

## Section 17

# ENERGY AND SCIENCE

This section presents statistics on energy production and consumption, the electric and gas utility industries, research and development, and scientific resources. Related series are cited in Sections 12 (on utility employment), 14 (prices), and 18 (gasoline consumption).

Total energy consumption in 1985 amounted to 232 trillion British thermal units, compared with 217 trillion BTU a decade earlier. Transportation, including aviation fuels, accounted for 62 percent of the 1985 total. Total expenditures for fuels and electricity in 1986 totaled \$1.56 billion.

Electricity sales exceeded 7.0 billion kilowatt-hours in 1986, a total that has increased 25 percent since 1976. Manufactured gas sales reached 31 million therms in 1986, 12.5 percent below the figure ten years earlier. Residential rates in 1986 averaged 9.3 cents per kilowatt-hour and \$1.57 per therm, both almost double the corresponding rates a decade earlier. Average residential use (6,714 kWh and 194 therms in 1986) has declined significantly since the early 1970s. By 1986, almost 11 percent of the housing units in the State had solar heating devices.

The liquid fuel tax base for 1986 was approximately 1.06 billion gallons, compared with 850 million in 1976. The 1986 total included 337 million gallons of gasoline, 603 million of aviation fuel, and 115 million of diesel oil. The average price for automotive gasoline rose from 78 cents per gallon in June 1978 to \$1.58 three years later, then fell to \$1.07 by December 1986.

The State is well served with scientific resources. Especially noteworthy is the cluster of large telescopes used for astronomical observations at the summit of Mauna Kea -- nine major facilities, including those under construction. Federal research and development obligations in Hawaii reached \$71 million in 1983. Thirty-seven patents were granted to Hawaii residents in 1986.

Information on energy and science can be obtained from reports and records of the U.S. Department of Energy, U.S. Patent and Trademark Office, U.S. Bureau of Labor Statistics, National Science Foundation, Hawaii State Department of Taxation, Hawaii State Department of Commerce and Consumer Affairs and its Division of Consumer Advocacy, Hawaii State Department of Business and Economic Development Energy Division, UH Institute for Astronomy, and individual utility companies. Historical Statistics of Hawaii, Section 19, presents data for earlier years. Data for the nation as a whole can be found in the Statistical Abstract of the United States: 1987, Sections 19 and 20.

Table 490.-- CONSUMPTION OF ENERGY, BY SOURCE (PHYSICAL UNITS):  
1960 TO 1985

| Year      | Petroleum <sup>1/</sup><br>(1,000<br>barrels) | Hydro-<br>electric<br>power <sup>2/</sup><br>(million kWh) | Geothermal<br>energy<br>(million kWh) | Other <sup>3/</sup><br>(million kWh) |
|-----------|---|--|---------------------------------------|--------------------------------------|
| 1960 .... | 17,067  | 27   | 0                                     | 0                                    |
| 1961 .... | 20,690  | 24   | 0                                     | 0                                    |
| 1962 .... | 19,733  | 20   | 0                                     | 0                                    |
| 1963 .... | 20,672  | 23   | 0                                     | 0                                    |
| 1964 .... | 22,117  | 115  | 0                                     | 0                                    |
| 1965 .... | 23,178  | 105  | 0                                     | 0                                    |
| 1966 .... | 25,823  | 112  | 0                                     | 2                                    |
| 1967 .... | 29,125  | 108  | 0                                     | 0                                    |
| 1968 .... | 32,385  | 94   | 0                                     | 30                                   |
| 1969 .... | 33,832  | 100  | 0                                     | 29                                   |
| 1970 .... | 34,806  | 108  | 0                                     | 24                                   |
| 1971 .... | 37,432  | 89   | 0                                     | 15                                   |
| 1972 .... | 38,390  | 91   | 0                                     | 18                                   |
| 1973 .... | 39,300  | 95   | 0                                     | 22                                   |
| 1974 .... | 37,286  | 92   | 0                                     | 30                                   |
| 1975 .... | 37,598  | 89   | 0                                     | 25                                   |
| 1976 .... | 37,965  | 93   | 0                                     | 29                                   |
| 1977 .... | 40,229  | 86   | 0                                     | 26                                   |
| 1978 .... | 40,820  | 84   | 0                                     | 0                                    |
| 1979 .... | 44,521  | 90   | 0                                     | 0                                    |
| 1980 .... | 43,500  | 86   | 0                                     | 0                                    |
| 1981 .... | 38,701  | 80   | 0                                     | 15                                   |
| 1982 .... | 35,618  | 90   | 0                                     | 26                                   |
| 1983 .... | 36,322  | 84   | 0                                     | 28                                   |
| 1984 .... | 36,914  | 82   | 21                                    | 28                                   |
| 1985 .... | 39,355  | 86   | 19                                    | 25                                   |

<sup>1/</sup> For data by type of petroleum, see source. 1981-1984 revised from Data Book 1986, table 465.

<sup>2/</sup> Includes industrial and electric utility production.

<sup>3/</sup> Wood, waste, wind, photovoltaic, and solar thermal energy sources consumed at electric utilities to produce electricity. Excludes coal, natural gas, and nuclear electric power.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data Report, Consumption Estimates, 1960-1985 (April 1987), p. 79.

Table 491.-- CONSUMPTION OF ENERGY, BY SOURCE (TRILLION BTU):  
1960 TO 1985

[Revised from Data Book 1986, table 466]

