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THE UNIVERSITY AT ALBANY

1400 WASHINGTON AVENUE, ALBANY, NEW YORK 12222

JOLLY TIGER DATA REPORT

APRIL 1978

DOE Contract
EY-76-C-03-1304

MASTER

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APRIL

1978 JOLLY TIGER DATA REPORT

Monthly Report Submitted to:

U.S. Department of Energy
Division of Buildings & Community Systems
Room 2252C
20 Massachusetts Avenue
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ATTENTION: Howard Ross, Project Officer
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Submitted by:

Sambo's Restaurant's, Inc.
3760 State Street
Santa Barbara, California 93105

Prepared by:

Atmospheric Sciences Research Center
State University of New York at Albany
1400 Washington Avenue
Albany, New York 12222

New York State Assembly Science & Technology Staff
State Capitol
Albany, New York 12248

William S. Fleming Associates
4495 Brickyard Falls Road
Manlius, New York 13104

951 1899

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APRIL 1978 JOLLY TIGER DATA REPORT

This is the seventeenth monthly report of the Jolly Tiger Restaurant Project. The analysis and discussion refers to data taken during the period 1 April 1978 to 30 April 1978.

For April 557 hours of data were collected. This represents 77.4% data collection.

APRIL 1978

ECONOMICS SUMMARY - TABLE I

Sales and customer counts increased 10% in April. Power consumption decreased 9% during the same period, mostly because of lights and kitchen equipment usage. LP gas use decreased 15% because of a decreased heating load and dishwasher use.

WATER USAGE - TABLE I

Total water consumption decreased 22% over March. Most of the decrease was caused by reduced dishwasher usage.

ELECTRIC POWER CONSUMPTION - TABLE II

Electric power consumption increased 25% for HP1 and HP2, 10% for the refrigeration rack and 228% for AC1 and AC2 and AC3. The increases occurred because reclamation systems which were turned off in March, were back in service in April. Kitchen and lighting power consumption was 36% lower than in March. This reduction was caused mainly by decreased dishwasher usage, the reactivation of the variable exhaust and make-up air units, and the photocell light reduction system. The peak demand for the month was 79.2 kw, occurring on April 13 and April 24.

LP GAS CONSUMPTION - TABLE III

The Colonie store used 15% less LP gas in April than in March. This resulted from a combination of 35% less gas for heating and hot water, and 76% more gas for cooking.

APRIL 1978

HVAC AND HOT WATER SUMMARY - TABLE IV

Power consumption of the AC units increased 228% because the heat pumps were reactivated. LP gas usage for heating hot water decreased 35% although the apparent efficiency was lower than in March. The reason for this was that some of the supplemental heating valves permitted water to pass when closed. This effect was less apparent in March because the valves were open much more frequently (the heating load was greater in March and the heat pumps in the AC units were deactivated).

BUILDING HEATING SUMMARY - TABLE V

The building heating demand was met by pre-heat (37.2%), heat pumps (21.3%) and supplemental heat (41.5%). In addition, 82% of the hot water load (140°F) and 52% of the dishwasher (180°F) load was supplied by the reclamation systems.

ALTERNATE FUEL SOURCE COMPARISONS - TABLE VI

The reclaimed energy for April is worth \$55.80 to \$942.39 depending upon the alternate fuel used and the price paid for it.

When making an economic analysis of the energy conservation system it is important to compare energy costs using several fuel sources. Under "Net Reclaimed Energy," the "Actual" column lists the energy reclaimed by the subsystems. These values have been transformed into units for alternate fuel sources using "typical" efficiency factors.

The following factors are used in the calculations:

Fuel	BTU Value	Burner Efficiency
Electricity	3414 BTU/kWh	100%
LP Gas	91,500 BTU/GAL	67%
#2 Oil	130,000 BTU/GAL	62%
Natural Gas	102,500 BTU/CCF	76%

The BTU and burner efficiency values chosen are typical for fuels and burners in the Albany, New York area and will remain as constants when Table VI is presented in future monthly reports.

Under "Fuel Cost Comparisons" four alternate fuel sources are listed. Three different costs are listed for each fuel source. Under the EARS and R-1 columns are listed the dollar values saved by each subsystem for three fuel rates. Typical costs of these fuels in the Albany, New York area are: electricity \$0.035/kWh; LP Gas \$0.48/gal; #2 Oil \$0.48/gal; natural gas \$0.21/CCF. The price of natural gas assumes that the customer used gas in sufficient quantity (1500-2000 CCF/month) to be purchased at a rate block at that price. Fuel cost adjustments are not considered.

MONTHLY WEATHER SUMMARY - TABLE VII

This data is from the weather service station at the Albany Airport. The airport is about 4 air miles from the Colonie store and the weather conditions are for all purposes comparable.

