TWIN RIVERS PROJECT
PUBLIC DATA SET DOCUMENTATION

by

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Section A - Welcome to the Twin Rivers Data Set

During the years 1973 to 1977, Princeton University's Center for Environmental Studies instrumented a number of townhouses at Twin Rivers as part of a study on energy consumption and conservation. The data collected include air temperature in various parts of the building, the thermostat setting, the gas used by the furnace, the on-time of the water heater, the total electric consumption, door and window open-times, and attic fan on-times. In addition, weather data were also collected from a weather station on-site.

The data acquisition system OMNIBUS can record up to 12 channels of data hourly and was widely used at Twin Rivers. At one time or another twenty seven houses were instrumented using the Omnibus system, usually for several seasons.

The Twin Rivers public data set is a collection of Omnibus data from these houses and the weather data.

The instrumentation package as well as a number of studies based on this type of data are described in the Journal Energy and Buildings, Vol 1, No 3 (1978) and reprinted in the book, Saving Energy in the Home, edited by R. Socolow (Ballinger). The data set whose detailed description is attached should only be used in conjunction with the journal issue or the book. These volumes also carry numerous citations to other published work based on the same data set.

The public data set is contained in a single reel of magnetic tape. This 2400 ft tape has data recorded in EBCDIC notation at 1600 BPI. The tape carries an IBM standard label, i.e. the actual file organization on the tape is as follows:

Item	Size (bytes)
Volume Label (INVOLID) = 2269	80
Header 1	80
Header 2	80
Data file #1	(logical record length = 80, block size = 9600)
Trailer 1	80
Trailer 2	80

This pattern - two "headers" preceding and two "trailers" following each data file - is continued for each of the data files; the trailers following the last data file are followed by a double end-of-file. (As noted above, all data records are of fixed length - 80 bytes - blocked into 9600 bytes).

An index of files on the tape and a description of the data sets are presented in Section B. The house condition was changed by various retrofits and the type of data recorded changed periodically. A guide to the instrumentation and retrofit status of each house at any time is presented in Section C.

Conventions about Appliances

The channels dedicated to energy consumption by furnace, air conditioner, and water heat are all timer channels, which record the minutes each of these appliances was on over the hour.

For peculiar reasons, the output of the Public Data Set cannot be read immediately as minutes on per hour, because the output contains a multiplicative factor that must be divided out. To obtain minutes on per hour:

a) for the furnace, multiply the output value by 10/13.

b) for the air conditioner, multiply the output value by 13 1/3

c) for the water heater, multiply the output value by 18 3/4.

The energy consumption by each of these appliances can be estimated from the minutes on per hour by multiplying by the nominal rate of energy consumption of the appliance. These nominal rates are:

a) for the furnace

Quad II (TR 1-14, 16, 19, 27) 80,000 Btu/hr.

Quad III (TR 17, 18, 20-26) 105.000 Btu/hr.

b) for the air conditioner

TR 26 (29,000 Btu/hr. unit): electric power consumption by compressor at a rate of 3.9 kW

All other townhouses (24,000 Btu/hr. unit): electric power consumption by compressor at a rate of 3.2 kW.

c) for the water heater

electric: Quad II (TR 1-14, 16, 19, 27) 4.5 kW

gas: Quad III (TR 17, 18, 20-26) 45,000 Btu/hr.

Combining the two preceding paragraphs, one obtains the result that the output of the public Data Set is approximately:

a) for the gas furnace in Quad II (but not in Quad III), the hourly gas consumption in kBtu.

b) for the air conditioner (except in townhouse 26), the hourly electric consumption in kWh.

c) for the water heater in Quad II, the hourly electric consumption in kWh.

d) for the water heater in Quad III, the hourly gas consumption in units of 10^4 Btu/hr.

Notes on the data

1. Re all winter and summer data, the total electric channel is read directly in kWh from a watt-hour meter.

2. Re all winter and summer data, electric consumption of the water heater in kWh per hour assumes the water heater element draws power at a rate of 4.5 kW. (Data were taken originally in minutes on per hour.)

3. Re all winter data, gas consumption in cubic feet per hour assumes furnace consumes exactly 1.30 cubic feet of gas per minute on, (or 80,000 Btu/hour at 1025 Btu/cubic feet) (Data were taken originally in minutes on per hour.)

4. Re all summer data, electric consumption of the air conditioner in kWh per hour assumes the air conditioner draws power at a rate of 3.3 kW. (Data were taken originally in minutes on per hour.)

5. Re all winter data, "other electric" is calculated by subtracting water heater consumption from total electric consumption.

