Solution. According to Table 6, a store would use 0.624 lb of steam per degree-day per 1000 cu ft heated space. From Table 1, Philadelphia has 4739 degree-days per normal year. Inserting in Equation 4:

$$F = 0.624 \times 250 \times 4739 = 739{,}284 \text{ lb of steam.}$$

Degree-Day as an Operating Unit

The degree-day is also widely used as a means of comparing the efficiency of the fuel consumption of one period with another *for the same building*. Since the fuel consumption is proportional to the weather (degree-days), and since the periods to be compared may not have the same weather conditions, the comparison can be made only after the fuel consumptions have been computed on a comparable weather basis, that is, upon the actual number of degree-days occurring for a given month and year in the city under consideration. Since fuel consumption is proportional to the number of degree-days, plant operators frequently compute each month the fuel burned per degree-day by the heating plant. The resulting unit figure, by eliminating the outside temperature variable, indicates whether the operating efficiency of the plant is above or below the previous month or year.

Table 7. Heat Consumption Record for Comparison

Heating Season	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7
		Total Consumption	Consumption for Heating	Avg Mean Temp.	Deg Days 65 F Base	Lb/Deg Day	Lb/Deg Day/ M Cu Ft
1942-43	Sept.	337,500	170,500	65	146	1,170	0.575
	Oct.	834,200	667,200	53	339	1,966	0.970
	Nov.	1,446,600	1,279,600	44	641	1,990	0.982
	Dec.	2,176,400	2,009,400	25	1,233	1,630	0.804
	Jan.	2,332,200	2,165,200	22	1,297	1,670	0.822
	Feb.	2,131,100	1,964,100	28	1,106	1,775	0.888
	Mar.	2,021,900	1,854,900	31	1,032	1,799	0.885
	Apr.	1,241,500	1,074,500	43	647	1,660	0.818
	May	672,500	505,500	55	303	1,670	0.822
	June	258,600	91,600	......	50	1,830	0.905
	July	188,400	......	......	......	......	......
	Aug.	180,100	......	......	......	......	......
	Total	13,821,000	......	......	......	......	......
1943-44	Sept.	330,200	146,200	61	167	875	0.431
	Oct.	887,100	703,100	52	410	1,718	0.845
	Nov.	1,525,200	1,341,200	39	812	1,653	0.815
	Dec.	2,045,500	1,861,500	28	1,120	1,660	0.817
	Jan.	1,933,400	1,749,400	30	1,044	1,670	0.825
	Feb.	1,990,200	1,806,200	30	1,111	1,624	0.800
	Mar.	1,984,100	1,800,100	31	1,021	1,760	0.868

If, for example, the heat consumption in March, 1943, is compared with that in March, 1944, it will be found that in the latter the steam consumption is 1799 − 1760 = 39 lb less which is a decrease of 2.2 percent.

The figures in Table 7 illustrate a typical example of a method of using the degree-day for making heating comparisons for one building for two consecutive heating seasons. The heat quantity figures inserted are pounds of steam, but a similar comparison could be made using pounds of coal, gallons of oil, or cubic feet of gas.

For such a comparison, a two-year record is often used, as shown in Table 7. The year under consideration may then be compared, month by month, with the previous year. Column 3, Consumption for Heating, would be used if the same fuel is used for heating and process steam. Some reasonable figure must be assumed for the process requirement and should be deducted from the amount shown in column 2. This would leave in column 3 only the fuel chargeable to heating. The degree-day values in column 5 are obtainable from the local Weather Bureau. Figures in column 6 are obtained by dividing corresponding values in column 3 by the degree-days in column 5. The heating index in column 6 is, then, a figure of heat consumption, corrected for outdoor temperature, and should be relatively constant month by month. Column 7 in Table 7 may be used if the heat consumption is to be compared on a building volume basis with average values shown in Table 6.

MAXIMUM DEMANDS AND LOAD FACTORS

In one form of district heating rates, a portion of the charge is based upon the maximum demand of the building. The maximum demand may be measured in several different ways. It may be taken as the instantaneous peak or as the rate of use during any specified interval. One method is to take the average of the three highest hours during the winter. These figures are available for a number of buildings in Detroit, as shown in Table 8.[5]

Table 8. Building Load Factors and Demands of Some Detroit Buildings

Building Classification	Load Factor	Lb of Demand per (Hour) (Sq Ft of Equivalent Installed Radiator Surface)
Clubs and Lodges	0.318	0.184
Hotels	0.316	0.207
Printing	0.287	0.217
Offices	0.263	0.209
Apartments	0.255	0.225
Retail Stores	0.238	0.182
Auto Sales and Service	0.223	0.248
Banks	0.203	0.158
Churches	0.158	0.152
Department Stores	0.138	0.145
Theaters	0.126	0.151

These maximum demands were measured by an attachment on the condensation meter, and therefore represent the amounts of condensation passed through the meter in the highest hours, rather than the true rate at which steam is supplied. There might be slight differences in these two quantities due to time lag and to storage of condensate in the system, but wherever this has been investigated it has been found to be negligible.

The load factor of a building is the ratio of the average load to the maximum load and is an index of the utilization. Thus, in Table 8, the theaters, operating for short hours, have a load factor of 0.126 as compared with the figure of 0.318 for clubs and lodges.

SEASONAL EFFICIENCY

The task of predicting fuel consumption within reasonably accurate limits is a simple one where sufficient experience data are available for the fuel in question. Such data can be analyzed to the point where average unit factors can be determined and expressed in such terms as, for example, cubic feet of gas actually burned per (square foot of calculated steam radiator surface) (degree-day). The unit U can be inserted directly in Equation 4 without reference to efficiency. Such experience factors are available for gas (see Table 2) and for district steam (Table 6), but not for coal or oil.