HOUSE

NIGHT TEMPERATURE

REDUCTION

ENERGY

CASE STUDY

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CONTENTS

PREFACE

APS DOES NOT WORK ON RESIDENTIAL HEATING AND COOLING SYSTEMS. WE HAVE PREPARED THIS CASE STUDY SOLEY TO ADDRESS A COMMON MYTH REGARDING NIGHT SET BACK IN HOUSES.

INCORRECT INFORMATION RELATING TO RESIDENTIAL NIGHT SET BACK, NEEDLESSLY INCREASES OUR TOTAL POLLUTION IMPACT.

USING NIGHT SET BACK AND REDUCING YOUR DAYTIME TEMPERATURE WILL REDUCE YOUR CONTRIBUTION TO THE POLLUTION PROBLEM AND SAVE YOU MONEY.

THE BACK PAGE OF THIS REPORT IS A DRAWING ILLUSTRATING A CHANGE MADE TO A HOUSE IN 1981.

THE CHANGES IMPROVED THE COMFORT IN THE HOUSE AND REDUCED THE ENERGY CONSUMPTION, BY MAXIMIZING THE BENEFIT OF SOLAR GAIN.

PURPOSE OF CASE STUDY

Often people express the opinion that more heat is required regaining daytime temperature, than is saved over night, if night temperature reduction is used. Based on this opinion, they control their houses to daytime temperatures, both day and night.

This case study graphically disproves this opinion illustrating the energy use of one house under three operational scenarios.

(1) The house operating at 21°C (70°F) day and night.
(2) The house operating at 21°C (70°F) day and 14.5°C (58°F) night.
(3) The house operating at 17.2°C (63°F) day and 14.5°C (58°F) night.