TABLE I
Economics Summary
April 1978

ITEM	QUANTITY
Gross Sales, \$	\$20,288.68
Customer Count, Number	9,990
Electric Consumption*, kWh	27,852
Propane Gas Consumption, Gals.	2,347
Total Energy Consumption, kWh	90,773
kWh Per \$ Sales	4.47
kWh Per Customer	9.09
Total Water Consumption, Gals.	54,671
Dishwasher Use (180°), Gals.	16,741
Faucet Use (140°), Gals.	4,461
Cold Water , Gals.	33,469
Total Faucet Use, Gals.	37,930
Energy Costs \$	
Electric @ 0.035/kWh	\$ 974.82
Gas @ 0.427/Gal	\$ 1,002.17
Totals, \$	\$ 1,976.99

*Does not include ASRC use of 900 kWh

TABLE II
Electric Power Consumption
April 1978

	<u>kWh</u>	<u>%Total</u>
HP-1	2,484	8.6
HP-2	2,549	8.9
Subtotal HP-1 & HP-2	5,033	17.5
Refrigeration	4,169	14.5
AC-1	1,102	3.8
AC-2	3,067	10.7
AC-3	1,606	5.6
Subtotals AC's	5,775	20.1
ASRC use	900	3.1
Lights, kitchen	12,875	44.8
Total Electric	28,752	100%
Peak Demand 4/13, 4/24	79.2 kWh	

TABLE III
L.P. Gas Consumption

	<u>Gallons</u>	<u>%Total</u>
Hot Water Heater	1456.2	62%
Cooking use	890.8	38%
Total LP Gas Delivered	2347.0	100%

TABLE IV
HVAC and Hot Water Summary
April 1978

	<u>kWh</u>	<u>LP Gas Gallons</u>
AC-1	1,102	----
AC-2	3,067	----
AC-3	1,606	----
Hot Water Heater	-----	1456.2
Totals	5,775	1456.2
Total Energy Consumption	44,815 kWh	1456.2 x 32.4% EFF = 472 gal.
Total Energy Consumption (100% Eff Gas)	18,424 kWh	at 100% EFF = 12,649 kWh

Hot Water Heater Efficiency

Energy Consumed: 1456.2 gals x 91,500 BTU/gal = 133,242,300 BTU's
 Energy Supplied (water): (185.65°F-115.62°F)x8.33 lbs/galx1 BTU/lb°F
 x16,741 gal + (129.73°F-115.62°F)x8.33 lbs/gal
 x1 BTU/lb°Fx4,461 gal = 9,765,861 BTU
 + 524,329 BTU's = 10,290,190 BTU's + supplemental
 of 32,892,480 = 43,182,670 BTU's

$$\text{Efficiency} = \frac{43,182,670}{133,242,300} = 32.4\%^*$$

*The efficiency is low because of leaks in supplemental heating valves which allowed flow to pass even when closed.

TABLE V

Jolly Tiger Colonie, NY Building Heating Summary

APRIL 1978

	DEMAND	PRE-HEAT	HEAT PUMPS	SUPPLEMENTAL HEAT (FOR HEATING)	HEAT EXCHANGERS
BTU/HR	110,137	41,008	23,435	45,684	11,135
kW	32.27	12.02	6.87	13.39	3.26
BTU/FT ²	14,529	5,409	3,091	6,026	1,469
kW/FT ²	4.26	1.58	0.906	1.77	0.430
BTU/\$	3,909	1,455	832	1,621	395
kW/\$	1.15	0.426	0.244	0.475	0.116
BTU/Cust	7,938	2,956	1,689	3,293	803
kW/Cust	2.33	0.866	0.495	0.965	0.235
%Heating demand	100%	37.2%	21.3%	41.5%	10.1%

	HEAT FROM STORAGE TANKS	TOTAL REUSED ENERGY REF. RACK	EARS	ENERGY DISH	NET REUSED ENERGY REF. RACK	ENERGY EARS
BTU/HR	52,143	12,435	56,467	7,144	9,898	32,593
kW/HR	15.28	3.64	16.54	2.09	2.90	9.55
BTU/FT ²	6,878	1,640	7,449	942	1,306	4,299
kW/FT ²	2.02	0.481	2.18	0.276	0.383	1.26
BTU/\$	1,850	441	2,004	254	351	1,157
kW/\$	0.542	0.129	0.587	0.074	0.103	0.339
BTU/Cust	3,758	896	4,070	515	713	2,349
kW/Cust	1.10	0.263	1.19	0.151	0.209	0.688
%Heating demand	47.3%	11.3%	51.3%	6.5%	9.0 %	29.6%

LP Gas Consumption 1,456 gal.

