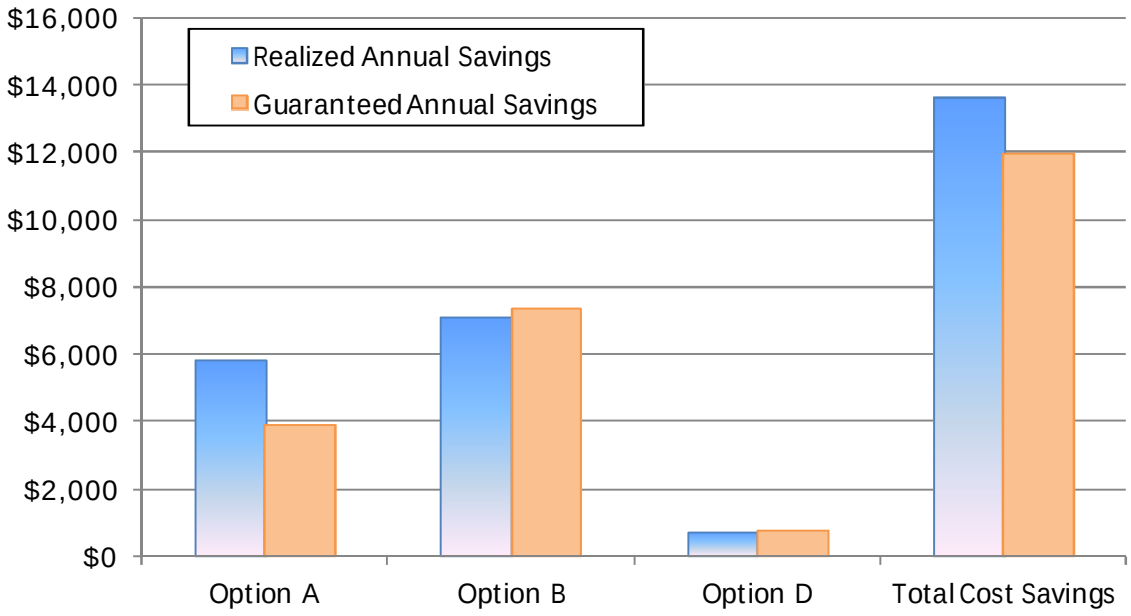



Figure 2. Realized and Guaranteed Annual Cost Savings for Year 2

## 3.2. Option A Savings

### 3.2.1. Performance Year Savings

Option A savings are verified based on one-time measurements taken after substantial completion of each facility improvement measure and the estimated savings are included as ongoing realized savings in each subsequent performance year. The table below summarizes Option A savings realized during the current performance year and shows that total Option A savings amount to $5,825 which is $1,915 above the guaranteed Option A savings of $3,910.

Table 10. Summary of Option A Savings for Performance Year 2

| Facility Improvement Measure | Electric Energy Savings (kWh/yr) | #2 Fuel Oil Savings (Gal) | Realized Annual Cost Savings | Guaranteed Annual Cost Savings | Excess/Shortfall in Savings ($) |
|---|---|---|---|---|---|
| Lighting Upgrade | 36,653 | (329) | $5,825 | $3,910 | $1,915 |

### 3.2.2. Results by Measure

#### 3.2.2.1. Lighting & Controls Retrofit

Energy savings resulting from the lighting retrofit were verified based upon a one-time measurement of the lighting power capacity under existing conditions, a one-time measurement of the lighting power capacity upon completion of the lighting retrofit project and agreed-upon annual operating hours. Table 11 details the savings results from the lighting and controls retrofit. A representative sample of each lighting-fixture type was used to determine pre-retrofit and post-retrofit kW (Table 12).