6. Re all summer data, "other electric" is calculated by subtracting the sum of water heater consumption and air conditioner consumption from total electric consumption.

7. Re data from houses with instrumented attic fans, the electric consumption of the attic fan in kWh per hour assumes the attic fan draws power at the rate of 4.5kW. The attic fans draw about 210W so that the correct figures are obtained from the recorded values by multiplying by 0.0467. (Data were taken originally in minutes on per hour.)

8. Re data from TR14, which had an instrumented humidifier, the water consumption data is not useful as the resident turned off the humidifier shortly after installation, because of excessive humidity.

A Brief Description of the Experiments

Standard Winter and Summer Experiments

Modeling the furnace gas use was a major objective in winter. One of the timers was used during winter to record the on-time of the furnace gas valve. During summer, the same channel was switched to record the on-time of the air conditioner. The dates of the instrumentation changes in each house are recorded in Section C. Typical analyses are reported in Energy and Buildings Vol 1, No.3 and references cited therein.

Attic Temperature and Attic Fan Experiments

To evaluate the performance of powered attic ventilation and its impact on air conditioner energy use, some of the houses were retrofitted with attic fans; additional temperature sensors were introduced into their attics, and one of the timers was wired to record attic fan on-time. Although the dates of this retrofit and the instrumentation changes are indicated in Section C, users interested in these data should also consult Forced Ventilation for Cooling Attics in Summer (G.S.Dutt and D.T. Harrje, presented at the Attic Ventilation Workshop sponsored by the National Bureau of Standards, July 1978)

Humidifier Experiment

In order to determine the influence of humidification on furnace gas consumption, some houses were retrofitted with humidifiers. As in the attic experiments, retrofit dates and instrumentation changes are indicated in Section C but potential users should refer to The Effect of Humidification on Space Heating Energy Requirements in Twin Rivers Townhouses (D.T.Harrje and J.R.Spriegel, Princeton University Center for Environmental Studies, July 1978)

A Warning about Bad Data

As with any data set this is not free of errors and omissions. Missing data is often marked as "-99.99" as indicated in Section B. However, there were breakdowns in various channels of data - some of relatively short duration, some longer. It has not been possible to validate every single data entry. Care should be exercised when interpreting the data. In most cases, bad data is non-physical and therefore obvious, e.g. an electric meter reading that is zero for a long period of time. In addition , we would like to caution users against the "doors and windows open-time", the thermostat setting and the total electric consumption data.

The weather data has some problems too. To start with, the data set name in the final version appears to be "ATHER.TWIN.RIVERS" and not "WEATHER.TWIN RIVERS" as intended. There was never any attempt to validate the barometric pressure, which for our purposes was an unimportant data channel. There were two wind speed meters - one recording instantaneous wind speed three times an hour, the other recording 20-minute average wind speeds. Each is recorded on tape as a single hourly average value. A comparison between the two values indicates when one is not functioning correctly. (There were short periods of time when neither was working). Similarly there are four solar flux channels. Of these, one recorded the shaded solar flux for a few months early in the program. However, the data is suspect because of occasional improper shading leading to exaggerated values. The other three data channels, based on two solar flux meters, can be used to check whether either meter was malfunctioning. An important item - the outdoor dry bulb temperature - was checked against the National Weather Service data recorded at Trenton, N.J.

Section B - Description of Files on Omnibus Data Set

B1 Tape Description (list of files)

B2 File Listing in Matrix Form

B3 Data Description -- Format for Files

TAPE DESCRIPTION (List of files)

file number	data set name	file number	data set name
1	HOUSE19.SUMMER75	26	HOUSE17.WINTER76
2	16.	27	18.
3	14.	28	19.
4	13.	29	HOUSE21.WINTER76
5	12.	30	HOUSF01.SUMMER76
6	11.	31	02.
7	09.	32	03.
8	06.	33	04.
9	05.	34	05.
10	HOUSE01.SUMMER75	35	06.
11	HOUSE01.WINTER76	36	07.
12	02.	37	08.
13	03.	38	09.
14	04.	39	10.
15	05.	40	11.
16	06.	41	12.
17	07.	42	13.
18	08.	43	14.
19	09.	44	16.
20	10.	45	17.
21	11.	46	18.
22	12.	47	19.
23	13.	48	20.
24	14.	49	21.
25	HOUSE16.WINTER76	50	HOUSE22.SUMMER76

