Interim Report on Task I
of
Field Studies of Year-Round Air Conditioning Systems

by
Paul R. Achenbach

Report to
Office of the Chief of Engineers
Bureau of Yards and Docks
Headquarters, U.S. Air Force
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Paul R. Achenbach

Air Conditioning, Heating, and Refrigeration Section
Building Technology Division

to

Office of the Chief of Engineers
Bureau of Yards and Docks
Headquarters, U.S. Air Force

IMPORTANT NOTICE

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1. Introduction

The Arkansas Power and Light Company, the electric utility that serves the Little Rock Air Force Base, has been collecting electrical energy consumption data on 16 houses in the Air Base housing area since October 1958, using four or more demand meters on each house to record separately the energy used for the electric range, the electric water heater, the heat pump, and the total for the house on a 15-minute demand interval. Indoor air temperatures have also been recorded in each of the houses, and outdoor air temperatures were recorded at three separate stations in the housing area. The total monthly energy use indicated by these four meters in each of the 16 houses has been summarized by Arkansas Power and Light Company personnel.

These monthly summaries of energy usage and the original charts from the recording demand meters and the temperature recorders have been made available to the National Bureau of Standards for further analysis. Task I under this project indicated that the following information should be developed from these records:

(a) Information on the amount of electric power used by the occupants for cooking, lighting, ironing, etc.

(b) Information on the amount of electric power used for electric water heating.

(c) Correlation between power used by heat pump (including strip heaters) and the outdoor temperature.

(d) Estimate of the contribution of the electrical equipment (other than the heat pump) to the heating function in the winter time and to the cooling load in the summer time.

More recently the U.S. Air Force requested that the demand charts be examined to determine what elements contributed in a significant way to the monthly 15-minute peak demands in the 16 houses, since the cost of the electrical energy to the Government was closely related to the maximum demands. It was considered probable that such an analysis would indicate one or more ways in which the 15-minute demand values for the entire housing area could be reduced.
2. Description of Sample Houses

The identification of the 16 houses used for the study with respect to location, type of house, floor area, and number of bedrooms is summarized in Table 1. House types A, A₁, B, and B₁ were used to domicile airmen, and house types C, D, E, F, and G were used primarily to domicile officers. House types A₁ and B₁ were of duplex construction with carports adjoining; house types A, B, C, and D were of duplex construction with living quarters adjoining; and the remainder were of detached design. All houses were of single story construction built on concrete slabs on grade.

Table 1
Identification of Sample Houses

<table>
<thead>
<tr>
<th>Street Address of House</th>
<th>Contractor Identification No.</th>
<th>House Type</th>
<th>Floor Area, sq ft</th>
<th>No. of Bedrooms</th>
</tr>
</thead>
<tbody>
<tr>
<td>114 Minnesota Circle</td>
<td>4</td>
<td>B₁</td>
<td>1070</td>
<td>999</td>
</tr>
<tr>
<td>122 Mississippi Loop</td>
<td>14</td>
<td>A₁</td>
<td>970</td>
<td>891</td>
</tr>
<tr>
<td>110 Missouri Circle</td>
<td>74</td>
<td>B</td>
<td>1070</td>
<td>1013</td>
</tr>
<tr>
<td>129 Georgia Avenue</td>
<td>163</td>
<td>B₁</td>
<td>1070</td>
<td>999</td>
</tr>
<tr>
<td>189 Pennsylvania Drive</td>
<td>172</td>
<td>B</td>
<td>1070</td>
<td>1013</td>
</tr>
<tr>
<td>102 Florida Avenue</td>
<td>180</td>
<td>A</td>
<td>970</td>
<td>891</td>
</tr>
<tr>
<td>115 Idaho Circle</td>
<td>263</td>
<td>A</td>
<td>970</td>
<td>891</td>
</tr>
<tr>
<td>126 Montana Circle</td>
<td>301</td>
<td>A₁</td>
<td>970</td>
<td>891</td>
</tr>
<tr>
<td>103 Arizona Drive</td>
<td>467</td>
<td>F</td>
<td>1680</td>
<td>1553</td>
</tr>
<tr>
<td>105 Arizona Drive</td>
<td>468</td>
<td>G</td>
<td>2050</td>
<td>1900</td>
</tr>
<tr>
<td>102 Alabama Drive</td>
<td>577</td>
<td>E</td>
<td>1190</td>
<td>1115</td>
</tr>
<tr>
<td>122 Illinois Drive</td>
<td>585</td>
<td>C</td>
<td>1050</td>
<td>999</td>
</tr>
<tr>
<td>130 Illinois Drive</td>
<td>587</td>
<td>D</td>
<td>1100</td>
<td>1046</td>
</tr>
<tr>
<td>129 Iowa Circle</td>
<td>656</td>
<td>D</td>
<td>1100</td>
<td>1046</td>
</tr>
<tr>
<td>123 Louisiana Drive</td>
<td>770</td>
<td>E</td>
<td>1190</td>
<td>1115</td>
</tr>
<tr>
<td>127 Michigan Circle</td>
<td>843</td>
<td>C</td>
<td>1050</td>
<td>999</td>
</tr>
</tbody>
</table>
There were 1535 houses in the housing area, so the sample that was used for this study represents 1.04 percent of the total. The sample includes six 2-bedroom units, eight 3-bedroom units, and two 4-bedroom units. The entire housing area was comprised of 456 2-bedroom units, 1067 3-bedroom units, and 12 4-bedroom units. It is evident from these figures that the proportion of 4-bedroom units was much greater in the sample group of houses than for the entire housing area and that the proportion of 2-bedroom houses was somewhat greater in the sample than for the entire group.

3. Analysis of Data

3.1 Monthly Electric Energy Use

The average monthly electric energy use per house for each of the major components comprising the load and for the entire house was determined for the 16 houses as a group and also for the 2-bedroom, 3-bedroom, and 4-bedroom houses as sub-groups. The average monthly energy usages for the heat pump, the water heater, the kitchen range, and miscellaneous devices were also expressed as a percentage of the total house load in each sub-group and for the entire sample. For this purpose, the energy use of the miscellaneous devices was determined by subtracting the sum of the usages of the heat pump, the water heater, and the range from the total energy use for the house. These results have been summarized in Table 2 on a monthly basis from October 1958 to March 1960, inclusive. It will be noted in Table 2 that all of the 16 houses were not occupied prior to June 1959. For this series of measurements, the energy used by the electric clothes dryer and the resistance heater in the bathroom was included in the miscellaneous devices.