Table 11. Annual Savings Associated with the Lighting Upgrade

| Lighting Upgrade | |
|---|---|
| Guaranteed Electric Savings (kWh) | 24,605 |
| Realized Electric Savings (kWh) | 36,653 |
| Cost per kWh | $0.1803 |
| Total Electric Cost Savings | $6,607 |
| | |
| Guaranteed Fuel Oil Savings (Gal) | (221) |
| Realized Fuel Savings (Gal) | (329) |
| Cost per Gal | $2.38 |
| Total Fuel Oil Cost Savings | ($782) |
| | |
| Total Guaranteed Savings | $3,910 |
| Total Realized Savings | $5,825 |
| Excess/Shortfall in Savings | $1,915 |

## Table 12. Measured Lighting Fixtures by Type.

| Map Location/ Room Name | ECO # | Qty Metered | Expected Before Watts | Measured Before Watts | Expected After Watts | Measured After Watts |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| Map 21 Main Hallway | C-T8-QLSS-UNV | 14 | 88 | 88 | 62 | 66 |
| Map 21 Main Hallway | C-T8-QLSS-UNV | | 88 | 87 | 62 | 65 |
| Map 10 Room 10 | A-T8-QLSS-UNV | 18 | 60 | 60 | 42 | 40 |
| Map 10 Room 10 | A-T8-QLSS-UNV | | 60 | 60 | 42 | 40 |
| Map 6 Room 6 | EDFW/N-T8-QXPS-UNV | 8 | 109 | 109 | 55 | 46 |
| Map 6 Room 6 | EDFW/N-T8-QXPS-UNV | | 109 | 109 | 55 | 46 |
| Map 5 | EDFW/N-T8-QXPS-UNV | 8 | 109 | 108 | 55 | 45 |
| Map 5 | EDFW/N-T8-QXPS-UNV | | 109 | 108 | 55 | 45 |
| Map 3 Room 3 | EDFW/N-T8-QXPS-UNV | 8 | 109 | 107 | 55 | 40 |
| Map 9 Room 9 | A-T8-QLSS-UNV | 18 | 60 | 59 | 42 | 40 |
| Map 9 Room 9 | A-T8-QLSS-UNV | | 60 | 60 | 42 | 40 |
| Map 16 Kitchen | B-T8-QLSS-UNV | 4 | 112 | 112 | 84 | 85 |
| Map 16 Kitchen | B-T8-QLSS-UNV | | 112 | 111 | 84 | 85 |
| Map 25 Auditorium | VDF-QXPS-UNV | 8 | 455 | 455 | 166 | 160 |
| Map 25 Auditorium | VDF-QXPS-UNV | | 455 | 453 | 166 | 164 |

## 3.3. Option B Savings

### 3.3.1. Performance Year Savings

Realized Option B savings amounted to $7,118 which is $212 short of Year 2 guaranteed Option B savings of $7,329. These realized savings are calculated each year based on measurements and methods outlined in Attachment F of the performance contract.

In order to increase Option B energy savings, Siemens recommends that the Town of Gill ensures regular preventative maintenance is performed annually on the boiler replacement and continuing to follow the night setback as contracted.

Table 13. Summary of Option B Savings for Performance Year 2

| Facility Improvement Measure | #2 Fuel Oil (gal/yr) | Realized Annual Cost Savings | Guaranteed Annual Cost Savings | Excess/Shortfall in Savings ($) |
|---|---|---|---|---|
| Boiler Replacement | 1,784 | $4,241 | $4,622 | ($381) |
| EMS (Setback) | 1,210 | $2,877 | $2,708 | $169 |
| Total Option B Savings | 2,994 | $7,118 | $7,329 | ($212) |

#### 3.3.2.1 Boiler Replacement

Siemens replaced the large existing steam boiler at Gill Elementary with a new smaller oil fired sectional steam boiler. Energy savings were achieved through downsizing the boiler capacity and increasing combustion efficiency while continuing to meet the required load of the building. Savings from downsizing the boiler is the result of the reduction in jacket and off-cycle flue losses from 2.5% and 1% respectively to 0.5% and 0.5% as calculated in the amended energy model. To verify savings for the increase in efficiency from the old boiler and new boiler a combustion efficiency test was performed at high and low fire. The average efficiency of 82.5% was less than the proposed efficiency of 85%. The results from the boiler combustion efficiency test are provided in the appendix of this document.