TAPE DESCRIPTION cont'd

file number	data set name
51	HOUSE23.SUMMER76
52	24.
53	25.
54	HOUSE26.SUMMER76
55	HOUSE01.WINTER77
56	03.
57	04.
58	05.
59	06.
60	07.
61	08.
62	09.
63	10.
64	11.
65	12.
66	13.
67	14.
68	16.
69	17.
70	18.
71	19.
72	20.
73	21.
74	22.
75	HOUSE23.WINTER77

file number	data set name
76	HOUSE24.WINTER77
77	25.
78	26.
79	HOUSE27.WINTER77
80	HOUSE01.SUMMER77
81	03.
82	04.
83	05.
84	06.
85	09.
86	10.
87	13.
88	14.
89	16.
90	17.
91	18.
92	19.
93	20.
94	21.
95	23.
96	24.
97	25.
98	26.
99	HOUSE27.SUMMER77
100	ATHER.TWIN.RIVERS

Files in Matrix Form

Time	HOUSE 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Summer 75	10				9	8			7		6	5	4	3		2			1								
Winter 76	11	12	13	14	15	16	17	18	19	20	21	22	23	24		25	26	27	28		29						
Summer 76	30	31	32	33	34	35	36	37	38	39	40	41	42	43		44	45	46	47	48	49	50	51	52	53	54	
Winter 77	55		56	57	58	59	60	61	62	63(b)	64	65	66	67(c)		68(b)	69	70(b)	71	72	73	74	75	76	77	78	79(d
Summer 77 (f)	80		81	82	83	84			85	86(e)			87	88(c)		89(e)	90	91(e)	92	93	94		95	96	97	98	99(e

Note: File 100 is weather

(a) No House 15 exists

(b) Humidifier and attic temperature experiments

(c) Humidifier experiment

(d) Attic temperature experiment

(e) Attic temperature and attic fan experiment

(f) July 1977 data were lost in all houses

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TWIN RIVERS PROJECT DATA DESCRIPTION

Data Set Name : HOUSEnn.SUMMER75 , where nn is the house number

Contents : Omnibus house data

Duration of Data : summer 75

Interval of Data : hourly

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	PL/I FORMAT	REMARKS
house number	1,5,6,9,11-14,16,19		F(2)	
month	1-12		F(2)	
day	1-31		F(2)	
hour	0-23		F(2)	
upstairs temperature		°F	F(6,2)	= -99.99 when missing
downstairs temperature		°F	F(6,2)	"
basement temperature		°F	F(6,2)	"
thermostat setting		°F	F(6,2)	"
doors & windows open time (front)		minutes/hr	F(6,2)	"
doors & windows open time (rear)		minutes/hr	F(6,2)	"

summer 75

(cont'd)

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
air conditioner		Kwh	F(8,4)	= - 99.99 when missing
hot water		Kwh	F(8,4)	"
other electric consumption		Kwh	F(8,4)	"
total electric consumption		Kwh	F(8,4)	"

Note: The value of the variable 'other electric consumption' is the difference between the total electric power consumption and the sum of the air conditioner and hot water power consumption.

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TWIN RIVERS PROJECT DATA DESCRIPTION

Data Set Name : HOUSEnn.WINTER76, where nn is the house number

Contents : Omnibus house data

Duration of Data : winter 75-76

Interval of Data : hourly

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
house number	1,14,16-19,21		F(2)	
month	1-12		F(2)	
day	1-31		F(2)	
hour	0-23		F(2)	
upstairs temperature		°F	F(6,2)	= - 99.99 when missing
downstairs temperature		°F	F(6,2)	"
basement temperature		°F	F(6,2)	"
thermostat setting		°F	F(6,2)	"
attic temperature		°F	F(6,2)	"
doors & windows open time		minutes/hr	F(6,2)	"
gas consumption		cubic ft/hr	F(8,4)	"

winter 75-76

(cont'd)

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
hot water		Kwh/hr	F(8,4)	= -99.99 when missing
other electric consumption		Kwh/hr	F(8,4)	"
total electric consumption		Kwh/hr	F(8,4)	"
	Note: The value of the variable 'other elelectric consumption' is the difference between the total electric power consumption and the hot water power consumption.			

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TWIN RIVERS PROJECT DATA DESCRIPTION

Data Set Name : HOUSEnn.SUMMER76 where nn is the house number

Contents : Omnibus house data

Duration of Data : summer 76

Interval of Data : hourly

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	PL/I FORMAT	REMARKS
house number	1-14, 16-26		F(2)	
month	1-12		F(2)	
day	1-31		F(2)	
hour	0-23		F(2)	
upstairs temperature		°F	F(6,2)	= -99.99 when missing
downstairs temperature		°F	F(6,2)	
basement temperature		°F	F(6,2)	
thermostat setting		°F	F(6,2)	
attic temperature		°F	F(6,2)	
doors & windows open time		minutes/hr	F(6,2)	
air conditioner		Kwh	F(8,4)	

summer 76

(cont'd)

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
hot water		Kwh/hr	F(8,4)	= - 99.99 when missing
other electric consumption		Kwh/hr	F(8,4)	"
total electric consumption		Kwh/hr	F(8,4)	"

Note: The value of the variable 'other electric consumption' is the difference between the total electric power consumption and the sum of the air conditioner and the hot water power consumption.