The average monthly energy use in the 16 houses for the several components of the total load was plotted in Fig. 1 for the period from October 1958 to February 1960. The average monthly energy use per house for the entire housing area was also plotted as a dotted line in Fig. 1. This represents approximately 1535 houses starting with June 1959.

It will be noted in Fig. 1 that the energy use for the heat pump and for the entire house reached an annual maximum in the middle of the winter and a smaller maximum during July and August. Two minimums occurred during the year, in April and October, for the heat pump and the house as a whole when little heating or cooling was required. The winter peak usage of energy was approximately twice the summer maximum. The energy usages for the water heater, the kitchen range, and the miscellaneous devices were relatively more stable throughout the year, although the minimum use of energy for water heating and miscellaneous devices occurred in July and the maximums occurred in the colder months of the year.
Fig. 1 shows that the average monthly energy used per house for the 16 houses was very close to that for 1535 houses for the period from July 1959 to February 1960 when the base was fully occupied, despite the disproportionate number of large houses in the 16-house sample.

Considering the average values for all 16 houses, Table 2 shows that the energy used for the heat pump ranged from about 30% of the total load during the spring and fall to a value between 50 and 60% during the middle of the summer and winter; the energy used for water heating ranged from about 15% in the middle of the winter to a little over 30% in the spring and fall; the energy used for the kitchen range was 5% or less of the total throughout the year; and the energy used for miscellaneous devices ranged from 20 to 30% of the total most of the time.

Considering the 2-bedroom, 3-bedroom, and 4-bedroom houses as separate groups, Table 2 shows that for most months of the year the energy used for the heat pump and for water heating increased for the larger houses, whereas the energy used for cooking was usually the greatest in the 3-bedroom houses, and the energy used for miscellaneous devices was rather inconsistent with respect to house size.

The energy used in the sample houses for each component of the total load and the percent of the total represented by each component is summarized in Table 3 for the 12-month period from March 1959 to February 1960, inclusive. It should be noted that only 15 houses were occupied during some months of this period.

Table 3

<table>
<thead>
<tr>
<th>Component of Load</th>
<th>Total Energy Used</th>
<th>Percent of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat Pump</td>
<td>12,290 KWH</td>
<td>48.6</td>
</tr>
<tr>
<td>Water Heater</td>
<td>6,135 KWH</td>
<td>24.3</td>
</tr>
<tr>
<td>Range</td>
<td>965 KWH</td>
<td>3.8</td>
</tr>
<tr>
<td>Miscellaneous (by difference)</td>
<td>5,905 KWH</td>
<td>23.3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>25,295 KWH</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Table 3 shows that the total energy used for heating and cooling by the heat pump on an annual basis was slightly less than that used for all other devices combined. The annual energy usages for water heating and miscellaneous devices were each about half as large as that for the heat pump.
3.2 Heating Accomplished by Range, Water Heater, and Miscellaneous Devices

It is known that the energy used by the electric range, the electric water heater, and the miscellaneous devices each make some contribution toward warming the house in any season of the year. This auxiliary heating reduces the load on the heating system in cold weather and increases the load on the cooling system in hot weather.

It is probable that all of the energy input to the cooking range assists in warming the house with very little time lag except for the water vapor generated by the cooking processes that escape from the house in the winter time without being condensed. During the cooling season the water vapor produced by cooking would add to the latent cooling load on the heat pump and the sensible heat emitted from the range would add to the sensible cooling load of the heat pump. For this analysis it was assumed that all of the electrical energy consumed by the cooking range was effective in warming the house.

The jacket heat losses from the water heater would warm the house winter and summer, and a variable fraction of the heat in the warm water used for bathing, dishwashing, and laundry would be transferred to the air in the house as sensible or latent heat. Observations of the electric energy required to maintain storage temperatures in the water tank in some of the sample houses during the night when no water was being drawn indicate that the jacket loss of these water heaters was 6 to 10% of the total monthly energy used for water heating. To make some allowance for the heat transferred to the air in the house from the hot water during use, it was assumed for this analysis that 15% of all the electrical energy supplied to the water heater was effective in warming the house.

It is probable that all of the electrical energy used by electric lights, resistance heaters, toasters, radio and television sets, and nearly all of the energy used by an electric iron would be converted into heat that would assist in warming a house. The situation with respect to an electric clothes dryer is less definite. Although there would be some heat transferred to the room from the jacket of the dryer, these devices are usually equipped with a small blower which uses room air to carry the water vapor and some sensible heat outside during the clothes-drying process. Such a blower, when in operation, would increase the infiltration into the house, which would probably more than offset the jacket heat loss in the winter time. In the summer time the clothes dryer would increase the cooling load somewhat. For the purpose of this analysis, it was assumed that the clothes dryer contributed nothing toward heating the houses at Little Rock Air Force Base and that all of the remainder of the energy used by miscellaneous devices was converted into heat within the house.
The electrical energy used by the electric clothes dryers at Little Rock Air Force Base was not metered separately from the other miscellaneous loads. However, the energy used for this purpose in 15 sample houses at three other air bases where it was metered separately averaged about 100 KWH per house per month. Accordingly, the energy used for miscellaneous devices in the houses at Little Rock Air Force Base was corrected by subtracting 100 KWH from the monthly totals reported in each case where the monthly total exceeded 100 KWH.

On the basis of the foregoing assumptions, the monthly contribution of the electric range, water heater, and miscellaneous devices to house heating was determined by the following expression:

\[
KWH_A = KWH_R + 0.15 KWH_W + (KWH_M - 100) \quad \text{where}
\]

- \( KWH_A \) is the computed contribution of all appliances, other than the heat pump, to house heating in KWH/month,
- \( KWH_R \) is the electric energy consumption of the electric range in KWH/month,
- \( KWH_W \) is the electric energy consumption of the electric water heater in KWH/month,
- \( KWH_M \) is the electric energy consumed by miscellaneous devices in KWH/month.

This formula was used in deriving one of the three factors for power usage per degree day per 1,000 sq ft of floor area in the next part of this analysis for the sample houses at Little Rock Air Force Base. It is recognized that this formula could probably be improved in accuracy by a careful statistical study of the heat dissipation characteristics of the various electrical appliances, as used in a house.