Table 14. Savings Associated with the Boiler Replacement

| Boiler Replacement | |
|---|---|
| Guaranteed Efficiency | 85.0% |
| Measured Efficiency | 82.5% |
| | |
| Guaranteed Fuel Oil Savings (Gal) | 1,944 |
| Realized Fuel Savings (Gal) | 1,784 |
| Cost per Gal | $2.38 |
| Total Fuel Oil Cost Savings | $4,241 |
| | |
| Total Guaranteed Savings | $4,622 |
| Total Realized Savings | $4,241 |
| Excess/Shortfall in Savings | ($381) |

The boiler efficiency has lowered by an average of 5.60% since the start up test was taken on October 7, 2011. Siemens recommends that the Town of Gill ensures regular preventative maintenance is performed annually.

Table 15. Combustion Efficiency Comparison, Start-up vs. Year 2

| Combustion Test Results | | | |
|---|---|---|---|
| Firing Rate: | High | Low | Average |
| 10/7/2011 | 87.40% | 88.80% | 88.10% |
| 2/19/2014 | 81.70% | 83.30% | 82.50% |
| Efficiency Change | 5.70% | 5.50% | 5.60% |

### 3.3.2.2 Energy Management System (EMS)

Siemens furnished and installed a Siemens APOGEE Building Automation System at the Gill Elementary School. The following control strategies were implemented.

Night Setback:

Conditioned spaces in Gill Elementary School are automatically "setback" during unoccupied periods by the EMS. The setbacks reduce electrical energy consumption by reducing or eliminating operation of the applicable supply and return fans and setting space temperatures to reduce the cooling load when areas are unoccupied. Thermal heating savings were also achieved during the setback periods, when space temperatures are automatically lowered during the heating season to reduce the heat transfer losses through the building envelope. As contracted, Siemens continuously monitored the different variables of the control strategy and completed a one month sample trend report to ensure that the proposed set points are being followed by the Town of Gill. Savings for night setback were determined through trending space temperature set points and schedules, the results are shown in Table 17. Temperature set points are slightly different from the contracted 60°F during unoccupied hours and 70°F. Actual set points were found to be on average 61°F during unoccupied hours and 70°F during occupied hours, with some individual units deviating.

Table 16. Savings Associated with the EMS.

| Energy Management System | |
|---|---|
| Guaranteed Fuel Oil Savings (Gal) | 1,139 |
| Realized Fuel Savings (Gal) | 1,210 |
| Cost per Gal | $2.38 |
| Total Fuel Oil Cost Savings | $2,877 |
| | |
| Total Guaranteed Savings | $2,708 |
| Total Realized Savings | $2,877 |
| Excess/Shortfall in Savings | $169 |

Table 17. Results of Night Setback trend reports, November 2013

| Unit | Occupied Temperature | Occupied Set point | Unoccupied Temperature | Unoccupied Set point |
|---|---|---|---|---|
| FCU 4 | 73 | 70 | 68 | 60 |
| RAD 1 | 72 | 70 | 67 | 60 |
| RAD 2 | 68 | 64 | 65 | 60 |
| RAD 3 | 70 | 72 | 65 | 72 |
| RAD 7 | 71 | 70 | 68 | 60 |
| RAD 10 | 70 | 70 | 67 | 60 |
| RAD 18 | 72 | 70 | 66 | 60 |
| UV 5 | 72 | 70 | 65 | 60 |
| UV 6 | 72 | 70 | 66 | 60 |
| UV 9 | 74 | 68 | 70 | 60 |
| UV 11 | 74 | 73 | 68 | 60 |
| UV 12 | 72 | 70 | 67 | 60 |
| UV 13 | 72 | 70 | 66 | 60 |
| UV 14 | 72 | 68 | 67 | 60 |
| UV 15 | 71 | 70 | 65 | 60 |
| UV 16 | 72 | 70 | 65 | 60 |
| UV 17 | 72 | 70 | 64 | 60 |
| Average | 72 | 70 | 66 | 61 |