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TWIN RIVERS PROJECT DATA DESCRIPTION

Data Set Name : HOUSEnn.WINTER77 , where nn is the house number nn≠ (10,14,16, 18,27)

Contents : Omnibus house data

Duration of Data : winter 76-77

Interval of Data : hourly

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
house number			F(2)	
month	1-12		F(2)	
day	1-31		F(2)	
hour	0-23		F(2)	
upstairs temperature		°F	F(6,2)	= - 99.99 when missing
downstairs temperature		°F	F(6,2)	"
basement temperature		°F	F(6,2)	"
thermostat setting		°F	F(6,2)	"
attic temperature		°F	F(6,2)	"
doors & windows open time		minutes/hr	F(6,2)	"
gas consumption		cubic ft/hr	F(8,4)	"

winter 76-77

(cont'd)

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
hot water		Kwh	F(8,4)	-99.99 when missing
other electric consumption		Kwh	F(8,4)	"
total electric consumption		Kwh	F(8,4)	"

Note: The value of the variable 'other electric consumption' is the difference between the total electric power consumption and the hot water power consumption.

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TWIN RIVERS PROJECT DATA DESCRIPTION

Data Set Name : HOUSEnn.WINTER77 where nn = 10,16,18

Contents : Omnibus house data, with additional attic temperature channels

Duration of Data : winter 76-77

Interval of Data : hourly

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
house number	10,16,18		F(2)	
month	1-12		F(2)	
day	1-31		F(2)	
hour	0-23		F(2)	
upstairs temperature		°F	F(6,2)	=-99.99 when missing
downstairs temperature		°F	F(6,2)	"
basement temperature		°F	F(6,2)	"
thermostat setting		°F	F(6,2)	"
attic (center) temperature		°F	F(6,2)	"
doors & windows open time		minutes/hr	F(6,2)	"
gas consumption		cubic ft/hr	F(8,4)	"

winter 76-77

(cont'd)

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
humidifier on time		minutes/hr	F(8,4)	= -99.99 when missing
attic temperature	(location 1)	°F	F(6,2)	"
attic temperature	(location 2)	°F	F(6,2)	"
attic temperature	(location 3)	°F	F(6,2)	"
attic temperature	(location 4)	°F	F(6,2)	"
location of attic meters: (1) attic ceiling (2 & 4) just above insulation (3) below insulation				

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TWIN RIVERS PROJECT DATA DESCRIPTION

Data Set Name : HOUSE14.WINTER77

Contents : omnibus house data

Duration of Data : winter 1976-1977

Interval of Data : hourly

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
house number			F(2)	= 14
month	1-12		F(2)	
day	1-31		F(2)	
hour	0-23		F(2)	
upstairs temperature		°F	F(6,2)	= - 99.99 when missing
downstairs temperature		°F	F(6,2)	"
basement temperature		°F	F(6,2)	"
attic temperature		°F	F(6,2)	"
thermostat setting		°F	F(6,2)	"
doors and windows open time		minutes/hr	F(6,2)	"
gas consumption		cubic ft/hr	F(8,4)	
humidifier		gallon/hr	F(8,4)	should not be used

winter 76-77

(cont'd)

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
other electric consumption		Kwh	F(8,4)	= - 99.99 when missing
total electric consumption		Kwh	F(8,4)	"

NOTE: Data set name: HOUSE27.SUMMER77 exactly the same except gas consumption (cubic ft) air conditioner(kWh)

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TWIN RIVERS PROJECT DATA DESCRIPTION

Data Set Name : HOUSE27.WINTER77

Contents : Omnibus house data

Duration of Data : winter 1977

Interval of Data : hourly

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
house number	27		F(2)	
month	1-12		F(2)	
day	1-31		F(2)	
hour	0-23		F(2)	
upstairs temperature		°F	F(6,2)	= - 99.99 when missing
downstairs temperature		°F	F(6,2)	"
basement temperature		°F	F(6,2)	"
thermostat setting		°F	F(6,2)	"
attic (center) temperature		°F	F(6,2)	"
doors & windows open time		minutes/hr	F(6,2)	"
gas consumption		cubic ft/hr	F(8,4)	"
water heater		Kwh	F(8,4)	
attic temperature	(location 1)	°F	F(6,2)	