This single point of false information **contributes cumulative damage to our children's future** by causing excessive emission of green house gasses into the atmosphere. We wish to address this situation, saving families money, as well as relieving the environment of the additional pollution burden. (Work with your heating experts to assess the best set up for your house.)

DATA COLLECTION METHOD

The component arrangement allowed reading and graphing the boiler's percentage firing time, the outside temperature and the indoor temperature.

The readings occurred every eight seconds and averaged into forty second logging points.

ANALYSIS OF DATA

We consider the relative run time of the boiler, while running under the three different scenarios, the indicator of comparative energy use.

GENERAL

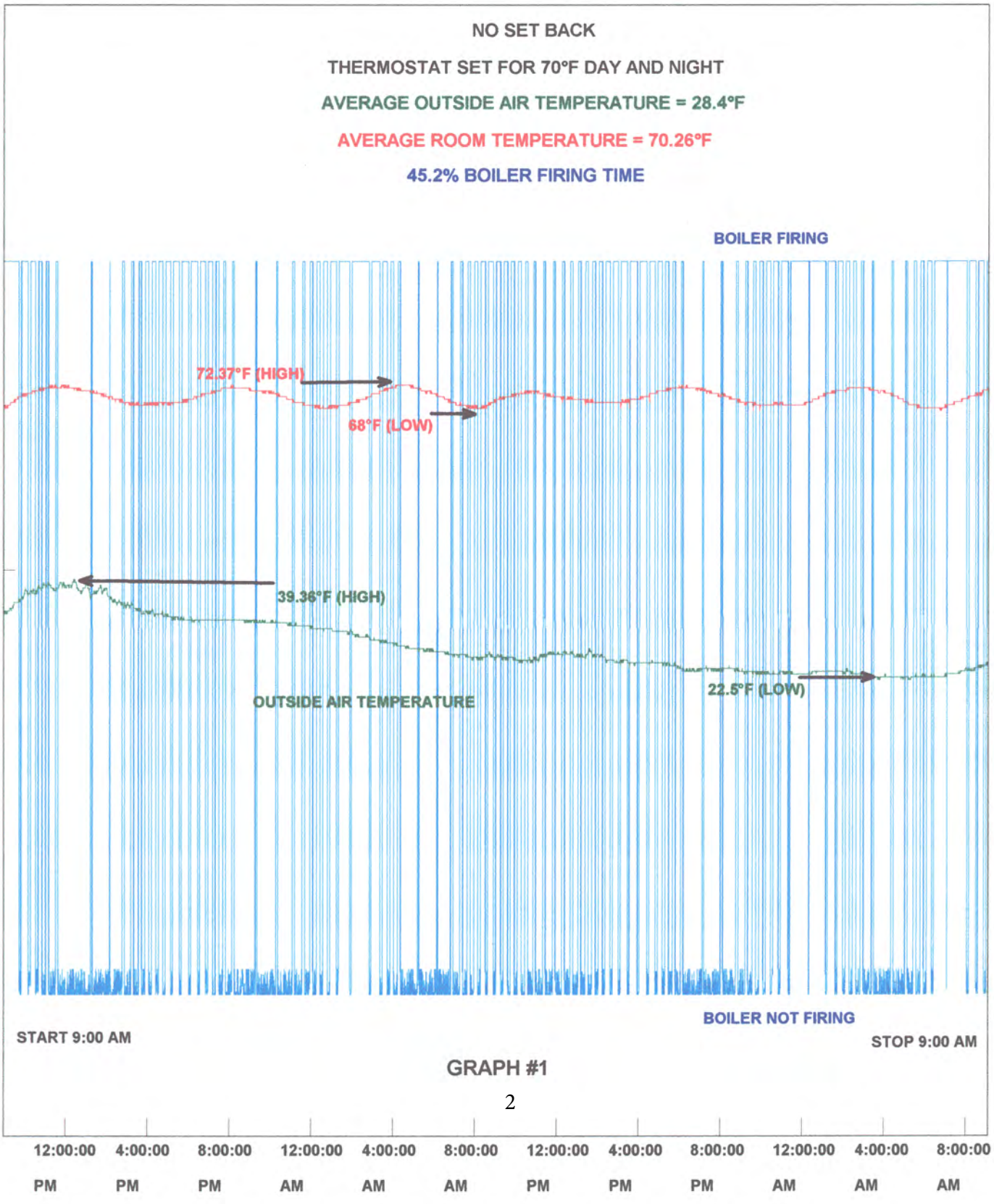
We have focused on improving building energy performance since 1976 in commercial, industrial and institutional environments. The vast majority of buildings required a multiple front approach to reducing energy use with night set back being only one of many techniques simultaneously employed. Although night set back has been a factor in nearly all, there are only two examples allowing isolation of the benefit relating to night set back.