| Year      | Total energy consumed <u>1/</u> | Petroleum <u>2/</u> | Hydro-electric power <u>3/</u> | Geo-thermal energy | Coal, nuclear power, and natural gas <u>4/</u> | Other types <u>5/</u> |
|-----------|---------------------------------|---------------------|--------------------------------|--------------------|--|-----------------------|
| 1960 .... | 95.8                            | 95.5                | 0.3                            | 0.0                | 0.0  | 0.0                   |
| 1961 .... | 117.1                           | 116.8               | 0.3                            | 0.0                | 0.0  | 0.0                   |
| 1962 .... | 112.2                           | 112.0               | 0.2                            | 0.0                | 0.0  | 0.0                   |
| 1963 .... | 118.1                           | 117.8               | 0.2                            | 0.0                | 0.0  | 0.0                   |
| 1964 .... | 127.9                           | 126.7               | 1.2                            | 0.0                | 0.0  | 0.0                   |
| 1965 .... | 134.2                           | 133.1               | 1.1                            | 0.0                | 0.0  | 0.0                   |
| 1966 .... | 149.2                           | 148.0               | 1.2                            | 0.0                | 0.0  | (Z)                   |
| 1967 .... | 168.4                           | 167.2               | 1.1                            | 0.0                | 0.0  | 0.0                   |
| 1968 .... | 187.4                           | 186.1               | 1.0                            | 0.0                | 0.0  | 0.3                   |
| 1969 .... | 194.9                           | 193.6               | 1.0                            | 0.0                | 0.0  | 0.3                   |
| 1970 .... | 200.6                           | 199.2               | 1.1                            | 0.0                | 0.0  | 0.3                   |
| 1971 .... | 215.2                           | 214.1               | 0.9                            | 0.0                | 0.0  | 0.2                   |
| 1972 .... | 221.1                           | 220.0               | 0.9                            | 0.0                | 0.0  | 0.2                   |
| 1973 .... | 226.5                           | 225.3               | 1.0                            | 0.0                | 0.0  | 0.2                   |
| 1974 .... | 214.7                           | 213.5               | 1.0                            | 0.0                | 0.0  | 0.3                   |
| 1975 .... | 216.8                           | 215.6               | 0.9                            | 0.0                | 0.0  | 0.3                   |
| 1976 .... | 219.2                           | 217.9               | 1.0                            | 0.0                | 0.0  | 0.3                   |
| 1977 .... | 232.5                           | 231.3               | 0.9                            | 0.0                | 0.0  | 0.3                   |
| 1978 .... | 235.9                           | 235.0               | 0.9                            | 0.0                | 0.0  | 0.0                   |
| 1979 .... | 255.4                           | 254.5               | 0.9                            | 0.0                | 0.0  | 0.0                   |
| 1980 .... | 253.1                           | 249.2               | 0.9                            | 0.0                | 3.0  | 0.0                   |
| 1981 .... | 226.3                           | 222.5               | 0.8                            | 0.0                | 2.8  | 0.2                   |
| 1982 .... | 207.2                           | 203.2               | 0.9                            | 0.0                | 2.8  | 0.3                   |
| 1983 .... | 209.4                           | 205.5               | 0.9                            | 0.0                | 2.7  | 0.3                   |
| 1984 .... | 217.7                           | 213.7               | 0.8                            | 0.4                | 2.4  | 0.3                   |
| 1985 .... | 232.2                           | 227.9               | 0.9                            | 0.4                | 2.7  | 0.3                   |

Z Less than 0.05.

1/ Totals may not equal sum of components due to independent rounding.

2/ For data by type of petroleum, see source.

3/ Includes industrial and electric utility production.

4/ Data for 1980-1985 are apparently in error.

5/ Wood, waste, wind, photovoltaic, and solar thermal energy sources consumed at electric utilities to produce electricity.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data Report, Consumption Estimates, 1960-1985 (April 1987), p. 79.

Table 492.-- CONSUMPTION OF ENERGY BY END-USE SECTOR: 1960 TO 1984

[Trillion Btu. Revised from Data Book 1986, table 444]

| Year       | Consumption <u>1/</u> |            |            |                | Electric utilities <u>2/</u> |
|------------|-----------------------|------------|------------|----------------|------------------------------|
|            | Residential           | Commercial | Industrial | Transportation |                              |
| 1960 ..... | 7.3                   | 5.2        | 18.2       | 65.2           | 17.6                         |
| 1961 ..... | 7.5                   | 5.4        | 26.8       | 77.4           | 19.4                         |
| 1962 ..... | 8.0                   | 5.5        | 28.9       | 69.8           | 21.4                         |
| 1963 ..... | 8.9                   | 6.0        | 29.6       | 73.5           | 24.2                         |
| 1964 ..... | 9.6                   | 6.6        | 32.4       | 79.2           | 26.7                         |
| 1965 ..... | 10.1                  | 6.8        | 34.7       | 82.6           | 27.6                         |
| 1966 ..... | 10.8                  | 7.4        | 36.0       | 95.1           | 29.7                         |
| 1967 ..... | 12.1                  | 8.0        | 39.1       | 109.2          | 31.3                         |
| 1968 ..... | 13.1                  | 8.8        | 38.9       | 126.7          | 35.0                         |
| 1969 ..... | 14.9                  | 9.8        | 41.0       | 129.2          | 38.7                         |
| 1970 ..... | 16.4                  | 11.6       | 43.9       | 128.7          | 43.2                         |
| 1971 ..... | 17.8                  | 11.4       | 43.7       | 142.3          | 47.7                         |
| 1972 ..... | 19.6                  | 12.7       | 49.0       | 139.7          | 54.1                         |
| 1973 ..... | 20.0                  | 13.5       | 49.2       | 143.8          | 55.6                         |
| 1974 ..... | 20.3                  | 13.3       | 49.5       | 131.7          | 57.5                         |
| 1975 ..... | 19.6                  | 13.8       | 49.9       | 133.4          | 58.8                         |
| 1976 ..... | 21.3                  | 15.3       | 50.9       | 131.7          | 62.5                         |
| 1977 ..... | 21.8                  | 16.8       | 52.6       | 141.3          | 65.2                         |
| 1978 ..... | 21.8                  | 17.4       | 52.1       | 144.6          | 66.8                         |
| 1979 ..... | 22.9                  | 18.1       | 58.0       | 156.3          | 67.7                         |
| 1980 ..... | 23.2                  | 20.8       | 62.4       | 146.7          | 69.7                         |
| 1981 ..... | 23.0                  | 18.8       | 60.5       | 124.0          | 69.9                         |
| 1982 ..... | 21.5                  | 17.6       | 65.9       | 102.2          | 66.9                         |
| 1983 ..... | 22.1                  | 17.8       | 51.5       | 118.0          | 68.6                         |
| 1984 ..... | 21.0                  | 18.6       | 46.4       | 131.7          | 70.6                         |
| 1985 ..... | 20.8                  | 19.3       | 47.2       | 144.8          | 70.0                         |

1/ Excludes small quantities of energy sources for which consistent historical data are not available, such as solar energy obtained by the use of thermal and photovoltaic collectors; wind energy; and geothermal, biomass, and waste energy other than that consumed at the electric utilities. Includes power from electric utilities, including electrical energy losses incurred in the generation and transmission of electricity.

2/ Energy input at electric utilities. Distributed among the other four sectors.

Source: U.S. Department of Energy, Energy Information Administration, State Energy Data Report, Consumption Estimates, 1960-1985 (April 1987), pp. 80-84.

Table 493.-- PRIMARY ENERGY USE, BY SOURCE: 1981 TO 1986

[Thousands of barrels of oil equivalent]

| Year                 | All sources | Petroleum | Biomass | Hydro electricity | Coal | Geothermal | Wind |
|----------------------|-------------|-----------|---------|-------------------|------|------------|------|
| 1981 .....           | 46,084      | 42,879    | 2,791   | 117               | 297  | -          | -    |
| 1982 .....           | 45,891      | 42,510    | 2,980   | 174               | 202  | 25         | -    |
| 1983 .....           | 47,007      | 43,616    | 3,069   | 141               | 151  | 30         | -    |
| 1984 .....           | 46,644      | 43,233    | 3,119   | 124               | 135  | 33         | -    |
| 1985 .....           | 45,078      | 41,786    | 3,021   | 156               | 58   | 30         | 27   |
| 1986 <u>1/</u> ..... | 44,762      | 41,439    | 2,961   | 162               | 79   | 28         | 93   |

1/ Provisional.

