from Table 3 is 0.875. Solving $0.875 \times 0.00383 = 0.00335$. Making a further correction for the heating value,

$$0.00335 \times \frac{141{,}000}{144{,}000} = 0.00328 \text{ gal per 1000 Btu per hr calculated heat loss per degree-day.}$$

From Table 2, the total normal degree-days for Toledo are 6269. Since U is expressed in 1000 Btu, N is equal to 240. Substituting in Equation 4

$$F = 0.00328 \times 6269 \times 240 = 4930 \text{ gal.}$$

Estimating Coal or Coke Consumption

Coal or coke consumption estimates are made by following exactly the same procedure as for oil. Values of U are given in Table 6 which only apply to an inside design temperature of 70 F and an outside design temperature of 0 F. A correction must be made for other conditions by use of

TABLE 4. UNIT FUEL CONSUMPTION CONSTANTS (U) FOR GAS[a]
Based on 0 F Outside Temperature, 70 F Inside Temperature

Heating Value of Gas Btu per Cu Ft	Hot Water			Steam			Warm Air	
	Cu Ft Gas per Degree-Day per Sq Ft EDR			Cu Ft Gas per Degree-Day per Sq Ft EDR			Cu Ft Gas per Degree-Day per 1000 Btu Hourly Design Heat Loss	
	Up to 500 Sq Ft	500 to 1200 Sq Ft	Over 1200 Sq Ft	Up to 300 Sq Ft	300 to 700 Sq Ft	Over 700 Sq Ft	Gravity	Fan Systems
500	0.149	0.142	0.134	0.254	0.242	0.231	0.896	0.861
535	0.139	0.132	0.126	0.237	0.226	0.216	0.840	0.805
800	0.094	0.087	0.085	0.159	0.151	0.144	0.560	0.538
1000	0.075	0.071	0.068	0.127	0.121	0.116	0.449	0.431
1 Therm = 100,000 Btu	Gas Consumption in Therms per Degree-Day							
	0.000743	0.000709	0.000675	0.00127	0.00121	0.00116	0.00450	0.00430

[a] Abstracted from Comfort Heating, *American Gas Association*, 1938 and 5 percent added for operation without night reduction of temperature.

the multiplying factors in Table 3. Data in Table 6 are based on 12,000 Btu per lb coal, and for other heating values of coal they must be multiplied by the ratio of 12,000 divided by the heating value of fuel used.

Example 6: A building in Scranton, Pa. has a calculated heat loss of 240,000 Btu per hr based on an inside design temperature of 70 F and an outside design temperature of −10 F. What will be the estimated normal seasonal anthracite or coke consumption for heating if 13,000 Btu per lb fuel is burned in a hand-fired boiler, with automatic control, at a seasonal efficiency of 80 percent, and what part of the total will be used during November, December, and January?

Solution: From Table 6, U is 0.0444 of coal or coke per 1000 Btu per hr heat loss per degree-day. Correcting for the outside design temperature of −10 F from Table 3, the value of U is $0.875 \times 0.0444 = 0.0389$. From Table 2, D is 6218 and from the problem, N is 240.

Substituting in Equation 4,

$$F = 0.0389 \times 240 \times 6218 = 58{,}100 \text{ lb.}$$

Fuel used over any period is, according to the theory of the degree-day, proportional to the number of degree-days during the period. From Table 2, the average numbers of degree-days for November, December, and January in Scranton are 717, 1074, and 1162 respectively, a total of 2953. The yearly total is 6218, so that during these three months the estimated consumption is

$$\frac{2953}{6218} \times 58{,}100 = 27{,}600 \text{ lb.}$$

TABLE 5. UNIT FUEL CONSUMPTION[a] CONSTANTS (U) FOR OIL[b]
Based on 0 F Outside Temperature, 70 F Inside Temperature

Unit[c]	Efficiency in Percent	
	70	80
Gal Oil per Sq Ft Steam Radiator	0.00105	0.00092
Gal Oil per Sq Ft Hot Water Radiator	0.00066	0.00058
Gal Oil per 1000 Btu per Hour Heat Loss	0.00437	0.00383

[a] Based on a heating value of 141,000 Btu per gallon.
[b] Abstracted by permission from *Degree-Day Handbook* (Second Edition, 1937), by C. Strock and C. H. B. Hotchkiss. Seven percent added for operation without night reduction of temperature and change to heating value of 141,000 Btu per gallon.
[c] Per degree day.

Estimating Steam Consumption

In estimating steam consumption the efficiency is generally assumed at 100 percent. If for low-pressure steam an average heating value of 1000 Btu per pound of steam is used, no correction is necessary. In comparing values from different cities, correction should be made for design temperature (see Table 3) when the unit figures are in terms of heat loss but not when the values are in terms of building volume or floor space.

Where the heat loss is calculated in Btu per (hour) (*degree difference in temperature*) the simple Equation 5 may be used:

$$F = \frac{H \times 24 \times D}{1000} \tag{5}$$

where

F = pounds of steam required for estimate period.
H = calculated heat loss, Btu per (hour) (degree difference).
24 = hours in one day.
D = number of degree-days for the period of estimation.
1000 = Btu delivered per pound of steam condensed.

In this method the number of degree-days automatically takes care of average inside and outside temperature difference. When degree-days are taken from Table 2, an average inside temperature of approximately 70 F is assumed throughout the period. If an average inside temperature other

TABLE 6. UNIT FUEL CONSUMPTION[a] CONSTANTS (U) FOR COAL[b]
Based on 0 F Outside Temperature, 70 F Inside Temperature

Unit[c]	Efficiency in Percent				
	40	50	60	70	80
Lb Coal per Sq Ft Steam Radiator	0.0216	0.0172	0.0143	0.0123	0.0108
Lb Coal per Sq Ft Hot Water Radiator	0.0135	0.0108	0.0091	0.0078	0.0068
Lb Coal per 1000 Btu per Hour Heat Loss	0.0889	0.0717	0.0592	0.0507	0.0444

[a] Based on a heating value of 12,000 Btu per pound.
[b] Abstracted by permission from *Degree-Day Handbook* (Second Edition, 1937), by C. Strock and C. H. B. Hotchkiss. Eight percent added for operation without night reduction of temperature.
[c] Per degree-day.