(1) In 1976, we worked in cooperation with the Scarborough Board of Education assessing the relative savings as different techniques were employed. We used an identical building, built to the same specifications as our test building, as a control reference. The energy use reduction relating to only night set back was 15%, while the total energy reduction employing the three tested techniques simultaneously, was 43%.

(2) The oil section of Wendell Statton S., PS in Scarborough only enjoyed the benefit of night set back allowing a 19.5% reduction in energy use. (See chart last page)

The dollar saving in this case study is significant, comparing the house at a constant 70°F to its normal operation; however, this case study is not about saving dollars. It is intended as one technical document, added to our collective effort, in the attempt to preserve the children's future.

HOUSE SET BACK COMPARISON



GRAPH #1

GRAPH #1

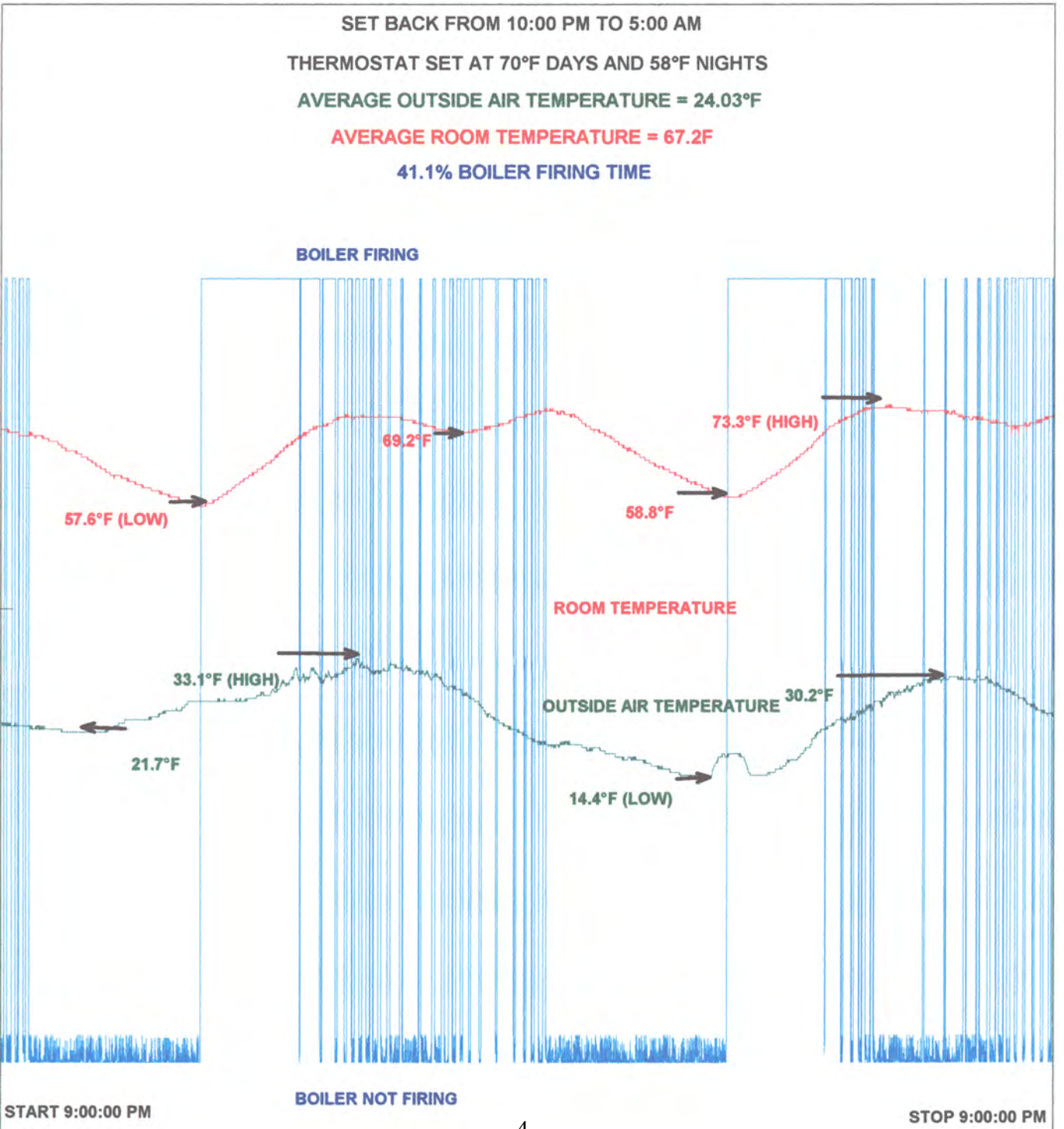
Graph #1 illustrates the energy performance of a house that has a hot water boiler with cast iron radiators.

The red line illustrates the room temperature, the green line illustrates the outside air temperature and the blue line illustrates the run time of the burner.

The computer trending program provides the highest, the lowest and the average value for each of the three channels.

The boiler was required to run 45.2% of the time, maintaining the house at an average temperature of 70.26°F, with an average outside air temperature of 28.4°F.

HOUSE SET BACK COMPARISON



GRAPH #2

12:00:00 AM | 4:00:00 AM | 8:00:00 AM | 12:00:00 PM | 4:00:00 PM | 8:00:00 PM | 12:00:00 AM | 4:00:00 AM | 8:00:00 AM | 12:00:00 PM | 4:00:00 PM | 8:00:00 PM

GRAPH #2

Graph #2 illustrates the energy performance of the same house with the thermostat reprogrammed to control at 70°F during the day and 58°F during the night.