Source: Hawaii State Department of Commerce and Consumer Affairs, records; Hawaii State Department of Business and Economic Development, records; Hawaiian Sugar Planters' Association, records.

Table 494.-- ELECTRICITY GENERATION BY SOURCE: 1981 TO 1986

[Millions of kWh generated]

| Year             | Total | Petroleum | Biomass | Hydro-electric | Geothermal | Wind | Coal |
|------------------|-------|-----------|---------|----------------|------------|------|------|
| 1981 .....       | 7,615 | 6,913     | 628     | 74             | -          | -    | -    |
| 1982 .....       | 7,467 | 6,729     | 612     | 110            | 16         | -    | -    |
| 1983 .....       | 7,689 | 6,914     | 667     | 89             | 19         | -    | -    |
| 1984 .....       | 7,841 | 7,073     | 669     | 78             | 21         | -    | -    |
| 1985 .....       | 7,821 | 7,001     | 670     | 98             | 19         | 17   | 16   |
| 1986 <u>1/</u> . | 8,196 | 7,360     | 643     | 102            | 18         | 58   | 15   |

1/ Provisional.

Source: Hawaii State Department of Commerce and Consumer Affairs, records; Hawaii State Department of Business and Economic Development, records; Hawaiian Sugar Planters' Association, records.

Table 495.-- EXPENDITURES FOR FUELS AND ELECTRICITY, BY SOURCE:  
1970 TO 1986

[Millions of dollars]

| Year             | Total energy expend. | Fuel expenditures |                  |         | Less: electric utility fuel expend. | Plus: electric purch. by end-user |
|------------------|----------------------|-------------------|------------------|---------|-------------------------------------|-----------------------------------|
|                  |                      | Total             | Electric utility | Other   |                                     |                                   |
| 1970 ....        | 282.7                | 215.9             | 17.3             | 198.6   | 17.3                                | 84.1                              |
| 1971 ....        | 320.8                | 246.8             | 24.8             | 222     | 24.8                                | 98.8                              |
| 1972 ....        | 332.4                | 250.4             | 27.3             | 223.1   | 27.3                                | 109.3                             |
| 1973 ....        | 391.1                | 300.9             | 36.3             | 264.6   | 36.3                                | 126.5                             |
| 1974 ....        | 534.5                | 433.2             | 49.8             | 383.4   | 49.8                                | 151.1                             |
| 1975 ....        | 669.9                | 546.1             | 91.9             | 454.2   | 91.9                                | 215.7                             |
| 1976 ....        | 735.6                | 600               | 100.4            | 499.6   | 100.4                               | 236                               |
| 1977 ....        | 844.5                | 696.5             | 123.5            | 573     | 123.5                               | 271.5                             |
| 1978 ....        | 932.2                | 767.8             | 149.3            | 618.5   | 149.3                               | 313.7                             |
| 1979 ....        | 1,261.3              | 1,083.7           | 177              | 906.7   | 177                                 | 354.6                             |
| 1980 ....        | 1,721.3              | 1,529.8           | 267.8            | 1,262   | 267.8                               | 459.3                             |
| 1981 ....        | 2,195.2              | 1,947.7           | 451.5            | 1,496.2 | 451.5                               | 699                               |
| 1982 ....        | 2,153.8              | 1,869.6           | 439.4            | 1,430.2 | 439.4                               | 723.6                             |
| 1983 ....        | 2,019.9              | 1,730.1           | 369.3            | 1,360.8 | 369.3                               | 659.1                             |
| 1984 ....        | 2,048.4              | 1,724.8           | 379.3            | 1,345.5 | 379.3                               | 702.9                             |
| 1985 ....        | 1,921.6              | 1,586.6           | 337.6            | 1,249.0 | 337.6                               | 672.6                             |
| 1986 <u>1/</u> . | 1,564.0              | 1,147.3           | 224.6            | 922.7   | 224.6                               | 641.3                             |

1/ Provisional.

Source: Hawaii State Department of Business and Economic Development, Division of Energy, unpublished estimates.

Table 496.-- EXPENDITURES FOR FUELS AND ELECTRICITY, BY SECTORS:  
1970 TO 1986

[Millions of dollars]

| Year                  | Total fuel | Residential |        | Commercial and industrial |        | Transport: fuel | Electric utilities: fuel |
|-----------------------|------------|-------------|--------|---------------------------|--------|-----------------|--------------------------|
|                       |            | Fuel        | Elect. | Fuel                      | Elect. |                 |                          |
| 1970 .....            | 215.9      | 5.5         | 34.1   | 18.9                      | 50     | 174.2           | 17.3                     |
| 1971 .....            | 246.8      | 8.7         | 38.8   | 17.9                      | 60     | 195.4           | 24.8                     |
| 1972 .....            | 250.4      | 6.1         | 42.6   | 20.5                      | 66.7   | 196.5           | 27.3                     |
| 1973 .....            | 300.9      | 10.5        | 48.7   | 24.4                      | 77.8   | 229.7           | 36.3                     |
| 1974 .....            | 443.2      | 10.4        | 57.1   | 44.7                      | 94     | 328.3           | 49.8                     |
| 1975 .....            | 546.1      | 7.4         | 76.9   | 45.8                      | 138.8  | 401             | 91.9                     |
| 1976 .....            | 600        | 12.7        | 84     | 45.9                      | 152    | 441             | 100.4                    |
| 1977 .....            | 696.5      | 13.9        | 92.9   | 55                        | 178.6  | 504.1           | 123.5                    |
| 1978 .....            | 767.8      | 13.3        | 105.8  | 52.6                      | 207.9  | 552.6           | 149.3                    |
| 1979 .....            | 1,083.7    | 26.2        | 118.9  | 102.4                     | 235.7  | 778.1           | 177                      |
| 1980 .....            | 1,529.8    | 19.5        | 146.4  | 135.4                     | 312.9  | 1,107.1         | 267.8                    |
| 1981 .....            | 1,947.7    | 20.6        | 214.6  | 232.4                     | 484.4  | 1,243.2         | 451.5                    |
| 1982 .....            | 1,869.6    | 26.2        | 222.4  | 283.6                     | 501.2  | 1,120.4         | 439.4                    |
| 1983 .....            | 1,730.1    | 22.9        | 205.9  | 288.1                     | 453.2  | 1,049.8         | 369.3                    |
| 1984 .....            | 1,724.8    | 20.6        | 217.4  | 192.1                     | 485.5  | 1,132.8         | 379.3                    |
| 1985 <sup>1/</sup> .. | 1,586.6    | 20.6        | 213.5  | 100.8                     | 459.1  | 1,127.6         | 337.6                    |
| 1986 <sup>2/</sup> .. | 1,147.3    | 13.8        | 195.8  | 65.8                      | 445.6  | 843.1           | 224.6                    |

<sup>1/</sup> Revised from Data Book 1986, table 471.

<sup>2/</sup> Preliminary.

Source: Hawaii State Department of Business and Economic Development, Division of Energy, unpublished estimates.