In addition to the one month sample trend report an analysis was done to ensure that set points were being followed during the heating season. It was found that set points have been modified outside of contracted parameters, outlined in Article 2.6 of this document and 7.1 of Attachment F in the Performance Contract. To ensure that the Town of Gill will realize savings in future the performance assurance team had asked the Siemens service team to release points in operator were applicable during their latest scheduled service appointment (September 5, 2014) to follow the contracted post-implementation operating temperatures. Additional training is available at the customer's convenience to ensure that all parties understand the intent of the control strategy and energy savings potential that can be realized at the Gill Elementary School.

## 3.4. Option D Stipulated Savings

Realized Option D savings amounted to $730 and are based on the predicted savings calculated in the detailed energy audit as agreed upon in the performance contract.

### 3.4.1. Performance Year Savings

Table 18. Summary of Option D Stipulated Savings.

| Facility Improvement Measure | Fuel Oil (gallons/yr) | Realized Annual Cost Savings | Guaranteed Annual Cost Savings | Excess/Shortfall in Savings ($) |
|---|---|---|---|---|
| Domestic Hot Water Upgrade | 33 | $77 | $77 | $0 |
| Building Envelope Improvements | 274 | $652 | $652 | $0 |
| Total Option D Savings | 307 | $730 | $729 | $0 |

#### 3.4.2.1 Building Envelope

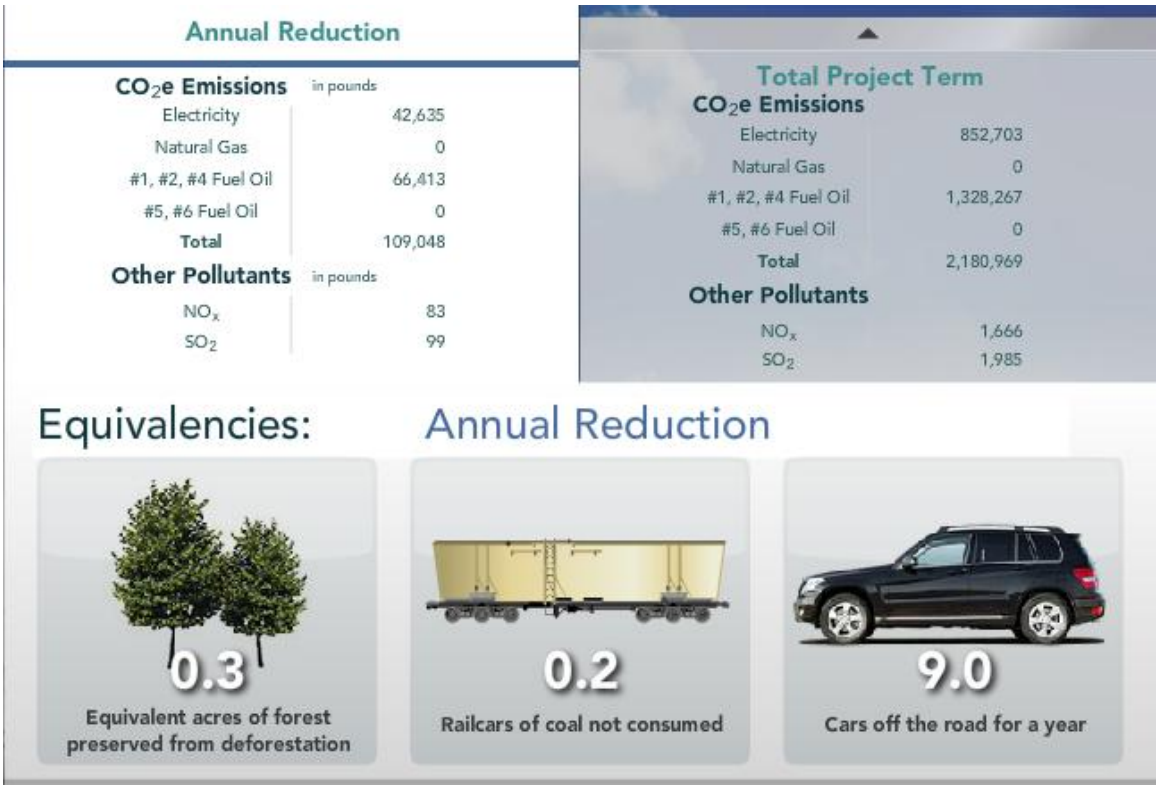
To control air leakage Siemens' sealed gaps, cracks, and holes using appropriate materials and systems in sixteen exterior door sweeps and unit ventilator wall gaps.