3.3 Correlation of Heating Power Requirements and Heating Degree-Days

Seasonal heat requirements for residences and other types of buildings in different climates have often been compared on the basis of the number of degree-days occurring in each locality. The heat requirements for different months in the same locality have also been compared on this basis. The heat requirements of houses of similar size and construction is approximately proportional to the floor area, if the range of size is not too great. In an effort to correlate the power requirements of the 16 sample houses at Little Rock Air Force Base, three different power usage factors were determined for the months of October, November, and December of 1959 and for January 1960. These data are summarized in Tables 4-7.

These power usage factors relate the electrical energy used by the heat pump only in one case and the total energy used for heating in the other two cases to the interior floor area of the houses and to the
degree-days below an outdoor reference temperature of 65°F in two cases and to the degree-days based on the average indoor-outdoor temperature difference in the third case. The contribution made by other appliances than the heat pump to heating the houses was determined by the formula cited earlier in this report. The degree-day value based on indoor-outdoor temperature difference was determined by multiplying the monthly average indoor-outdoor temperature difference by the number of days in the month.

A review of Tables 4-7 indicates that the methods employed to obtain the power usage factors correlate the observed data for 2, 3, and 4 bedroom houses for the months from October to January reasonably well. The factors obtained, when the power consumption of the heat pump only and the degree-days related to a 65-degree base are used together, agree quite well with those obtained when the total power for heating and the degree-days based on average indoor-outdoor temperature difference are used. The variation between houses within the 2-bedroom and 3-bedroom groups is somewhat less for the latter factor, probably because it takes into account two human choices not involved in the former factor, namely, the selection of indoor temperature and the usage of power for miscellaneous appliances. It should be pointed out that the power usage factor involving the power consumption of the heat pump alone and the degree-days related to a 65-degree base is much easier to obtain than the others because less instrumentation and fewer observations are involved.

3.4 Correlation of Cooling Power Requirements and Cooling Degree-Days

A similar correlation of power usage, floor area, and cooling degree-days was tried for the month of August 1959 for the 16 sample houses, and is summarized in Table 8. In this case, however, the heat contributed by electrical appliances added to the summer cooling load rather than assisting the heat pump as it did during the winter. Also, in the summertime, the outdoor temperature frequently crosses the reference value used for degree-day totals whether the reference value is chosen at 65°F or 75°F. Solar radiation on a house is a much greater factor in the total cooling load than it is for the heating load, and it is only indirectly reflected in the indoor-outdoor temperature difference during the summer.

The degree-day values in columns 6 and 7 of Table 8 are based on the hourly values of outside temperature related to reference values of 65°F and 75°F, respectively. The degree-day values in column 8 of Table 8 are based on the mean of the maximum and minimum daily outdoor temperatures and the average indoor temperature.

It will be noted in Table 8 that the power usage factor for cooling varied over quite a range depending on the basis selected for determining the degree-days of cooling. The average value for the 16 sample
houses ranged from 2.3 KWH/degree-day (1,000 sq ft) when 65°F was used as the reference value of outdoor temperature to 8.5 in the same units when the degree-days were based on mean outdoor temperature and average indoor temperature. In the latter case the degree-day value was negative for house No. 585 because the average indoor temperature was 1°F higher than the mean daily outdoor temperature.

Basing the degree-days on the difference between mean daily outdoor temperature and average indoor temperature is probably the least suitable of the three methods for correlating power usage; first, because this temperature difference can become vanishingly small, or even negative, and yet the house can have a cooling requirement; secondly, because a house probably responds with respect to heating or cooling on a time cycle of less than 24 hours; and, thirdly, because the maximum outdoor dry bulb temperature would usually occur more or less coincidentally with the maximum solar irradiation on the house.

The data reported in the monthly summaries of power usage for the 16 sample houses at Little Rock Air Force Base are not suitable for selecting the proper outdoor reference temperature for cooling degree days because a month is too long a time increment on which to determine the lowest outdoor temperature for which cooling is required in these houses. The weekly data on outdoor temperature and hours of operation for both cooling and heating being obtained under Task IV of this study will probably reveal an approximate or average reference temperature for cooling degree-days.

3.5 Factors Affecting Peak Demands for Electric Power in the Housing Area

The unit rate for electric energy at the Little Rock Air Force Base is related by sliding scales to the following three factors: (1) the total monthly usage of electric energy, (2) the magnitude of the maximum 15-minute demand during the month, and (3) the load factor, i.e. the ratio of the average load to the peak 15-minute demand for the month. A reduction of the maximum 15-minute demand in any month would tend to lower the unit rate by virtue of its effect on the second and third factors above even if the total energy usage remained unchanged.

In order to study the contributions of the various house appliances to the peak demands for electric energy, the simultaneous demands in the sample houses at the time of the peak demand for the entire housing area were graphed for a four-hour period, bracketing the time of the maximum value for the months of August 1959 and January 1960, and the individual non-concurrent peak demands for the 16 sample houses were also graphed for periods of four hours for the same months. The data used for these graphs were taken from the strip recorder charts of the demand meters which recorded the average power demand in kilowatts in 15-minute increments for the heat pump, the water heater, the range,
and the total house load. The miscellaneous load in the house, which consisted of the lights, the toaster, the television and radio sets, the refrigerator, the clothes dryer, etc. was not metered separately, but was calculated by subtracting the sum of the range, water heater, and heat pump demands from the total house meter demand.

The concurrent demands in the sample houses at the time of the maximum demand for the entire housing area are shown in Figs. 2 - 13, inclusive, and the average of the demands of the sample houses for the same four-hour periods are shown in Fig. 14. The maximum 15-minute demand for January 1960 for the entire housing area occurred on January 18 at 11:00 a.m., and it averaged 8.1 KW for each of the 1535 houses in the project. The average demand for each of the 16 sample houses at the same time was 7.6 KW, indicating that the sample was fairly representative in this particular instance. An inspection of Figs. 2 - 7, showing the demands of the individual houses from 9:00 a.m. to 1:00 p.m. on January 18, shows that the average demands of five of the sample houses were above 8 KW, the average demands for four others were about 8 KW, and the remaining 7 houses had demands averaging below 8 KW for this four-hour period. Figs. 2 - 7 also show that, for the four hours plotted, the heat pump in eight houses had a maximum or steady high demand coincidental with the housing area maximum, the water heater in eight houses had a maximum or steady high demand coincidental with the housing area maximum, the miscellaneous loads in three houses had maximum demands coincidental with the housing area maximum, and there were no coincidental maximums for the electric range in the 16 sample houses. In each of the sample houses for which the average demand during the four hours from 9:00 a.m. to 1:00 p.m. on January 18 was greater than 8 KW, either the heat pump and water heater, or the water heater and miscellaneous appliances, or all three of these components had maximum demands at 11:00 a.m. when the maximum demand occurred for the entire housing area.