Table 497.-- ELECTRIC UTILITIES: 1976 TO 1986

| Year    | Customers, Dec. 31                     |             |                                | Installed capacity, Dec. 31 (kW) | Power sold (1,000 kWh) |             |           |
|---------|--|-------------|--------------------------------|----------------------------------|------------------------|-------------|-----------|
|         | Total                                  | Residential | Other                          |                                  | Total                  | Residential | Other     |
| 1976 .. | 270,035                                | 232,070     | 37,965                         | 1,454,359                        | 5,615,209              | 1,750,618   | 3,864,592 |
| 1977 .. | 275,616                                | 237,557     | 38,059                         | 1,481,680                        | 5,831,610              | 1,779,314   | 4,052,296 |
| 1978 .. | 284,064                                | 244,863     | 39,201                         | 1,487,490                        | 6,004,891              | 1,799,024   | 4,205,867 |
| 1979 .. | 293,061                                | 252,898     | 40,163                         | 1,502,840                        | 6,197,426              | 1,851,457   | 4,345,969 |
| 1980 .. | 301,544                                | 260,358     | 41,186                         | 1,514,180                        | 6,345,531              | 1,852,984   | 4,492,547 |
| 1981 .. | 305,927                                | 265,042     | 40,885                         | 1,652,380                        | 6,424,016              | 1,855,837   | 4,568,179 |
| 1982 .. | 313,009                                | 270,712     | 42,297                         | 1,644,980                        | 6,332,707              | 1,801,297   | 4,531,410 |
| 1983 .. | 319,449                                | 276,194     | 43,255                         | 1,578,780                        | 6,425,578              | 1,814,336   | 4,611,242 |
| 1984 .. | 324,384                                | 280,518     | 43,866                         | 1,578,780                        | 6,606,255              | 1,837,954   | 4,768,301 |
| 1985 .. | 330,407                                | 285,117     | 45,290                         | 1,567,230                        | 6,635,158              | 1,879,027   | 4,756,131 |
| 1986 .. | 337,563                                | 291,222     | 46,341                         | 1,553,580                        | 7,025,739              | 1,959,447   | 5,066,292 |
| Year    | Average annual use (kWh) <sup>1/</sup> |             | Average rate (dollars per kWh) |                                  | Revenues (\$1,000)     |             |           |
|         | Residential                            | Other       | Residential                    | Other                            | Total                  | Residential | Other     |
| 1976 .. | 7,543                                  | 101,794     | .04796                         | .03934                           | 235,999                | 83,957      | 152,042   |
| 1977 .. | 7,490                                  | 106,474     | .05222                         | .04408                           | 271,553                | 92,917      | 178,636   |
| 1978 .. | 7,347                                  | 107,290     | .05883                         | .04943                           | 313,722                | 105,846     | 207,876   |
| 1979 .. | 7,321                                  | 108,208     | .06420                         | .05424                           | 354,595                | 118,862     | 235,733   |
| 1980 .. | 7,117                                  | 109,079     | .07901                         | .06964                           | 459,251                | 146,397     | 312,854   |
| 1981 .. | 7,002                                  | 111,732     | .11563                         | .10605                           | 699,031                | 214,584     | 484,447   |
| 1982 .. | 6,654                                  | 107,133     | .12348                         | .11061                           | 723,622                | 222,423     | 501,199   |
| 1983 .. | 6,569                                  | 106,606     | .11348                         | .09828                           | 659,089                | 205,889     | 453,200   |
| 1984 .. | 6,552                                  | 108,702     | .11831                         | .10181                           | 702,899                | 217,447     | 485,452   |
| 1985 .. | 6,590                                  | 105,015     | .11361                         | .09653                           | 672,600                | 213,478     | 459,122   |
| 1986 .. | 6,728                                  | 109,326     | .09294                         | .07505                           | 562,345                | 182,110     | 380,234   |

<sup>1/</sup> Based on number of customers at end of year.

Source: Hawaii State Department of Commerce and Consumer Affairs, Division of Consumer Advocacy, records.



Table 498.-- ELECTRIC UTILITIES, BY ISLANDS: 1986

| County or island  | Customers, Dec. 31                 |             |                                | Installed capacity, Dec. 31 (kW) | Power sold (1,000 kWh) |             |           |
|-------------------|------------------------------------|-------------|--------------------------------|----------------------------------|------------------------|-------------|-----------|
|                   | Total                              | Residential | Other                          |                                  | Total                  | Residential | Other     |
| State total       | 337,563                            | 291,222     | 46,341                         | 1,553,580                        | 7,025,739              | 1,959,447   | 5,066,292 |
| Oahu .....        | 235,742                            | 205,636     | 30,106                         | 1,277,000                        | 5,625,398              | 1,450,473   | 4,174,925 |
| Hawaii .....      | 42,686                             | 35,524      | 7,162                          | 101,880                          | 545,615                | 216,133     | 329,482   |
| Kauai .....       | 20,195                             | 17,086      | 3,109                          | 59,800                           | 252,511                | 90,660      | 161,851   |
| Maui County ..... | 38,940                             | 32,976      | 5,964                          | 114,900                          | 602,216                | 197,892     | 404,323   |
| Lanai .....       | 884                                | 760         | 124                            | -                                | 5,654                  | 3,464       | 2,191     |
| Maui .....        | 35,493                             | 30,121      | 5,372                          | 103,700                          | 571,290                | 188,531     | 382,759   |
| Molokai .....     | 2,563                              | 2,095       | 468                            | 11,200                           | 25,271                 | 10,187      | 15,084    |
|                   | Average annual use (kWh) <u>1/</u> |             | Average rate (dollars per kWh) |                                  | Revenues (\$1,000)     |             |           |
| County or island  | Residential                        | Other       | Residential                    | Other                            | Total                  | Residential | Other     |
| State total       | 6,728                              | 109,326     | 0.09294                        | 0.07505                          | 562,345                | 182,110     | 380,234   |
| Oahu .....        | 7,054                              | 138,674     | 0.08328                        | 0.06723                          | 401,478                | 120,798     | 280,680   |
| Hawaii .....      | 6,084                              | 46,004      | 0.11879                        | 0.10797                          | 61,249                 | 25,674      | 35,575    |
| Kauai .....       | 5,306                              | 52,059      | 0.12528                        | 0.12470                          | 31,541                 | 11,358      | 20,183    |
| Maui County ..... | 6,001                              | 67,794      | 0.12270                        | 0.10832                          | 68,077                 | 24,281      | 43,796    |
| Lanai .....       | 4,558                              | 17,666      | 0.18806                        | 0.18811                          | 1,063                  | 651         | 412       |
| Maui .....        | 6,259                              | 71,251      | 0.11461                        | 0.10542                          | 61,959                 | 21,608      | 40,351    |
| Molokai .....     | 4,862                              | 32,232      | 0.19845                        | 0.20109                          | 5,055                  | 2,022       | 3,033     |

1/ Based on number of customers at end of year.

Source: Hawaii State Department of Commerce and Consumer Affairs, Division of Consumer Advocacy, records.