WINTER 1977

(cont'd)

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
attic temperature	(location 2)	°F	F(6,2)	= - 99.99 when missing
attic temperature	(location 3)	°F	F(6,2)	"
attic temperature	(location 4)	°F	F(6,2)	"

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TWIN RIVERS PROJECT DATA DESCRIPTION

Data Set Name : HOUSEnnSUMMER77 where nn-house number nn ≠(10,14,16,18,27)

Contents : omnibus house data

Duration of Data : summer 1977

Interval of Data : hourly

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
house number			F(2)	
month	1-12		F(2)	
day	1-31		F(2)	
hour	0-23		F(2)	
upstairs temperature		°F	F(6,2)	= -99.99 when missing
downstairs temperature		°F	F(6,2)	"
basement temperature		°F	F(6,2)	"
thermostat setting		°F	F(6,2)	"
attic temperature		°F	F(6,2)	"
doors & windows open time		minutes/hr	F(6,2)	"
air conditioner		Kwh	F(8,4)	"
hot water		Kwh	F(8,4)	"
other electric consumption		Kwh	F(8,4)	"

summer '77

(cont'd)

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
total electric consumption		Kwh	F(8,4)	= - 99.99 when missing

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TWIN RIVERS PROJECT DATA DESCRIPTION

Data Set Name : HOUSEnn.SUMMER77 where nn = 10,16,18,27

Contents : Omnibus house data

Duration of Data : summer 1977

Interval of Data : hourly

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
house number	10,16,18 ,27		F(2)	
month	1-12		F(2)	
day	1-31		F(2)	
hour	0-23		F(2)	
upstairs temperature		°F	F(6,2)	= -99.99 when missing
downstairs temperature		°F	F(6,2)	"
basement temperature		°F	F(6,2)	"
thermostat setting		°F	F(6,2)	
attic (temp) temperature		°F	F(6,2)	"
doors & windows opentime		minutes/hr	F(6,2)	"
air conditioner		Kwh	F(8,4)	"
attic fan		Kwh	F(8,4)	"

summer '77

(cont'd)

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
attic temp.	(location 1)	°F	F(6,2)	= -99.99 when missing
attic temp.	(location 2)	°F	F(6,2)	"
attic temp.	(location 3)	°F	F(6,2)	"
attic temp.	(location 4)	°F	F(6,2)	"

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TWIN RIVERS PROJECT DATA DESCRIPTION

Data Set Name : HOUSE14.SUMMER77

Contents : Omnibus house data

Duration of Data : summer 1977

Interval of Data : hourly

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
house number	= '14'		F(2)	
month	1-12		F(2)	
day	1-31		F(2)	
hour	0-23		F(2)	
upstairs temperature		°F	F(6,2)	= - 99.99 when missing
downstairs temperature		°F	F(6,2)	"
basement temperature		°F	F(6,2)	"
attic temperature		°F	F(6,2)	"
thermostat setting		°F	F(6,2)	"
doors & windows open time		minutes/hr	F(6,2)	"
air conditioner		Kwh	F(8,4)	"
humidifier		gallons/hr	F(8,4)	"
other electric consumption		Kwh	F(8,4)	"
total electric consumption		Kwh	F(8,4)	"

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TWIN RIVERS PROJECT DATA DESCRIPTION

Data Set Name : ATHER.TWIN.RIVERS

Contents : Weather data (Twin Rivers, N.J.)

Duration of Data : Nov. 19, 1975 thru Jan. 23, 1978

Interval of Data : Hourly (See note)

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	PL/I FORMAT	REMARKS
month	1-12		F(2)	
day	1-31		F(2)	
year	75-78		F(2)	
hour	0-23		F(2)	
readings	number of 20-minutely readings averaged for the hourly data		F(2)	='-1' when the number of 20-minutely readings averaged for the hourly data is unknown
wind vel. I		mph	F(7,2)	Average of three instantaneous wind speeds
wind vel. II		mph	F(7,2)	Average of three integrated average wind speeds
wind direction	↷ from North	degrees	F(7,2)	Average of three instantaneous values
Barometric pressure		inches Hg	F(7,2)	

Nov.19,1975 thru Jan.23,1978

(cont'd)

VARIABLE NAME	VARIABLE DESCRIPTION	UNITS	FORMAT	REMARKS
air temperature	dry bulb	°F	F(7,2)	
solar flux I	horizontal, shaded (meter 1)	Btu/ft^2h	F(7,2)	Average of three integrated solar fluxes
solar flux II	horizontal, unshaded (meter 1)	Btu/ft^2h	F(7,2)	Average of three integrated solar fluxes
solar flux III	horizontal, unshaded (meter 2)	Btu/ft^2h	F(7,2)	Average of three integrated solar fluxes
solar flux IV	horizontal, unshaded (meter 2)	Btu/ft^2h	F(7,2)	Average of three instantaneous solar fluxes

Notes on weather dataset.