It should be noted that the graphs for miscellaneous demands show some negative values. This situation, which is a physical impossibility, is believed to be caused by a lack of perfect synchronization in the clocks and the 15-minute demand intervals of the four recorder charts used to record the demands for the heat pump, water heater, range, and total for the house.

The maximum 15-minute demand for August 1959 for the entire housing area occurred on August 24 at 11:45 a.m. when the outdoor temperature was 92°F, and the demand averaged 4.9 KW for each of the 1535 houses in the project. The average demand for each of the sample houses (15 in this case, since the total demand meter was not working at this time in house No. 587) at the same time was 5.6 KW, indicating that the demand for the sample houses was above the average for the project by about 15 percent in this instance. Figs. 8 - 13
show that the heat pump in five houses and the water heater in two houses had a maximum or a steady high demand coincidental with the housing area maximum at 11:45 a.m. on August 24, the miscellaneous appliances in five houses had a maximum demand coincidental with housing area maximum demand, and that there was no coincidental maximum demand between the electric range and the entire housing area.

The average demand for all of the sample houses for the four-hour periods bracketing the time of the maximum housing area demand in January and August are plotted in Fig. 14. It is evident in this figure that the average demand for the 16 houses is considerably steadier than for the individual houses. The total house demand averaged about 2 KW less per house in August than in January, due principally to lower heat pump and water heater demands.

The non-concurrent maximum demands in each of the 16 sample houses during the billing period from January 8 to February 8, 1960 were plotted in Figs. 15 - 20, inclusive. It will be noted in these figures that the individual house peaks occurred on different days and at different times of the day in most cases. The outdoor temperature at the time of the peak ranged from 21.6°F in house No. 467 to 57.6°F in house No. 263.

The time of the peaks in the individual houses ranged from 7:15 a.m. to 6:15 p.m., indicating that the activities of the occupants during the day were the principal factor in creating the peak demand. The magnitude of the maximum demand in the sample houses ranged from 12.5 KW to 27 KW and averaged 17.4 KW for the 16 houses. This average value is more than twice as large as the average for the entire housing project at the time of the maximum demand for the entire project.

Figs. 15 - 20 show that the demands of the several items of electrical equipment in the sample houses had a maximum or steady high value coincidental with the maximum for the entire load in 8 houses in the case of the heat pump, in 9 houses for the water heater, in 4 houses for the electric range, and in 12 houses for the miscellaneous appliances. The demand curves for the heat pump in Figs. 15 - 20 indicate that the demand was intermittently greater than the 3 to 4 KW required by the compression system under steady operation in 13 of the 16 sample houses, indicating that the supplementary resistance heaters were energized at times even though the outdoor temperature averaged less than 32°F in only two cases at the time of the peak demand. The figures show that the water heater never contributed more than 5 KW to the peak demand and that the miscellaneous appliances contributed 8 KW or more in eight of the sample houses.

The non-current maximum demands in each of the 16 sample houses during the billing period from August 8 to September 8, 1959 were plotted in Figs. 21 - 26, inclusive. The maximum demand in the individual houses occurred on different days and at different times of the day in most cases. The time of the peaks in the individual houses
ranged from 9:30 a.m. to 8:15 p.m., with all but four occurring after
noon. The outdoor temperature at the time of peak demand ranged from
78°F to 93°F. The magnitude of the peak demand ranged from 11.5 KW to
16.5 KW and averaged 13.5 KW for the 16 sample houses.

Figs. 21 - 26 show that the demands of the several items of elec-
trical equipment in the sample houses had a maximum or steady high value
coincidental with the maximum for the entire load in 16 houses in the
case of the heat pump and miscellaneous appliances, in 13 houses for the
water heater, and in 2 houses for the electric range.

The average of the non-concurrent demands for all of the sample
houses for the four hours bracketing the time of the individual house
peak demands are plotted in Fig. 27 for the months of August 1959 and
January 1960. These graphs indicate a fairly high degree of coincidence
among the peaks for the individual appliances in the houses in producing
the maximum value for the house as a unit. This figure also shows that
a short duration high demand for the miscellaneous appliances was an
important contributing factor in the magnitude of the maximum total
demand.

3.6 Methods of Limiting Maximum Demand in Housing Area

The electric water heaters at Little Rock Air Force Base were not
wired for off-peak heating and were of such a size that the electric
element was energized continuously for several hours when a considerable
amount of hot water was used. The demand meter records showed that the
steady power usage was 4.5 to 5.0 KW when the water heater was operating.
During laundering, the electric clothes dryer, whose energy consumption
was about 5 KW, would be operated intermittently, such that the 15-
minute demand of the water heater and dryer could frequently total 9.5
to 10 KW.

The demand meter records and laboratory data on the heat pumps
used at this air base indicate that the compressor and two blowers would
use 3 to 4 KW when in operation. On a winter day with outdoor tempera-
tures at the balance point or lower, the compressor in many of the heat
pumps would be running continuously, and during a hot summer day near
design conditions continuous operation of many of the heat pumps would
be expected. After adding an average miscellaneous load (other than the
dryer) of 1 KW, and at least 1 KW for the bathroom resistance heater in
the winter time, it can be seen that peak demands on the order of 14 to
15 KW could easily recur, either winter or summer, on a day with outdoor
temperatures near the design conditions when laundering operations
caused the water heater and clothes dryer to be operating at the same
time.

Various devices have been used to limit the power demand in houses
designed for electric heating and all electric appliances. Some of the
load-limiting controls that could be used for this purpose are as follows:
(1) A non-preferential total load limiting device,
(2) A total load limiting device that gave preference to
certain appliances,
(3) A load selector that permitted either of two appliances,
but not both, to be energized,
(4) An off-peak water heating control.

Administrative procedures could also be used to schedule a certain per-
centage of the houses to perform intermittent functions, such as launder-
ing, on each day of the week. This latter method has the advantage that
no equipment is required, but it might be difficult to implement and
would cause some inconvenience at times.

At Little Rock Air Force Base the type of load selector that per-
mitted either of two appliances, but not both, to be energized seems to
be the most practical. Such a control could be connected to the water
heater and clothes dryer circuits so only one of these devices could be
energized at a time. This control should probably give preference to
the clothes dryer because the water heater has at least limited stor-
age capacity. Even this device could cause some delay in heating water
and some inconvenience if prolonged laundering was carried out. Such a
load selector could reduce the peak demand in a given house by 4 to 5
KW, but of course, the average reduction for all houses would be less
than this value because of diversity of appliance use.