Table 499.-- GAS UTILITIES: 1976 TO 1986

[Excludes bottled gas]

| Year     | Customers, Dec. 31 |             |       | Gas sold<br>(1,000 therms) |             |        |
|----------|--------------------|-------------|-------|----------------------------|-------------|--------|
|          | Total              | Residential | Other | Total                      | Residential | Other  |
| 1976 ... | 34,264             | 29,873      | 4,391 | 35,568                     | 8,121       | 27,447 |
| 1977 ... | 33,722             | 29,408      | 4,314 | 34,844                     | 7,612       | 27,232 |
| 1978 ... | 33,413             | 29,091      | 4,322 | 34,919                     | 7,388       | 27,532 |
| 1979 ... | 33,309             | 29,014      | 4,295 | 35,264                     | 7,326       | 27,937 |
| 1980 ... | 33,019             | 28,825      | 4,194 | 34,705                     | 7,030       | 27,675 |
| 1981 ... | 32,421             | 28,343      | 4,078 | 32,396                     | 6,422       | 25,975 |
| 1982 ... | 32,905             | 28,979      | 3,926 | 32,224                     | 6,329       | 25,895 |
| 1983 ... | 32,880             | 28,933      | 3,947 | 31,307                     | 6,338       | 24,970 |
| 1984 ... | 32,643             | 28,859      | 3,784 | 30,928                     | 5,853       | 25,075 |
| 1985 ... | 32,988             | 29,253      | 3,735 | 31,203                     | 5,911       | 25,292 |
| 1986 ... | 33,369             | 29,678      | 3,691 | 31,122                     | 5,762       | 25,360 |

  

| Year     | Average annual use<br>(therms) <u>1/</u> |       | Average rate<br>(dollars per therm) |         | Revenues<br>(\$1,000) |             |        |
|----------|--|-------|-------------------------------------|---------|-----------------------|-------------|--------|
|          | Residential                              | Other | Residential                         | Other   | Total                 | Residential | Other  |
| 1976 ... | 272                                      | 6,251 | .82767                              | .63369  | 24,115                | 6,722       | 17,393 |
| 1977 ... | 259                                      | 6,313 | .85883                              | .65821  | 24,462                | 6,537       | 17,925 |
| 1978 ... | 254                                      | 6,370 | .91647                              | .71792  | 26,536                | 6,770       | 19,766 |
| 1979 ... | 253                                      | 6,505 | 1.09260                             | .89221  | 32,931                | 8,006       | 24,925 |
| 1980 ... | 244                                      | 6,599 | 1.46583                             | 1.25951 | 45,162                | 10,305      | 34,857 |
| 1981 ... | 227                                      | 6,369 | 1.72585                             | 1.50091 | 50,069                | 11,083      | 38,986 |
| 1982 ... | 218                                      | 6,596 | 1.73311                             | 1.43891 | 48,229                | 10,969      | 37,260 |
| 1983 ... | 219                                      | 6,326 | 1.79719                             | 1.44022 | 47,352                | 11,390      | 35,962 |
| 1984 ... | 203                                      | 6,627 | 1.78958                             | 1.37488 | 44,949                | 10,474      | 34,475 |
| 1985 ... | 202                                      | 6,772 | 1.76934                             | 1.33821 | 44,305                | 10,459      | 33,846 |
| 1986 ... | 194                                      | 6,871 | 1.57151                             | 1.12027 | 37,465                | 9,055       | 28,410 |

1/ Based on number of customers at end of year.

Source: Hawaii State Department of Commerce and Consumer Affairs, Division of Consumer Advocacy, records.

Table 500.-- GAS UTILITIES, BY ISLANDS: 1986

[Excludes bottled gas]

| Island        | Customers, Dec. 31                       |                  |   | Gas sold (therms) |                    |                  |        |
|---------------|--|------------------|---|-------------------|--------------------|------------------|--------|
|               | Total                                    | Residen-<br>tial | Other                                   | Total             | Residen-<br>tial   | Other            |        |
| State total   | 33,369                                   | 29,678           | 3,691                                   | 31,121,766        | 5,762,090          | 25,359,676       |        |
| Oahu .....    | 30,831                                   | 27,516           | 3,315                                   | 28,137,478        | 5,318,246          | 22,819,232       |        |
| Hawaii .....  | 1,890                                    | 1,579            | 311                                     | 2,106,560         | 332,768            | 1,773,792        |        |
| Kauai .....   | 275                                      | 275              | -                                       | 55,749            | 55,749             | -                |        |
| Maui .....    | 373                                      | 308              | 65                                      | 821,979           | 55,327             | 766,652          |        |
| Molokai ..... | -  | -                | -                                       | -                 | -                  | -                |        |
| Lanai .....   | -  | -                | -                                       | -                 | -                  | -                |        |
| Island        | Average annual<br>use (therms) <u>1/</u> |                  | Average rate<br>(dollars per<br>(therm) |                   | Revenues (\$1,000) |                  |        |
|               | Resi-<br>dential                         | Other            | Resi-<br>dential                        | Other             | Total              | Resi-<br>dential | Other  |
| State total   | 194                                      | 6,871            | 1.57151                                 | 1.12027           | 37,465             | 9,055            | 28,410 |
| Oahu .....    | 193                                      | 6,884            | 1.58703                                 | 1.12941           | 34,212             | 8,440            | 25,772 |
| Hawaii .....  | 211                                      | 5,704            | 1.37861                                 | 1.05523           | 2,331              | 459              | 1,872  |
| Kauai .....   | 203                                      | -                | 1.42512                                 | -                 | 79                 | 79               | -      |
| Maui .....    | 180                                      | 11,795           | 1.38786                                 | 0.99884           | 843                | 77               | 766    |
| Molokai ..... | -  | -                | -                                       | -                 | -                  | -                | -      |
| Lanai .....   | -  | -                | -                                       | -                 | -                  | -                | -      |

1/ Based on number of customers at end of year.

Source: Hawaii State Department of Commerce and Consumer Affairs,  
Division of Consumer Advocacy, records.

Table 501.-- SERVICE PROVIDED BY HAWAIIAN ELECTRIC CO., INC., ON OAHU:  
1981 TO 1986

| Year    | Number of customers, Dec. 31 |                  | Net input 1/<br>(1,000 kWh) | Power sold<br>(1,000 kWh) | Average annual residential use 2/<br>(kWh) | Average residential rate<br>(dollars per kWh) | Installed capacity 3/<br>(kW)<br>Dec. 31 |
|---------|------------------------------|------------------|-----------------------------|---------------------------|--|---|--|
|         | Total                        | Residential only |                             |                           |  |   |  |
| 1981 .. | 218,162                      | 191,283          | 5,507,151                   | 5,276,227                 | 7,474                                      | 0.11364                                       | 1,275,160                                |
| 1982 .. | 222,636                      | 194,468          | 5,441,941                   | 5,164,332                 | 7,068                                      | 0.12066                                       | 1,255,600                                |
| 1983 .. | 226,070                      | 197,400          | 5,546,600                   | 5,230,658                 | 7,030                                      | 0.10631                                       | 1,200,000                                |
| 1984 .. | 228,606                      | 199,722          | 5,633,940                   | 5,330,931                 | 6,960                                      | 0.11032                                       | 1,188,600                                |
| 1985 .. | 231,912                      | 202,222          | 5,637,678                   | 5,336,262                 | 6,997                                      | 0.10417                                       | 1,188,600                                |
| 1986 .. | 235,742                      | 205,636          | 5,933,569                   | 5,625,398                 | 7,113                                      | 0.08328                                       | 1,188,600                                |

1/ Net generated plus purchased power.