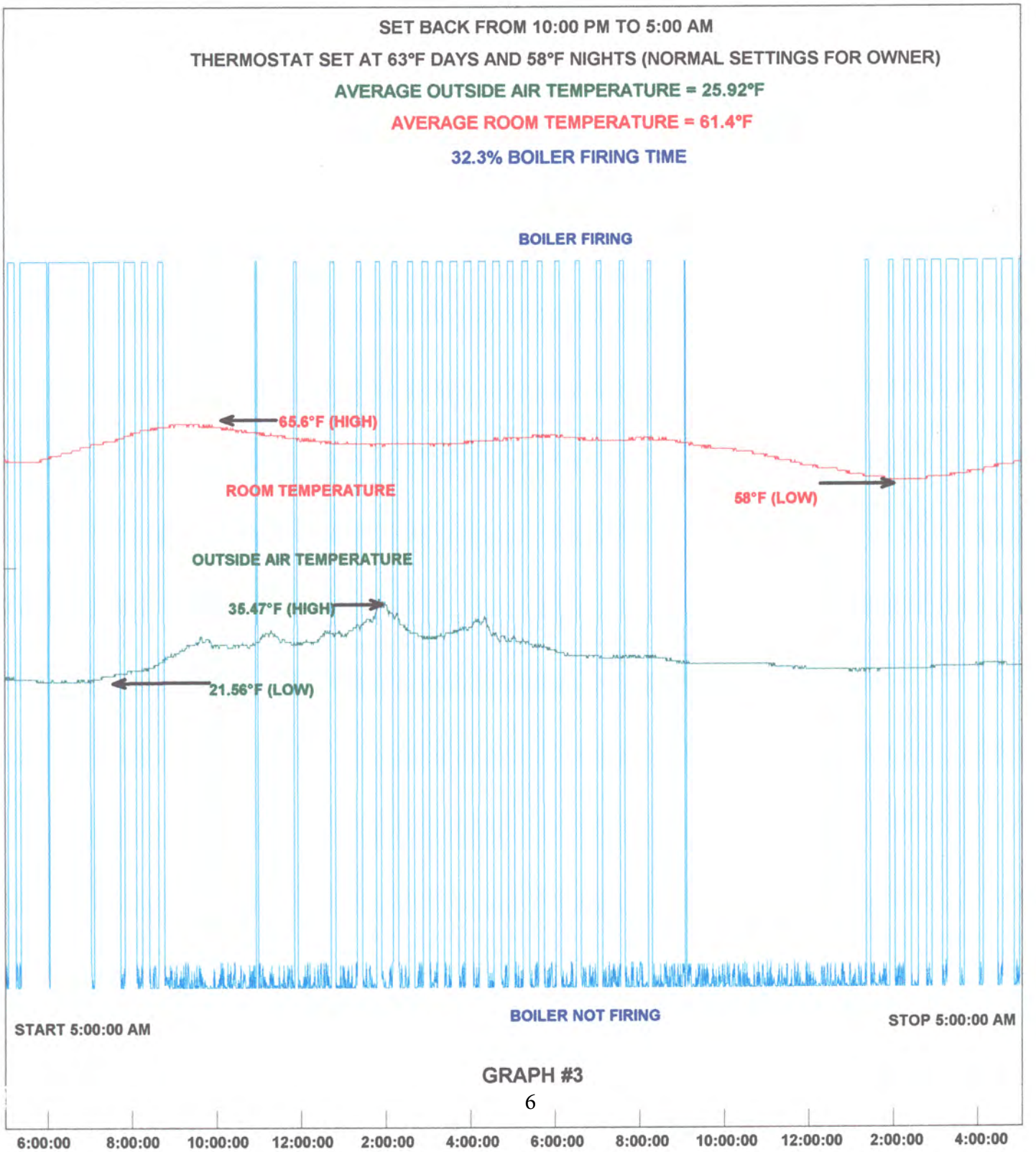
The red line illustrates the room temperature, the green line illustrates the outside air temperature and the blue line illustrates the run time of the burner.

The computer trending program provides the highest, the lowest and the average value for each of the three channels.

The boiler was required to run 41.1% of the time, maintaining the house at 70°F during the day and limiting the house to a minimum of 58°F during the night with an average outside air temperature of 24.03°F.

The boiler run time dropped by 9% using the night set back schedule; despite the fact that the outside air average temperature was 4.37F° colder than the first scenario.

HOUSE SET BACK COMPARISON



GRAPH #3

GRAPH #3

Graph #3 illustrates the energy performance of the same house with the thermostat reprogrammed to control at 63°F during the day and 58°F during the night. This programming reflects the normal values of operation that suit the owner.

The red line illustrates the room temperature, the green line illustrates the outside air temperature and the blue line illustrates the run time of the burner.

The computer trending program provides the highest, the lowest and the average value for each of the three channels.

The boiler was required to run 32.3% of the time, maintaining the house at 63°F during the day and limiting the house to a minimum of 58°F during the night with an average outside air temperature of 25.92°F.

The boiler run time dropped by 28.5% from the first scenario using the reduced day setting with the night set back schedule; despite the fact that the average outside air temperature was 2.48F° colder.

From our environment's viewpoint, the increase in run time from 32.3% in the third scenario, to the 45.2% in the first scenario, represents an increased energy consumption of 39.9%.