An off-peak water heating control is probably impractical at this
air base considering the limited size of the water storage tanks.

A load selector might be connected to the electric range and the
resistance strip heaters in the heat pump, with preference being given
to the range, since the heat output of the range assists in warming the
house with only a small time lag. However, such a device would not
reduce the peak demands in the summertime, and the demand records show
that the electric range seldom contributed significantly to the recorded
maximum demands during either summer or winter.

In general, any load selector should give preference to the house
heating and cooking appliances and provide for selective or delayed pro-
gramming of the more irregular functions such as water heating, laun-
dering, etc., in such a way as to cause the minimum inconvenience to the
occupants of the house.
### Table 2

MONTHLY ELECTRIC ENERGY USAGE IN A SELECTED GROUP OF HOUSES AT LITTLE ROCK AIR FORCE BASE

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<td>14.5</td>
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* Include electric clothes dryer and bathroom heater.
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Energy Use:
- Avg for Pe
- Avg for Pe
- Avg for Pe
- Avg for Pe
- Avg for Pe
- Avg for Pe

Energy Use:
- Avg for Pi
- Avg for Pi
- Avg for Pi
- Avg for Pi
- Avg for Pi
- Avg for Pi

Energy Use:
- Avg for Pi
- Avg for Pi
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Energy Use:
- Avg for Pi
- Avg for Pi
- Avg for Pi
- Avg for Pi
- Avg for Pi
- Avg for Pi

* Include
### Table 4
Relation of Power Usage and Degree-Days Under Heating Conditions for October 1959
Little Rock Air Force Base

<table>
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<tr>
<th>Contractors House Number</th>
<th>Power Consumption</th>
<th>Degree-Days Based on Avg Indoor Temp</th>
<th>Power Usage Factor, KWH/Deg-Days (1000 sq ft)</th>
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<tr>
<td>Number</td>
<td>Appliance Total for Heating</td>
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</tr>
<tr>
<td></td>
<td>KWH</td>
<td>KWH</td>
<td></td>
</tr>
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<td>469</td>
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<td>180</td>
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<td>360</td>
<td>423</td>
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<tr>
<td></td>
<td>585</td>
<td>640</td>
<td>366</td>
</tr>
<tr>
<td></td>
<td>843</td>
<td>440</td>
<td>240</td>
</tr>
<tr>
<td>Average</td>
<td>440</td>
<td>419</td>
<td>859</td>
</tr>
</tbody>
</table>

| 3-Bedroom Houses | 4  | 520 | 385 | 905 | 75 | 59 | 214 | 465 | 999 | 4.2 | 2.4 | 1.9 |
|                 | 74 | 580 | 295 | 875 | 76 | 59 | 214 | 527 | 1013 | 4.0 | 2.7 | 1.6 |
|                 | 163 | 1240 | 607 | 1847 | 76 | 59 | 214 | 527 | 999 | 8.6 | 5.8 | 3.5 |
|                 | 172 | 680 | 240 | 920 | 77 | 59 | 214 | 558 | 1013 | 4.3 | 3.1 | 1.6 |
|                 | 577 | 400 | 623 | 1023 | 74 | 59 | 214 | 465 | 1115 | 4.3 | 1.7 | 2.0 |
|                 | 587 | 500 | 380 | 880 | 73 | 59 | 214 | 434 | 1046 | 4.7 | 2.5 | 1.8 |
|                 | 656 | 560 | 486 | 1046 | 77 | 59 | 214 | 558 | 1046 | 5.5 | 2.9 | 2.5 |
| Average         | 645 | 454 | 1099 | 75 | 59 | 214 | 500 | 1043 | 4.9 | 2.9 | 2.1 |

| 4-Bedroom Houses | 467 | 380 | 782 | 1162 | 76 | 59 | 214 | 527 | 1553 | 3.5 | 1.1 | 1.4 |
|                 | 468 | 960 | 699 | 1659 | 73 | 59 | 214 | 434 | 1900 | 4.1 | 2.4 | 2.0 |
| Average         | 670 | 741 | 1411 | 75 | 59 | 214 | 481 | 1727 | 3.8 | 1.8 | 1.7 |

| Avg for 16 Houses | 571 | 477 | 1048 | 75 | 59 | 214 | 492 | 1085 | 4.6 | 2.5 | 2.0 |
Table 5
Relation of Power Usage and Degree-Days
Under Heating Conditions for
November 1959
Little Rock Air Force Base

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<tr>
<th>Contractors House Number</th>
<th>Power Consumption Heat Pump KWH</th>
<th>Heat Appliance KWH Contribution</th>
<th>Total KWH for Heating</th>
<th>Avg Indoor Temp °F</th>
<th>Avg Outdoor Temp °F</th>
<th>Based on Avg Indoor °F Based on 65° Outdoor °F</th>
<th>Inside Floor Area KWH/Deg-Days (1000 sq ft)</th>
<th>Power Usage Factor, KWH/Deg-Days (1000 sq ft)</th>
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<th>Avg fc</th>
<th>F</th>
<th>Avg fc</th>
<th>F</th>
<th>Avg fc</th>
<th>F</th>
<th>Avg fc</th>
<th>F</th>
</tr>
</thead>
</table>

* Include
**Table 6**

Relation of Power Usage and Degree-Days
Under Heating Conditions for December 1959
Little Rock Air Force Base