The data for each hour represents the average for 3 20-minutely readings starting on the hour, i.e. the readings for 14:00, 14:20, and 14:40 are averaged and referred to as weather for hour 14 (2 P.M).

All weather variables have a value of -99.00 when missing.

Section C House condition and instrumentation in place over time

C.1 Retrofit code

C.2 Instrumentation code

C.3 House condition over time, by house. Compass orientation, gas vs electric appliances, dates of retrofits.

RETROFIT CODE

A R/30 Attic insulation & party wall gap seal

B Caulk and seal living space

C Duct insulation in basement

D Furnace shaft seal

E Electronic start for furnace

F Fan in attic

G Night setback thermostat

H Humidifier

Note: Unless otherwise stated, a retrofit remains in effect after installation. When a retrofit is removed it is marked as follows:

$\bar{D}$: D retrofit removed.

D : D retrofit (re)installed.

INSTRUMENTATION CODE

Channel \ Code	I	II	III	IV	V	VI	VII	VIII	IX
A1 (temp.)	← UPSTAIRS TEMPERATURE →								
A2 (temp.)	← DOWNSTAIRS TEMPERATURE →								
A3 (temp.)	← BASEMENT TEMPERATURE →								
A4 (temp.)	← THERMOSTAT SETTING →								
B1 (timer/temp)	FRONT DOOR OR WINDOW OPEN TIME		← ATTIC TEMPERATURE →						
B2 (timer)	← PATIO DOOR OPEN TIME →		← FRONT WINDOW, FRONT DOOR, OR PATIO DOOR OPEN TIME →						
B3 (timer)	Furnace	A/C	Furnace	A/C	Furnace	A/C	A/C	Furnace	Furnace
B4 (timer)	← WATER HEATER ON-TIME →						Attic fan on time	Humidifier on time	Humidifier on time
C1	QUARTER HOUR ELECTRIC METER READING				← ATTIC TEMP (LOCATION 1) →				
C2					← ATTIC TEMP (LOCATION 2) →			QUARTER HOUR ELECTRIC METER READING	QUARTER HOUR HUMIDIFIER WATER USE
C3					← ATTIC TEMP (LOCATION 3) →				
C4					← ATTIC TEMP (LOCATION 4) →				

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 1

APPLIANCES*: Elec. GAS/ELEC

ORIENTATION OF WINDOWS: North

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
2/8/75	6/18/75		I
6/18/75	9/19/75		II
9/19/75	2/16/76	A,B,C,D	III
2/16/76	6/11/76		III
6/11/76	10/22/76		IV
10/22/76	5/26/77		III
5/26/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 2

APPLIANCES*: Elec. GAS/ELEC

ORIENTATION OF WINDOWS: North

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
1/31/75			I
	2/19/76	A,D	
	5/76 last tape change		

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 3

APPLIANCES*: Elec. GAS/ELEC

ORIENTATION OF WINDOWS: North

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
1/28/75	6/18/75		I
6/18/75	10/21/75		II
10/21/75	1/21/76		III
		A,C,D	
1/21/76	2/18/76		III
		B	
2/18/76	3/17/76		III
		caulked all exterior surfaces	
3/17/76	5/28/76		III
5/28/76	10/22/76		IV
10/22/76	5/26/77		III
5/26/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 4

APPLIANCES*: Elec. GAS/ELEC

ORIENTATION OF WINDOWS: North

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
1/27/75	6/27/75		I
6/27/75	10/16/75		II
10/16/75	1/21/76		III
1/21/76	2/17/76	A,C,D	III
		B (front door postponed)	
2/17/76	3/16/76		III
		Front door sweep installed	
3/16/76	6/15/76		III
6/15/76	9/27/76		IV
9/27/76	5/24/77		III
5/24/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 5

APPLIANCES*: Elec. GAS/ELEC

ORIENTATION OF WINDOWS: North East

OTHER FEATURES: Large gaps in attic party wall.