2/ Based on average number of customers during the year.

3/ Maximum generator nameplate. 1984 and 1985 data are revisions.

Source: Hawaiian Electric Co., Inc., records.

Table 502.-- GAS UTILITY SERVICE BY GASCO, INC., FOR OAHU: 1981 TO 1986

| Calendar year | Customers, Dec. 31 |             | Gas sold 1/<br>(1,000 therms) |             | Average annual residential usage 1/<br>(therms) |
|---------------|--------------------|-------------|-------------------------------|-------------|---|
|               | Total              | Residential | Total                         | Residential |   |
| 1981 ...      | 30,019             | 26,201      | 29,543                        | 5,893       | 225   |
| 1982 ...      | 30,221             | 26,665      | 29,307                        | 5,765       | 216   |
| 1983 ...      | 30,305             | 26,674      | 28,795                        | 5,849       | 219   |
| 1984 ...      | 30,041             | 26,636      | 28,190                        | 5,389       | 202   |
| 1985 ...      | 30,442             | 27,085      | 28,255                        | 5,436       | 201   |
| 1986 ...      | 30,831             | 27,516      | 28,137                        | 5,318       | 193   |

1/ Includes liquefied petroleum gas.

Source: Gasco, Inc., records.

Table 503.-- LIQUID FUEL TAX BASE: 1976 TO 1986

[In thousands of gallons]

| Year reported <u>1/</u> | All types | Gasoline | Diesel oil |          |
|-------------------------|-----------|----------|------------|----------|
|                         |           |          | Non-hwy.   | Hwy. use |
| 1976 .....              | 850,261   | 295,704  | 79,884     | 13,561   |
| 1977 .....              | 888,136   | 311,409  | 85,484     | 13,817   |
| 1978 .....              | 917,380   | 324,702  | 99,755     | 15,233   |
| 1979 .....              | 960,837   | 324,337  | 108,460    | 16,596   |
| 1980 .....              | 939,766   | 312,896  | 101,719    | 17,765   |
| 1981 .....              | 918,437   | 305,886  | 101,212    | 15,771   |
| 1982 .....              | 893,288   | 308,600  | 88,312     | 17,303   |
| 1983 .....              | 919,865   | 310,085  | 86,790     | 16,440   |
| 1984 .....              | 925,871   | 322,410  | 95,956     | 17,892   |
| 1985 .....              | 970,555   | 327,021  | 83,147     | 17,636   |
| 1986 .....              | 1,059,180 | 336,559  | 95,022     | 19,354   |

  

| Year reported <u>1/</u> | Liquefied petroleum gas |          | Aviation fuel | Small boats |            |
|-------------------------|-------------------------|----------|---------------|-------------|------------|
|                         | Off-hwy.                | Hwy. use |               | Gasoline    | Diesel oil |
| 1976 .....              | 1,858                   | 1,054    | 456,819       | 464         | 917        |
| 1977 .....              | 2,036                   | 1,280    | 472,654       | 558         | 899        |
| 1978 .....              | 1,821                   | 1,216    | 473,270       | 445         | 938        |
| 1979 .....              | 2,213                   | 1,140    | 506,825       | 410         | 856        |
| 1980 .....              | 2,448                   | 1,140    | 502,544       | 338         | 917        |
| 1981 .....              | 2,378                   | 1,136    | 489,551       | 424         | 2,079      |
| 1982 .....              | 2,628                   | 960      | 474,477       | 207         | 802        |
| 1983 .....              | 3,013                   | 1,052    | 501,648       | 213         | 624        |
| 1984 .....              | 2,600                   | 873      | 485,810       | 114         | 215        |
| 1985 .....              | 2,804                   | 1,028    | 538,055       | 187         | 676        |
| 1986 .....              | 2,969                   | 1,031    | 603,167       | 163         | 916        |

1/ Liquid fuel sold in a given month is usually reported the following month. Annual totals accordingly refer to fuel sold during a 12-month period ended November 30.

Source: Hawaii State Department of Taxation, "Liquid Fuel Tax Base, Collections and Distribution" (annual report).

Table 504.-- LIQUID FUEL TAX BASE, BY COUNTIES: 1986

[In thousands of gallons]

| Type of fuel             | State total | City and Co. of Honolulu | County of Maui | County of Hawaii | County of Kauai |
|--------------------------|-------------|--------------------------|----------------|------------------|-----------------|
| Total .....              | 1,059,180   | 867,266                  | 89,605         | 67,142           | 35,167          |
| Gasoline .....           | 336,559     | 236,287                  | 38,110         | 44,480           | 17,681          |
| Diesel oil, non-hwy. ... | 95,022      | 38,106                   | 27,803         | 12,725           | 16,388          |
| Diesel oil, hwy. use ... | 19,354      | 14,424                   | 1,532          | 3,018            | 379             |
| Liq. pet. gas, off hwy.  | 2,969       | 2,023                    | 390            | 424              | 132             |
| Liq. pet. gas, hwy. use  | 1,031       | 857                      | 38             | 98               | 38              |
| Small boats, gasoline .. | 163         | 77                       | -              | 86               | -               |
| Small boats, diesel oil  | 916         | 128                      | -              | 787              | -               |
| Aviation fuel .....      | 603,167     | 575,364                  | 21,732         | 5,522            | 549             |

Source: Hawaii State Department of Taxation, "Liquid Fuel Tax Base, Collections and Distribution, Calendar Year Ending December 31, 1986" (annual release).

Table 505.-- GASOLINE SERVICE STATIONS (SIC 554)  
WITH PAYROLL, BY COUNTIES: 1981 TO 1985

| Year       | State total | City and Co. of Honolulu | Hawaii County | Kauai County | Maui County |
|------------|-------------|--------------------------|---------------|--------------|-------------|
| 1981 ..... | 340         | 254                      | 45            | 17           | 24          |
| 1982 ..... | 365         | 252                      | 59            | 21           | 33          |
| 1983 ..... | 379         | 267                      | 59            | 25           | 28          |
| 1984 ..... | 359         | 251                      | 51            | 26           | 31          |
| 1985 ..... | 349         | 244                      | 50            | 26           | 29          |

Source: U.S. Bureau of the Census, County Business Patterns, Hawaii (annual).