<table>
<thead>
<tr>
<th>Contractors House Number</th>
<th>Power Consumption</th>
<th>Degree-Days</th>
<th>Power Usage Factor, KWH/Deg-Days (1000 sq ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heat Appliance</td>
<td></td>
<td>Heat Total, 65° Base, Pump, 65° Base Indoor-Outdoor, ΔT</td>
</tr>
<tr>
<td></td>
<td>Pump Contribution</td>
<td>based on 56° Base, Heat Total, sq ft</td>
<td>Heat</td>
</tr>
<tr>
<td></td>
<td>KWH KWH KWH KWH</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pump KWH KWH KWH</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heating</td>
<td>References</td>
<td>Outdoor Temperatures ΔT °F</td>
</tr>
<tr>
<td></td>
<td>Indoor Temp °F</td>
<td>Outdoor Temp °F</td>
<td>65° Base ❄ Outdoor Temp Area sq ft</td>
</tr>
<tr>
<td><strong>2-Bedroom Houses</strong></td>
<td></td>
<td></td>
<td>65° Base ❄ Outdoor Temp Area sq ft</td>
</tr>
<tr>
<td>14</td>
<td>1140 535 1675 77</td>
<td>43 643 1054</td>
<td>891 2.9 2.0 1.8</td>
</tr>
<tr>
<td>180</td>
<td>760 73 1492 73</td>
<td>43 643 930</td>
<td>891 2.6 1.3 1.8</td>
</tr>
<tr>
<td>263</td>
<td>1080 859 1939 77</td>
<td>43 643 1054</td>
<td>891 3.4 1.9 2.1</td>
</tr>
<tr>
<td>301</td>
<td>1742 529 2271 73</td>
<td>43 643 930</td>
<td>891 4.0 3.0 2.7</td>
</tr>
<tr>
<td>585</td>
<td>1200 560 1760 77</td>
<td>43 643 1054</td>
<td>999 2.7 1.9 1.7</td>
</tr>
<tr>
<td>843</td>
<td>1000 306 1306 69</td>
<td>43 643 806</td>
<td>999 2.0 1.6 1.6</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>1154 587 1741 74</td>
<td>43 643 971</td>
<td>927 2.9 2.0 2.0</td>
</tr>
</tbody>
</table>

| **3-Bedroom Houses**    |                   |             | 65° Base ❄ Outdoor Temp Area sq ft | Total, 65° Base 65° Base Indoor-Outdoor, ΔT |
| 4                        | 1320 390 1710 74 | 43 643 961 | 999 2.7 2.1 1.8 |
| 74                       | 980 677 1657 75 | 43 643 992 | 1013 2.6 1.5 1.6 |
| 163                      | 1700 720 2420 71 | 43 643 868 | 1013 3.8 2.6 2.5 |
| 172                      | 980 278 1258 71 | 43 643 868 | 1115 1.9 1.5 1.4 |
| 577                      | 1140 1016 2156 71 | 43 643 899 | 1046 3.0 1.6 2.2 |
| 587                      | 720 824 1544 72 | 43 643 1085 | 1046 2.3 1.1 1.6 |
| 656                      | 1140 735 1875 78 | 43 643 899 | 1115 2.8 1.7 1.7 |
| 770                      | 1340 1036 2376 72 | 43 643 942 | 1043 3.3 1.9 2.4 |
| **Average**              | 1165 710 1875 73 | 43 643 942 | 927 2.8 1.8 1.9 |

| **4-Bedroom Houses**    |                   |             | 65° Base ❄ Outdoor Temp Area sq ft | Total, 65° Base 65° Base Indoor-Outdoor, ΔT |
| 467                      | 1540 926 2466 72 | 43 643 899 | 1553 2.5 1.5 1.8 |
| 468                      | 1920 1293 3213 74 | 43 643 961 | 1900 2.7 1.6 1.8 |
| **Average**              | 1730 1110 2840 73 | 43 643 930 | 1727 2.6 1.6 1.8 |

Avg for 16 Houses 1231 714 1945 74 43 643 951 1085 2.8 1.8 1.9
<table>
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<tr>
<th>Year</th>
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<th>Total Energy</th>
<th>Avg for No</th>
<th>No</th>
<th>Avg for No</th>
<th>No</th>
<th>Avg for No</th>
<th>No</th>
<th>Avg for No</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<table>
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<tr>
<th>Energy Use</th>
<th>Avg for Pe</th>
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</table>

<table>
<thead>
<tr>
<th>Energy Use</th>
<th>Avg for Pe</th>
</tr>
</thead>
<tbody>
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</table>

<table>
<thead>
<tr>
<th>Energy Use</th>
<th>Avg for Pe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy Use</th>
<th>Avg for Pe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

* Incluc
### Table 7

Relation of Power Usage and Degree-Days Under Heating Conditions for January 1960

Little Rock Air Force Base

<table>
<thead>
<tr>
<th>Contractors House Number</th>
<th>Power Consumption</th>
<th>Degree-Days</th>
<th>Power Usage Factor, KWH/Deg-Days (1000 sq ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heat Pump KWH</td>
<td>Heat KWH A</td>
<td>Avg Indoor Temp °F</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>KWH</td>
</tr>
<tr>
<td>2-Bedroom Houses</td>
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<td></td>
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</tr>
<tr>
<td>14</td>
<td>1440</td>
<td>458</td>
<td>1898</td>
</tr>
<tr>
<td>180</td>
<td>1160</td>
<td>601</td>
<td>1761</td>
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<td>263</td>
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<td>694</td>
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<td>658</td>
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<td>595</td>
<td>1995</td>
</tr>
<tr>
<td>843</td>
<td>1380</td>
<td>613</td>
<td>1993</td>
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<tr>
<td>Average</td>
<td>1430</td>
<td>603</td>
<td>2033</td>
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<tr>
<td>3-Bedroom Houses</td>
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<tr>
<td>4</td>
<td>1400</td>
<td>825</td>
<td>2225</td>
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<tr>
<td>74</td>
<td>1020</td>
<td>934</td>
<td>1954</td>
</tr>
<tr>
<td>163</td>
<td>2580</td>
<td>858</td>
<td>3438</td>
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<tr>
<td>172</td>
<td>1800</td>
<td>609</td>
<td>2409</td>
</tr>
<tr>
<td>577</td>
<td>1400</td>
<td>1076</td>
<td>2476</td>
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<tr>
<td>587</td>
<td>840</td>
<td>1040</td>
<td>1880</td>
</tr>
<tr>
<td>656</td>
<td>1340</td>
<td>729</td>
<td>2069</td>
</tr>
<tr>
<td>770</td>
<td>1680</td>
<td>1019</td>
<td>2699</td>
</tr>
<tr>
<td>Average</td>
<td>1508</td>
<td>886</td>
<td>2394</td>
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<tr>
<td>4-Bedroom Houses</td>
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<td></td>
<td></td>
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<tr>
<td>467</td>
<td>2180</td>
<td>1418</td>
<td>3598</td>
</tr>
<tr>
<td>468</td>
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<td>1265</td>
<td>3865</td>
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<tr>
<td>Average</td>
<td>2390</td>
<td>1342</td>
<td>3732</td>
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<tr>
<td>Avg for 16 Houses</td>
<td>1589</td>
<td>837</td>
<td>2426</td>
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</tbody>
</table>
### Table 8
Relation of Power Usage and Degree-Days Under Cooling Conditions for August 1959
Little Rock Air Force Base

|-------------------------|-----------------------------------------------|--------------------------|---------------------------|---------------------------------------------------------------|-----------------------------------------------|
ELECTRIC ENERGY USE IN 16 HOUSES
LITTLE ROCK A.F.B.