TABLE VI

Alternate Fuel Source Comparison

April 1978

Net Reclaimed Energy

	Actual (MMBTU)	Elec (kWh)	LP Gas (gal)	#2 Oil (gal)	Nat Gas (CCF)
HX 1&2	5.14	1,507	84	64	67
EARS	23.46	6,876	383	291	305
AC's	0	0	0	0	0
R-1	7.13	2,088	116	88	93

Fuel Cost Consumption

Fuel	Cost	HX 1&2	EARS	AC's	R-1	TOTAL
Elec.	\$0.035/kWh	\$ 52.75	\$240.66	0	\$ 73.08	\$366.49
	0.050/kWh	75.35	343.80	0	104.40	523.55
	0.090/kWh	135.63	618.84	0	187.92	942.39
LP Gas	\$0.45/gal	\$37.80	\$172.35	0	\$52.20	\$262.35
	0.50/gal	42.00	191.50	0	58.00	291.50
	0.55/gal	46.20	210.65	0	63.80	320.65
#2 Oil	\$0.40/gal	\$25.60	\$116.40	0	\$35.20	\$177.20
	0.45/gal	28.80	130.95	0	39.60	199.35
	0.50/gal	32.00	145.50	0	44.00	221.50
Nat Gas	\$0.12/CCF	\$ 8.04	\$ 36.60	0	\$11.16	\$ 55.80
	0.21/CCF	14.07	64.05	0	19.53	97.65
	0.34/CCF	22.78	103.70	0	31.62	158.10

MONTHLY WEATHER SUMMARY*
ALBANY AIRPORT

APRIL 1978

TEMPERATURE (degrees Fahrenheit)

Mean=====	43.4°
Normal=====	46.9
Departure from normal=====	-3.5
Highest recorded and date=====	73 on the 13th
Normal maximum=====	58.0
Lowest recorded and date=====	20 on the 3rd
Normal minimum=====	35.7

Records broken or equalled=====

43 on the 30th equalled the lowest maximum for that date

HEATING DEGREE DAYS (base 65°F)

Monthly total=====	642
Monthly normal=====	543
Departure from monthly normal=====	+99
Seasonal total=====	6869
Seasonal normal=====	6596
Departure from seasonal normal=====	+273

PRECIPITATION (inches)

Monthly total=====	1.68"
Monthly normal=====	2.70"
Departure from monthly normal=====	-1.02"
Greatest amount in 24 hours and date=====	0.64" on the 19th &
Number of days with 0.01 inch or more=====	8 20th

SNOWFALL (inches)

Monthly total=====	0.2"
Monthly average in recent years=====	2.1"
Departure from monthly average=====	-1.9"

SUNSHINE

Total number of hours=====	240.1
Percent of possible sunshine=====	60%
Normal percent of possible sunshine=====	53%
Departure from normal percent=====	+7%

WIND (miles/hour)

Mean hourly speed=====	11.5
Prevailing direction=====	NW
Fastest wind and date=====	36 on the 2nd & 14th
Highest gust and date:=====	55 on the 2nd

MISCELLANEOUS

Number of days with thunderstorms=====	1
Number of days with heavy fog=====	0

APRIL 1970

ALBANY AIRPORT

JOLLY TIGER PROJECT

MONTHLY ELECTRIC POWER CONSUMPTION

1977

1978

DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

FIGURE 1

JOLLY TIGER PROJECT

MONTHLY ELECTRIC POWER AND LP GAS CONSUMPTION & DATA COLLECTED

FIGURE 2

JOLLY TIGER PROJECT

MONTHLY ENERGY RECLAIMED

1977

1978

DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

REFRIGERATION RACK

R-1

KWH x 10³

16
12
8
4

a

EARS

KWH x 10³

16
12
8
4

b

DW

HX-1

KWH x 10³

4
0
-4

c

DW

HX-2

KWH x 10²

8
6
4
2
0

d

FIGURE 3

FIGURE 3 (con't)

46 1512

10 X 10 TO THE CENTIMETER 18 X 25 CM.
KEUFFEL & ESSER CO. MADE IN U.S.A.

K&E

JOLLY TIGER PROJECT

MONTHLY HEATING BY WATER SYSTEM

1977

1978

DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

PRE-HEAT

BTU $\times 10^6$ 60
50
40
30
20
10

a

SUPPLEMENTAL
HEATBTU $\times 10^6$ 120
100
80
60
40
20

b

HEAT SUPPLIED
TO
AC HEAT PUMPSBTU $\times 10^5$ 300
200
100

c

FIGURE 4

JOLLY TIGER PROJECT

MONTHLY MEAN TEMPERATURES

1977

1978

DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

OUTSIDE AIR

TEMP (°F)

80

60

40

20

a

TANK-1

TEMP (°F)

130

120

110

100

90

b

TANK-2

TEMP (°F)

130

120

110

100

90

c

FIGURE 5