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
2/20/75	6/27/75		I
6/27/75	9/19/75		II
9/19/75	2/16/76		II
		C	
2/16/76	6/11/76		III
6/11/76	9/27/76		IV
9/27/76	1/28/77		III
		G	
1/28/77	5/25/77		III
5/25/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 6

APPLIANCES*: Elec. GAS/ELEC

ORIENTATION OF WINDOWS: South

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
1/31/75	6/13/75		I
6/13/75	9/12/75		II
9/12/75	2/25/76		III
		B,D	
2/25/76	3/2/76		III
		D^{-}	
3/2/76	3/15/76		III
		A	
3/15/76	3/30/76		III
		D	
3/30/76	6/24/76		III
6/24/76	9/24/76		IV
9/24/76	2/7/77		III
		G	
2/7/77	5/31/77		III
5/31/77	not recorded		

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 7

APPLIANCES*: Elec. GAS/ELEC

ORIENTATION OF WINDOWS: East

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
2/20/75	6/13/75		I
6/13/75	10/14/75		II
10/14/75	1/19/76		III
		A,D	
1/19/76	1/20/76		III
		C	
1/20/76	1/21/76		III
		B	
1/21/76	7/8/76		III
7/8/76	9/24/76		IV
9/24/76	5/31/77		III
5/31/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 8

APPLIANCES*: Elec GAS/ELEC

ORIENTATION OF WINDOWS: South

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
2/11/75	6/13/75		I
6/13/75	9/15/75		II
9/15/75	1/22/76		III
		C	
1/22/76	1/27/76		III
		B,D	
1/27/76	2/19/76		III
		A	
2/19/76	6/17/76		III
6/17/76	11/1/76		IV
11/1/76	2/27/77		III
		See note below	
2/27/77	5/24/77		III
5/24/77	-		

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

Adjusted furnace controls to cutoff @ 82-84°

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 9

APPLIANCES*: Elec GAS/ELEC

ORIENTATION OF WINDOWS: East

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
4/22/75	6/16/75		I
6/16/75	9/22/75		II
9/22/75	1/7/76	new thermostat installed	III
1/7/76	2/18/76	A,C,D	III
2/18/76	2/19/76	B	III
2/19/76	6/15/76		IV
6/15/76	10/5/76		III
10/5/76	5/23/77		IV
5/23/77	not recorded		

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 10

APPLIANCES*: Elec. GAS/ELEC

ORIENTATION OF WINDOWS: East

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
4/22/75	6/13/75		I
6/13/75	10/23/75		II
10/23/75	1/22/76		III
		C	
1/22/76	1/28/76		III
		B,D	
1/28/76	2/17/76		III
		A	
2/17/76	6/17/76		III
6/17/76	10/22/76		IV
10/22/76	12/1/76		III
12/1/76	12/16/76		V
12/16/76	5/27/77		V***
5/27/77	7/20/77		VI***
7/20/77	not recorded		VII

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

***Humidifier on-time was on channel B4 (not water heater on-time)

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 11

APPLIANCES*: Elec GAS/ELEC

ORIENTATION OF WINDOWS: East

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
6/11/75	9/22/75		II
9/22/75	1/19/76		III
		A,C,D (B started)	
1/19/76	1/28/76		III
		B completed	
1/28/76	6/11/76		III
6/11/76	10/28/76		IV
10/28/76	6/29/77		III
6/29/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 12

APPLIANCES*:Elec. GAS/ELEC

ORIENTATION OF WINDOWS: South

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
6/13/75	9/23/75		II
9/23/75	2/26/76		III
		B,D	
2/26/76	3/2/76		III
		D⁻	
3/2/76	3/30/76		
		D	
3/30/76	6/16/76		III
6/16/76	9/24/76		IV
9/24/76	5/23/77		III
5/23/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 13

APPLIANCES*: Elec/GAS/ELEC

ORIENTATION OF WINDOWS: East

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
6/24/75	9/23/75		II
9/23/75	1/20/76		III
		A,D	
1/20/76	1/22/76		III
		B	
1/22/76	6/16/76		III
6/16/76	10/26/76		IV
10/26/76	2/22/77		III
		***See below	
2/22/77	5/31/77		III
5/31/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

***Adjusted furnace fan controls to cut off at 80°F.

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 14

APPLIANCES*: Elec. GAS/ELEC

ORIENTATION OF WINDOWS: South

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
7/1/75	9/12/75		II
9/12/75	1/20/76	A,D,(B begun)	III
1/20/76	1/21/76	B completed	III
1/21/76	2/17/76	C	III
2/17/76	6/24/76		III
6/24/76	10/26/76		IV
10/26/76	12/16/76		III
12/16/76	5/26/77		IX
5/26/77	not recorded		IX***