Figure 1
POWER DEMAND OF SAMPLE HOUSE BASED ON 15 MINUTE DEMAND AT TIME OF TOTAL HOUSING PEAK LITTLE ROCK A.F.B.

HOUSE 263 A  HOUSE 180 A  HOUSE 587 D
1/18/60  1/19/60  1/18/60
BASE PEAK 1100  BASE PEAK 1100  BASE PEAK 1100
AVG. TEMP. 31.4  AVG. TEMP. 31.4  AVG. TEMP. 31.4

TIME IN HOURS

Figure 2
POWER DEMAND OF SAMPLE HOUSE BASED ON 15 MINUTE DEMAND AT TIME OF TOTAL HOUSING PEAK LITTLE ROCK A.F.B.

HOUSE 74 B
1/18/60
BASE PEAK 1100
AVG. TEMP. 31.4

HOUSE 172 B
1/18/60
BASE PEAK 1100
AVG. TEMP. 31.4

HOUSE 968 G
1/18/60
BASE PEAK 1100
AVG. TEMP. 31.4

Figure 3
POWER DEMAND OF SAMPLE HOUSE BASED ON 15 MINUTE DEMAND AT TIME OF TOTAL HOUSING PEAK LITTLE ROCK A.F.B.

HOUSE 301 A2  
1/18/60  
BASE PEAK 1100  
AVG. TEMP. 31.4

HOUSE 577 E  
1/18/60  
BASE PEAK 1100  
AVG. TEMP. 31.4

HOUSE 163 B1  
1/18/60  
BASE PEAK 1100  
AVG. TEMP. 31.4

Figure 4
POWER DEMAND OF SAMPLE HOUSE BASED ON 15 MINUTE DEMAND AT TIME OF TOTAL HOUSING PEAK LITTLE ROCK A.F.B.

HOUSE 467 E
1/18/60
BASE PEAK 1100
AV6. TEMP. 31.4

HOUSE 656 D
1/18/60
BASE PEAK 1100
AV6. TEMP. 31.4

HOUSE 14 A
1/18/60
BASE PEAK 1100
AV6. TEMP. 31.4

Figure 5
POWER DEMAND OF SAMPLE HOUSE BASED ON 15 MINUTE DEMAND AT TIME OF TOTAL HOUSING PEAK LITTLE ROCK A.F.B.

HOUSE 585 C
1/18/60
BASE PEAK 1100
AVG. TEMP. 31.4

HOUSE 4 B1
1/18/60
BASE PEAK 1100
AVG. TEMP. 31.4

HOUSE 770 E
1/18/60
BASE PEAK 1100
AVG. TEMP. 31.4

Figure 6
Power demand of sample house based on 15 minute demand at time of total housing peak, Little Rock A.F.B.

House 843 C
1/18/60
Base peak 1100
Avg temp. 31.4

Figure 7
Power demand of sample house based on 15 minute demand at time of total housing peak, Little Rock A.F.B.

**House 4 B**
- Base peak 11:45 AM
- 8/24/59
- Avg. temp. 92.2

**House 14 A**
- Base peak 11:45 AM
- 8/24/59
- Avg. temp. 92.2

**House 74 B**
- Base peak 11:45 AM
- 8/24/59
- Avg. temp. 92.2

**Figure 8**
POWER DEMAND OF SAMPLE HOUSE BASED ON 15 MINUTE DEMAND AT TIME OF TOTAL HOUSING PEAK LITTLE ROCK A.F.B.

<table>
<thead>
<tr>
<th>HOUSE 163 B</th>
<th>HOUSE 172 B</th>
<th>HOUSE 180 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASE PEAK 1145</td>
<td>BASE PEAK 1145</td>
<td>BASE PEAK 1145</td>
</tr>
<tr>
<td>8/24/59</td>
<td>8/24/59</td>
<td>8/24/59</td>
</tr>
<tr>
<td>AVG. TEMP. 92.2</td>
<td>AVG. TEMP. 92.2</td>
<td>AVG. TEMP. 92.2</td>
</tr>
</tbody>
</table>

Figure 9
POWER DEMAND OF SAMPLE HOUSE BASED ON 15 MINUTE DEMAND AT TIME OF TOTAL HOUSING PEAK LITTLE ROCK A.F.B.

HOUSE 263 A
BASE PEAK 1145
8/24/59
AVG. TEMP. 92.2

HOUSE 301 A
BASE PEAK 1145
8/24/59
AVG. TEMP. 92.2

HOUSE 467 F
BASE PEAK 1145
8/24/59
AVG. TEMP. 92.2

Figure 10
POWER DEMAND OF SAMPLE HOUSE BASED ON 15 MINUTE DEMAND AT TIME OF TOTAL HOUSING PEAK LITTLE ROCK A.F.B.

HOUSE 656 D
BASE PEAK 1145
8/24/59
AVG. TEMP. 92.2

HOUSE 770 E
BASE PEAK 1145
8/24/59
AVG. TEMP. 92.2

HOUSE 843 C
BASE PEAK 1145
8/24/59
AVG. TEMP. 92.2

Figure 11
POWER DEMAND OF SAMPLE HOUSE BASED ON 15 MINUTE DEMAND AT TIME OF TOTAL HOUSING PEAK LITTLE ROCK A.F.B.

HOUSE 469 G
BASE PEAK 1145
7/24/59
AVG. TEMP. 92.2

HOUSE 577 E
BASE PEAK 1145
8/24/59
AVG. TEMP. 92.2

HOUSE 525 C
BASE PEAK 1145
9/24/59
AVG. TEMP. 92.2

Figure 12
POWER DEMAND OF SAMPLE HOUSE BASED ON 15 MINUTE DEMAND AT TIME OF TOTAL HOUSING PEAK LITTLE ROCK A.F.B.

HOUSE 587 D
BASE PEAK 1145
8/24/59
AVERAGE TEMP 92.8

Figure 13
AVERAGE OF PEAK OF 16 HOUSES AT TIME
OF TOTAL HOUSING PEAK LITTLE ROCK A.F.B.