Table 506.-- GASOLINE SERVICE STATIONS: 1982

[Data are shown only for establishments with payroll]

| Subject  | State total | Oahu only |
|--|-------------|-----------|
| Number of establishments .....                   | 366         | 251       |
| Offering self-service sale of gasoline .....     | 64          | 53        |
| Sales (\$1,000) .....                            | 400,141     | 299,966   |
| Gallon sales (1,000):                            |             |           |
| Gasoline, total .....                            | 228,151     | 172,809   |
| Through self-service .....                       | 51,926      | 48,879    |
| Other automotive fuels .....                     | 2,387       | 1,838     |
| Pumps, Dec. 31:                                  |             |           |
| Gasoline, total .....                            | 2,431       | 1,902     |
| Self-service .....                               | 478         | 412       |
| Other automotive fuel .....                      | 60          | 44        |
| Total gallon storage capacity, all fuels (1,000) | 6,300       | (S)       |

S Withheld because estimates did not meet publication standards.

Source: U.S. Bureau of the Census, 1982 Census of Retail Trade, RC82-I-4, Miscellaneous Subjects (June 1985), tables 2, 3, 4, and 5.

Table 507.-- GASOLINE AVERAGE PRICES PER GALLON, FOR OAHU:  
1978 TO 1986

[Dollars. Average prices include all applicable federal, state, and county taxes. This survey was discontinued after December 1986. For earlier years, 1903-1978, see Data Book 1984, tables 497 and 498]

| Date                     | All types <u>1/</u> | Leaded regular | Unleaded regular | Leaded premium  |
|--------------------------|---------------------|----------------|------------------|-----------------|
| 1978: June .....         | .778                | .761           | .765             | .793            |
| Dec. ....                | .804                | .778           | .791             | .821            |
| 1979: June .....         | .957                | .922           | .956             | .970            |
| Dec. ....                | 1.150               | 1.087          | 1.164            | 1.175           |
| 1980: June .....         | 1.352               | 1.310          | 1.350            | 1.383           |
| Dec. ....                | 1.407               | 1.348          | 1.413            | 1.441           |
| 1981: June .....         | 1.580               | 1.508          | 1.588            | 1.619           |
| Dec. ....                | 1.584               | 1.520          | 1.586            | 1.621           |
| 1982: June .....         | 1.512               | 1.454          | 1.511            | 1.556           |
| Dec. ....                | 1.518               | 1.446          | 1.522            | 1.566           |
| 1983: June .....         | 1.455               | 1.391          | 1.450            | 1.506           |
| Dec. ....                | 1.474               | 1.409          | 1.470            | 1.530           |
| 1984: June .....         | 1.497               | 1.425          | 1.490            | (NA)            |
| August ...               | 1.498               | 1.419          | 1.492            | (NA)            |
| Revised series <u>2/</u> |                     |                |                  |                 |
| 1984: Sept. ....         | 1.409               | 1.310          | 1.406            | (NA)            |
| Dec. ....                | 1.384               | 1.285          | 1.372            | (NA)            |
| 1985: June .....         | 1.386               | 1.269          | 1.387            | (NA)            |
| Dec. ....                | 1.406               | 1.295          | 1.421            | (NA)            |
| 1986: June .....         | 1.212               | 1.063          | 1.227            | <u>3/</u> 1.334 |
| Dec. <u>4/</u> ..        | 1.075               | 0.961          | 1.096            | <u>3/</u> 1.252 |

NA Not available.

1/ Includes types not shown separately.

2/ Because of revised sample design, data are not directly comparable to earlier figures.

3/ Unleaded premium.

4/ U.S. city averages in December 1986 were: all types, \$0.830; leaded regular, \$0.764; unleaded regular, \$0.823; unleaded premium, \$0.984.

Source: U.S. Bureau of Labor Statistics, Consumer Prices: Energy and Food (monthly, 1979-1985), CPI Detailed Report (monthly, 1985-1986), and printouts for 1978-1979.



Table 508.-- ENERGY GENERATED, PURCHASED, SOLD AND USED BY  
RAW SUGAR PLANTATIONS, BY ISLANDS: 1985

| Subject   | State total | Hawaii | Kauai  | Maui   | Oahu   |
|---|-------------|--------|--------|--------|--------|
| Electricity (millions of kilowatt-hours)              |             |        |        |        |        |
| Generated <u>1/</u> .....                             | 778.21      | 211.41 | 208.03 | 249.06 | 109.71 |
| Purchased .....                                       | 27.19       | 1.54   | 1.59   | 9.92   | 14.14  |
| Sold .....  | 334.82      | 130.04 | 98.68  | 94.96  | 11.14  |
| Used <u>2/</u> .....                                  | 470.58      | 82.91  | 110.94 | 164.02 | 112.71 |
| Gross heat values of boiler fuels (billions of Btu's) |             |        |        |        |        |
| All fuels .....                                       | 25,464      | 8,698  | 5,479  | 7,477  | 3,810  |
| Bagasse .....   | 22,864      | 8,134  | 5,154  | 6,127  | 3,448  |
| Fuel oil .....  | 2,321       | 564    | 265    | 1,277  | 215    |
| Other fuels .....                                     | 279         | -      | 60     | 72     | 147    |

1/ Includes electricity generated by steam and by hydroelectric or diesel engine generators.

2/ Includes transmission losses and electricity used to operate power plant auxiliaries.

Source: Hawaiian Sugar Planters' Association, Energy Inventory of Hawaiian Sugar Plantations - 1985 (Energy Report 23, December 23, 1986), pp. 6-9.

Table 509.-- BOILERS AND PRESSURE VESSELS: 1985 AND 1986

| Date              | Total | Power boilers | Heating boilers | Pressure vessels |
|-------------------|-------|---------------|-----------------|------------------|
| 1985: Dec. 31 ... | 8,643 | 606           | 2,592           | 5,445            |
| 1986: Dec. 31 ... | 8,561 | 588           | 2,533           | 5,440            |

Source: Hawaii State Department of Labor and Industrial Relations, Division of Occupational Safety and Health, Boiler and Elevator Inspection Bureau, records.

Table 510.-- TAX CREDITS FOR SOLAR DEVICES AND HEAT PUMPS:  
1977 TO 1985

[In 1976, the State Legislature approved a tax credit for solar energy devices installed after December 31, 1974. In 1981, the Legislature approved a tax credit for heat pumps installed after December 31, 1980]

| Year in-<br>stalled | Solar devices      |                              |  | Heat pumps         |                                   |
|---------------------|--------------------|------------------------------|--|--------------------|-----------------------------------|
|                     | Number<br>claiming | Average<br>cost<br>(dollars) | Total<br>credit<br>allowed 1/<br>(dollars) | Number<br>claiming | Credit<br>claimed 1/<br>(dollars) |
| 1977 .....          | 1,101              | 2,135                        | 229,729                                    | ...                | ...                               |
| 1978 .....          | 4,061              | 2,907                        | 1,119,870                                  | ...                | ...                               |
| 1979 .....          | 4,375              | 3,031                        | 1,249,971                                  | ...                | ...                               |
| 1980 .....          | 4,704              | 3,346                        | 1,492,602                                  | ...                | ...                               |
| 1981 .....          | 6,445              | 3,500                        | 2,107,293                                  | 2,013              | 164,155                           |
| 1982 .....          | 4,407              | 3,659                        | 1,511,796                                  | 3,122              | 154,173                           |
| 1983 .....          | 3,148              | 3,601                        | 1,076,222                                  | 665                | 39,921                            |
| 1984 .....          | 4,464              | 3,519                        | 1,482,095                                  | 257                | 12,935                            |
| 1985 .....          | 6,740              | 3,897                        | 2,616,357                                  | 12                 | 900                               |

1/ Credit limited to 10 percent of actual cost. Credits are prorated for condominium owners.