#### 3.4.2.2. Domestic Hot Water Upgrade

Siemens installed a new domestic hot water heater with an efficiency of 83%.

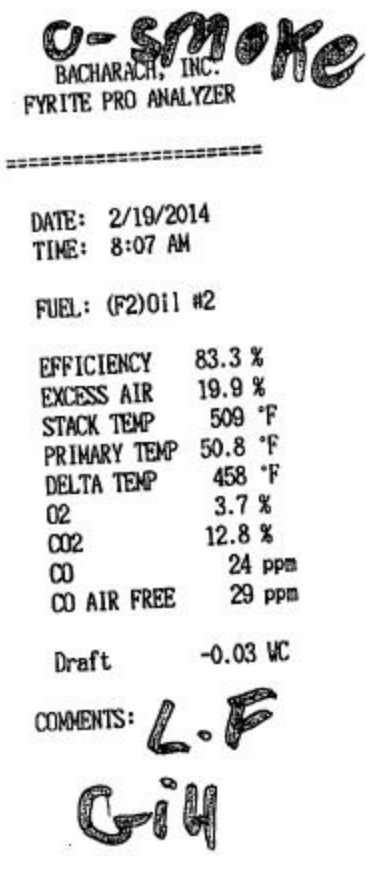
# 5. Emissions Reduction

The following table converts the energy savings (electric, fuel oil, propane, etc.) into pounds of carbon dioxide that would have been released into the atmosphere if this project was not performed. These values are then converted into everyday examples to illustrate how this performance contract has decreased the carbon footprint of the Town of Gill. For example, from the table below, the realized energy savings avoided the equivalent of the carbon dioxide emission of 9 cars in Year 2.



# 6. Appendices

## 6.1 Combustion Efficiency Results



O-SMOKE
BACHARACH, INC.
FYRITE PRO ANALYZER

==========

DATE: 2/19/2014
TIME: 8:07 AM

FUEL: (F2)Oil #2

| | |
|---|---|
| EFFICIENCY | 83.3 % |
| EXCESS AIR | 19.9 % |
| STACK TEMP | 509 °F |
| PRIMARY TEMP | 50.8 °F |
| DELTA TEMP | 458 °F |
| O2 | 3.7 % |
| CO2 | 12.8 % |
| CO | 24 ppm |
| CO AIR FREE | 29 ppm |
| Draft | -0.03 WC |

COMMENTS: L.F
Gill

Gill
O-SMOKE
BACHARACH, INC.
FYRITE PRO ANALYZER

==========

DATE: 2/19/2014
TIME: 7:56 AM

FUEL: (F2)Oil #2

| | |
|---|---|
| EFFICIENCY | 81.7 % |
| EXCESS AIR | 9.8 % |
| STACK TEMP | 625 °F |
| PRIMARY TEMP | 54.1 °F |
| DELTA TEMP | 571 °F |
| O2 | 2.0 % |
| CO2 | 14.1 % |
| CO | 52 ppm |
| CO AIR FREE | 58 ppm |
| Draft | 0.06 WC |

COMMENTS:
HF