*AUGUST
AVERAGES AFFECTED BY
ONE INOPERATIVE HOUSE
TOTAL METER.

Figure 14
POWER USAGE BASED ON 15 MINUTE DEMAND AT TIME OF MONTHLY PEAK LITTLE ROCK A.F.B.

HOUSE 163 B3 PEAK AT 14:30 2/1/60 AVG. TEMP. 53.2
HOUSE 467 F PEAK AT 07:15 1/22/60 AVG. TEMP. 21.6
HOUSE 770 E PEAK AT 13:00 1/18/60 AVG. TEMP. 32.0

Figure 15
POWER USAGE BASED ON 15 MINUTE DEMAND AT
TIME OF MONTHLY PEAK LITTLE ROCK A.F.B.

<table>
<thead>
<tr>
<th>HOUSE</th>
<th>180 A</th>
<th>HOUSE</th>
<th>14 B</th>
<th>HOUSE</th>
<th>14 A5</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEAK AT</td>
<td>1330</td>
<td>PEAK AT</td>
<td>1815</td>
<td>PEAK AT</td>
<td>1215</td>
</tr>
<tr>
<td>1/20/60</td>
<td>2/5/60</td>
<td>12/15/60</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVG. TEMP. 36.0</td>
<td>AVG. TEMP. 46.4</td>
<td>AVG. TEMP. 61.1</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

KILOWATTS

HOUSE TOTAL

KITCHEN WATER HEATER HEAT PUMP

MISC. (C404C)

TIME IN HOURS

Figure 16
POWER USAGE BASED ON 15 MINUTE DEMAND AT
TIME OF MONTHLY PEAK LITTLE ROCK A.F.B.

HOUSE 468 G
PEAK AT 0730 1/21/60
AVG. TEMP. 25.7

HOUSE 301 A1
PEAK AT 0915 1/29/60
AVG. TEMP. 39.1

HOUSE 263 A
PEAK AT 1245 2/8/60
AVG. TEMP. 57.6

TIME IN HOURS

Figure 17
POWER USAGE BASED ON 15 MINUTE DEMAND AT TIME OF MONTHLY PEAK LITTLE ROCK A.F.B.

HOUSE 587 D  
PEAK AT 0900 2/6/60  
AVG. TEMP. 39.3

HOUSE 577 E  
PEAK AT 0845 1/17/60  
AVG. TEMP. 38.4

HOUSE 585 C  
PEAK AT 1715 1/20/60  
AVG. TEMP. 35.3

Figure 18
POWER USAGE BASED ON 15 MINUTE DEMAND AT
TIME OF MONTHLY PEAK LITTLE ROCK A.F.B.

HOUSE 656 D
PEAK AT 0715
1/25/60
AVG. TEMP. 35.8

HOUSE 843 C
PEAK AT 1000
1/25/60
AVG. TEMP. 36.1

HOUSE 172 B
PEAK AT 1815
1/16/60
AVG. TEMP. 37.5

Figure 19
POWER USAGE BASED ON 15 MINUTE DEMAND AT
TIME OF MONTHLY PEAK LITTLE ROCK A.F.B.

HOUSE 467 F
PEAK AT 1415 8/21/59
AVG. TEMPERATURE 90.3

HOUSE 585 G
PEAK AT 1745 8/25/59
AVG. TEMPERATURE 87.3

HOUSE 140 R
PEAK AT 1215 8/20/59
AVG. TEMPERATURE 87.9

Figure 21
POWER USAGE BASED ON 15 MINUTE DEMAND AT TIME OF MONTHLY PEAK LITTLE ROCK A.F.B.

<table>
<thead>
<tr>
<th>HOUSE 468 G</th>
<th>HOUSE 301 R2</th>
<th>HOUSE 587 D</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEAK AT 1415</td>
<td>PEAK AT 1030</td>
<td>PEAK AT 1130</td>
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<tr>
<td>8/29/59</td>
<td>8/16/59</td>
<td>8/10/59</td>
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<tr>
<td>AVG. TEMP. 89.8</td>
<td>AVG. TEMP. 88.8</td>
<td>AVG. TEMP. 86.1</td>
</tr>
</tbody>
</table>

Figure 22
POWER USAGE BASED ON 15 MINUTE DEMAND AT
TIME OF MONTHLY PEAK LITTLE ROCK A.F.B.

HOUSE 180 A
PEAK AT 1315
4/2/59
AVG TEMP 89.7
AVG. TEMP 82.1

HOUSE 656 D
PEAK AT 0945
9/1/59
AVG TEMP 82.1

HOUSE 74 B
PEAK AT 1400
8/23/59
AVG TEMP 93.4

Figure 23
POWER USAGE BASED ON 15 MINUTE DEMAND AT
TIME OF MONTHLY PEAK LITTLE ROCK A.F.B.

HOUSE 263 A  
PEAK AT 1200  
8/7/59  
AVG. TEMP. 88.0

HOUSE 163 B  
PEAK AT 1615  
9/4/59  
AVG. TEMP. 78.3

HOUSE 843 C  
PEAK AT 245  
8/28/59  
AVG. TEMP. 86.6

Figure 24
POWER USAGE BASED ON 15 MINUTE DEMAND AT TIME OF MONTHLY PEAK LITTLE ROCK A.F.B.

HOUSE 770 E  
PEAK AT 1845  
8/17/59  
AVG. TEMP. 86.6

HOUSE 577 E  
PEAK AT 2015  
8/20/59  
AVG. TEMP. 80.9

HOUSE 172 B  
PEAK AT 1845  
8/17/59  
AVG. TEMP. 86.6

Figure 25
POWER USAGE BASED ON 15 MINUTE DEMAND AT TIME OF MONTHLY PEAK LITTLE ROCK A.F.B.

HOUSE 4 B1
PEAK AT 0930
9/8/59
AVG. TEMP. 83.9

Figure 26
AVERAGE OF PEAK OF 16 HOUSES AT TIME OF INDIVIDUAL PEAK LITTLE ROCK

Figure 27
THE NATIONAL BUREAU OF STANDARDS

The scope of activities of the National Bureau of Standards at its major laboratories in Washington, D.C., and Boulder, Colorado, is suggested in the following listing of the divisions and sections engaged in technical work. In general, each section carries out specialized research, development, and engineering in the field indicated by its title. A brief description of the activities, and of the resultant publications, appears on the inside of the front cover.

WASHINGTON, D.C.


- Office of Basic Instrumentation.
- Office of Weights and Measures.

BOULDER, COLORADO