Source: Hawaii State Department of Taxation, Tax Credits Claimed by Hawaii Residents for 1977-1985.

Table 511.-- HOUSING UNITS WITH SOLAR WATER HEATING SYSTEMS:  
1983 TO 1986

| Subject                          | 1983   | 1984   | 1985   | 1986   |
|----------------------------------|--------|--------|--------|--------|
| Number with systems, Dec. 31 ... | 26,800 | 31,800 | 39,000 | 39,500 |
| Percent with systems 1/ .....    | 7.6    | 8.9    | 10.7   | 10.7   |

1/ Based on April 1 estimates of total housing stock in table 628.

Source: Hawaii State Department of Business and Economic Development, Energy Division, unpublished estimates.

Table 512.-- FEDERAL OBLIGATIONS FOR RESEARCH AND DEVELOPMENT  
IN HAWAII: 1979 TO 1983

[Millions of dollars. For fiscal years ended September 30]

| Type of obligation              | 1979 | 1980 | 1981 | 1982 | 1983 |
|---------------------------------|------|------|------|------|------|
| Total obligations for R&D ..... | 40.8 | 42.6 | 49.9 | 44.5 | 71.4 |
| Obligations for R&D plant ..... | 0.5  | 0.2  | 0.7  | 0.1  | 0.1  |

Source: National Science Foundation, Federal Funds for Research and Development: Fiscal Years 1981, 1982, and 1983, Vol. XXXI, Final Report NSF 83-320, pp. 188-189; and Federal Funds for Research and Development: Fiscal Years 1983, 1984, and 1985, Vol. XXXIII, Detailed Statistical Tables NSF 84-336, p. 141.

Table 513.-- RESEARCH AND DEVELOPMENT EXPENDITURES AT UNIVERSITIES  
AND COLLEGES: 1980 TO 1984

[Thousands of dollars. For fiscal years ended September 30]

| Type of expenditure          | 1980   | 1981   | 1982   | 1983   | 1984   |
|------------------------------|--------|--------|--------|--------|--------|
| Total R&D expenditures ..... | 40,593 | 42,997 | 43,439 | 45,401 | 51,051 |
| Federally financed .....     | 25,833 | 25,153 | 26,616 | 27,633 | 32,701 |

Source: National Science Foundation, Academic Science/Engineering: R and D Funds, Fiscal Year 1984 (1986), pp. 41-42.

Table 514.-- RESEARCH AND NON-RESEARCH EXTRAMURAL FUNDING,  
FOR THE UNIVERSITY OF HAWAII: 1982-83 TO 1986-87

[Research and non-research awards received through the Office  
of Research Administration, University of Hawaii]

| Fiscal year | Total  |                     | Research |                     | Non-research |                     |
|-------------|--------|---------------------|----------|---------------------|--------------|---------------------|
|             | Awards | Amount<br>(dollars) | Awards   | Amount<br>(dollars) | Awards       | Amount<br>(dollars) |
| 1982-83 ... | 595    | 45,652,413          | 392      | 33,733,083          | 203          | 11,919,330          |
| 1983-84 ... | 583    | 47,954,042          | 358      | 30,204,420          | 225          | 17,749,622          |
| 1984-85 ... | 627    | 53,267,244          | 385      | 36,699,412          | 242          | 16,567,832          |
| 1985-86 ... | 643    | 53,976,468          | 354      | 35,750,696          | 289          | 18,225,772          |
| 1986-87 ... | 647    | 52,579,742          | 381      | 35,838,578          | 266          | 16,741,164          |

Source: Office of Research Administration, University of Hawaii,  
1986-1987 Extramural Awards (1987), p. 2.

Table 515.-- PATENTS ISSUED TO HAWAII  
RESIDENTS: 1979 TO 1986

[Fiscal years ended September 30. Data include  
design, plant, and reissue patents]

| Fiscal year | Patents | Fiscal year | Patents |
|-------------|---------|-------------|---------|
| 1979 .....  | 32      | 1983 .....  | 30      |
| 1980 .....  | 32      | 1984 .....  | 43      |
| 1981 .....  | 49      | 1985 .....  | 33      |
| 1982 .....  | 31      | 1986 .....  | 37      |

Source: U.S. Department of Commerce, Patent and  
Trademark Office, Commissioner of Patents and  
Trademarks Annual Report, Fiscal Year '85, p. 50, and  
records.

Table 516.-- TELESCOPES AT THE SUMMITS OF MAUNA KEA AND  
HALEAKALA: 1987

| Location and telescope<br>(diameter in meters)             | Year<br>com-<br>pleted | Capital<br>costs<br>(million<br>dollars) | Operating<br>costs,<br>1987<br>(million<br>dollars) | Hawaii-<br>based<br>staff<br>(persons) |
|--|------------------------|--|---|--|
| Mauna Kea:   |                        |  |   |  |
| UH .61-m .....   | 1969                   | 0.1                                      | } 0.1   | 13                                     |
| UH .61-m .....   | 1969                   | 0.1                                      |   |  |
| UH 2.24-m .....  | 1970                   | 3.0                                      |   |  |
| Canada-France-Hawaii .....                                 | 1979                   | 46.2                                     | 3.6   | 43                                     |
| NASA 3.0-m IRTF .....                                      | 1979                   | 15.4                                     | 1.8   | 10                                     |
| UK 3.8-m .....   | 1979                   | 15.4                                     | 1.5   | 29                                     |
| James Clerk Maxwell (UK/NL) ..                             | 1986                   | 20.0                                     | 1.0   | 20                                     |
| Caltech 10.4-m Submillimeter .                             | 1986                   | 10.0                                     | 1.5   | 11                                     |
| W.M. Keck Observatory 10-m<br>Optical/IR (under const.) .. | 1990                   | 100.0                                    | 2.3   | 35                                     |
| Haleakala (on UH land):                                    |                        |  |   |  |
| Mees Solar Observatory .....                               | 1956                   | 0.5                                      | 0.3   | 6                                      |
| Lunar Ranging Facility .....                               | 1976/84                | 3.25                                     | 0.7   | 9                                      |
| Gamma Ray Facility .....                                   | 1985                   | 2.0                                      | 0.2   | 1                                      |

Source: University of Hawaii at Manoa, Institute for Astronomy, data provided July 3, 1987.