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

*** After 5/26/77 channel B3 was air conditioner on time and not furnace on tim

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 16

APPLIANCES*: Elec GAS/ELEC

ORIENTATION OF WINDOWS: West

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
7/2/75	10/16/75		II
10/16/75	2/18/76		III
		C	
2/18/76	2/19/76		III
		B begun	
2/19/76	2/24/76		III
		D,B completed	
2/24/76	3/3/76		III
		D^-	
3/3/76	3/24/76		III
		D	
3/24/76	6/14/76		III
6/14/76	10/22/76		IV
10/22/76	11/30/76		III
11/30/76	12/16/77		V
12/16/76	5/25/77		V***
5/25/77	7/19/77		VI***
7/19/77	not recorded		VII

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

***Humidifier on-time was on channel B4.

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 17

APPLIANCES*: GAS GAS/ELEC

ORIENTATION OF WINDOWS: East

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
12/5/75	2/20/76		III
		B & D	
2/20/76	2/23/76		III
		A	
2/23/76	5/28/76		III
5/28/76	9/24/76		IV
9/24/76	5/24/77		III
5/24/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 18

APPLIANCES*: Gas GAS/ELEC

ORIENTATION OF WINDOWS: North East

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
12/10/75	2/21/76		III
		C	
2/21/76	2/23/76		III
		B & D	
2/23/76	5/28/76		III
5/28/76	9/24/76		IV
9/24/76	12/2/76		III
12/2/76	12/17/76		V
12/17/76	5/24/77		V***
5/24/77	7/20/77		VI***
7/20/77	not recorded		VII

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

***Humidifier on time was on channel B4 (not water heater on time).

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 19

APPLIANCES*: Elec GAS/ELEC

ORIENTATION OF WINDOWS: North

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
7/10/75	10/23/75		II
10/23/75	2/18/76		III
		A,D	
2/18/76	6/11/76		III
6/11/76	10/8/76		IV
10/8/76	5/24/77		III
5/24/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 20

APPLIANCES*: Gas GAS/ELEC

ORIENTATION OF WINDOWS: South

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
6/10/76	9/24/76		IV
9/24/76	1/21/77		III
		A,C	
1/21/77	5/23/77		III
5/23/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 21

APPLIANCES*:Gas GAS/ELEC

ORIENTATION OF WINDOWS: North West

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
12/15/75	2/21/76		III
		A,C,D	
2/21/76	2/24/76		III
		B	
2/24/76	5/28/76		III
5/28/76	10/26/76		IV
10/26/76	1/21/77		III
		***See below	
1/21/77	5/23/77		III
5/23/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

***Opening cut into return duct for downstairs return.

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 22

APPLIANCES*: Gas GAS/ELEC

ORIENTATION OF WINDOWS: South

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
6/2/76	9/24/76		IV
9/24/76	5/26/77		III
5/26/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 23

APPLIANCES*: Gas GAS/ELEC

ORIENTATION OF WINDOWS: South

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
6/3/76	9/24/76		IV
9/24/76	5/26/77		III
5/26/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 24

APPLIANCES*: Gas GAS/ELEC

ORIENTATION OF WINDOWS: South East

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
6/4/76	9/24/76		IV
9/24/76	1/21/77	A,D	III
1/21/77	5/25/77		III
5/25/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 25

APPLIANCES*: Gas GAS/ELEC

ORIENTATION OF WINDOWS: South East

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
6/8/76	9/24/76		IV
9/24/76	1/27/77		III
		A,D	
1/27/77	5/25/77		III
5/25/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 26 APPLIANCES*: Gas GAS/ELEC

ORIENTATION OF WINDOWS: East

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
6/17/76	9/24/76		IV
9/24/76	5/25/77		III
5/25/77	not recorded		IV

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets

OMNIBUS HOUSE CONDITION AND INSTRUMENTATION LOG

HOUSE NO: 27

APPLIANCES*:Elec GAS/ELEC

ORIENTATION OF WINDOWS: East

OTHER FEATURES:

PERIOD		RETROFIT**	INSTRUMENTATION**
From	To		
8/13/76	9/24/76		IV
9/24/76	12/3/76		III
12/3/76	12/8/76		V
		A,D	
12/8/76	12/23/76		V
		C	
12/23/76	1/22/77		V
		B	
1/22/77	5/26/77		V
5/26/77	7/20/77		VI
7/20/77	not recorded		VII

*Appliances are range, oven, water heater and clothes dryer.

** For interpretation of symbols see attached sheets