THE BOARD OF EDUCATION FOR THE BOROUGH OF SCARBOROUGH

CONTROL MODIFICATIONS BY

A P S

SCHOOL	UTILITY	ANNUAL REDUCTION	1979 UTILITY COST	UTILITY SAVINGS **	$	IMPROVEMENT COST	PAYBACK YR.
MILITARY TRAIL JR. PS	GAS	31.1%	9,863	2315	4,073	4,072	1
	ELECTRIC	20.9%	11,217	1758			
JACK MINER PS	GAS	20.4%	14,338	2194	4204	3,287	0.8
	ELECTRIC	17.8%	15,059	2010			
ALEXMUIR JR. PS	GAS	29.5%	7,308	1617	3515	2,699	0.8
	ELECTRIC	24.6%	10,285	1898			
SILVER SPRINGS PS	GAS	37.8%	6,425	1822	3,973	1943	0.5
	ELECTRIC	36.6%	7,835	2151			
WENDELL STATTON SR. PS →	GAS	57.6%	10,221	4415	10,114	5300	0.5
	OIL	19.5%	16,463	3210			
	ELECTRIC	22.6%	14,684	2489			
TIMBERBANK PS	GAS	17.1%	8,142	1044	2,784	2110	0.8
	ELECRIC	22.1%	10,499	1740			
WEST HILL C.I.	OIL	8.1%*	46,552	3771	24,419	36,370	1.5
	ELECTRIC	10.9%*	51,974	4249			
	GAS	51.8%*	42,211	16,399			
				TOTALS	53,082	55,781	1.05

- * - PART YEAR ONLY
- ** - GAS AND ELECTRIC @ 75% OIL @ 100%

JRM/sc June 18, 1981

LETTER FROM SCARBOROUGH BOARD ACCOMPANYING CHART ABOVE

Gentlemen:

During early 1979 control improvements were carried out by your firm on a number of our schools. These schools are listed on the attached schedule which indicates the savings that have been achieved.

For clarification purposes, it should be noted that:

a) no allowance has been made for the fact it was 4.7% colder in 1980 than in 1979.

b) The utility costs are 1979 actuals and no allowance has been made for escalation.

c) The majority of the savings are undoubtedly higher as the modifications were not in effect for the entire year.

d) We have assumed only 75% of the actual gas and electricity savings because of the sliding scale rate structures.

e) Approximately $17,000. Is included in the cost of improvements at West Hill Collegiate for other work that was performed at the time aimed primarily at improving poor environmental conditions.

It is almost needless to say that we are very pleased with the results and the manner in which they were carried out.

Yours very truly
J.R. Mazanik

A system was designed and installed as per figure "A".

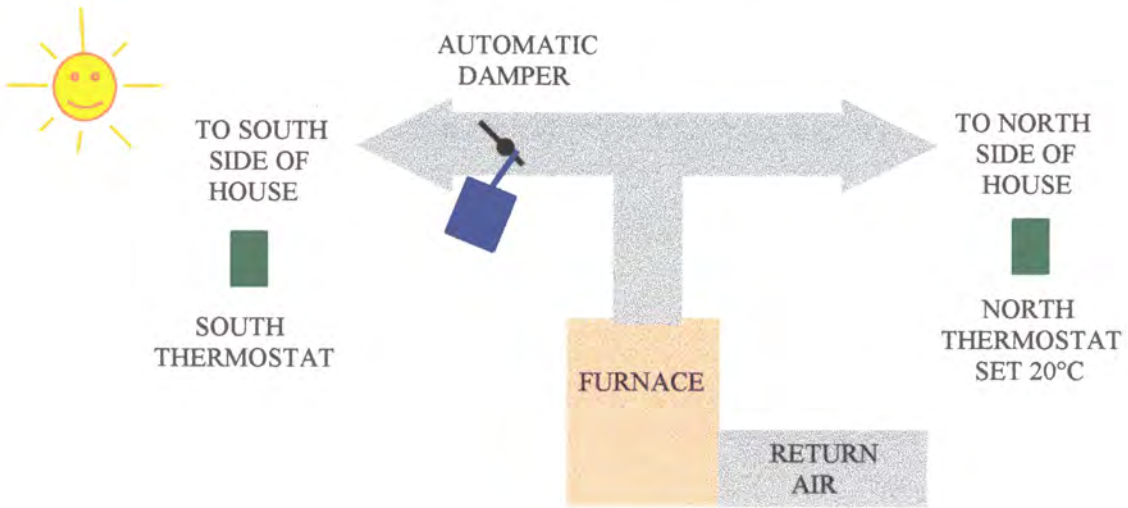


FIGURE "A"

The three modes of operation allowed;

(1) If the south side is below 20°C, the automatic damper is open and the north thermostat operates to heat the whole house with the furnace fan at medium speed.

(2) If the south side is between 20°C and 23°C, the automatic damper closes and the north thermostat operates heating only the north side of the house with, the furnace fan at low speed. (At these times, the solar gain is heating the south side of the house.)

(3) If the south side is over 23°C, the automatic damper opens and the furnace fan runs at high speed. (This mode uses the heat of the south side to warm up the north side and the cooler air from the north side to reduce the over-heating on the south side. If the north thermostat activates the heating during this mode, the automatic damper closes until the gas heating terminates.)

The alterations improved the comfort levels and reduced the energy use of the house.