

Apartment houses where high-class heating service is required. (Steam off at mid-night.) *Factor:* 650 lb per square foot of heating surface per season.

Hotels (commercial type) where very high-class service is required for 24 hours. *Factor:* 800 lb per square foot of heating surface per season.

By assuming one square foot of equivalent heating surface for each 100 cu ft of space heated, which seems a fair ratio in New York City, it is possible roughly to estimate the steam required per cubic foot of space, information which is often more easily obtained than the square feet of heating surface. Additional data on the heating requirements of various types of buildings in a number of cities may be found in the Handbook of the *National District Heating Association*.

RATES

Fundamentally, district heating rates are based upon the same principles as those recognized in the electric light and power industry, the main object being a reasonable return on the investment. However, there are other requirements to be met; the rate for each class of service should be based upon the cost to the utility company of the service supplied and upon the value of the service to the consumer, and it must be between these two limits. The profit need not be divided proportionately among the rate groups, but should be established from a competitive standpoint. District heating rates should be designed to produce a sufficient return on the investment regardless of weather conditions, although existing rate schedules do not conform with this principle. Lastly, the rate schedule must be reasonably easy for the intelligent layman to comprehend.

Depreciation should be based on a careful estimate of the life of various elements of the property. Appropriations to reserves should be made, with generosity in good years and with discretion in less favorable years.

Glossary of Terms

Load Factor. The ratio, in per cent, of the average load to the maximum load. This is usually based on a one year period but may be applied to any specified period.

Demand Factor. The relation between the connected radiator surface or required radiator surface and the demand of the particular installation. It varies from 0.25 to 0.3 lb per hour per square foot of surface.

Diversity Factor. The ratio of the sum of the individual demands of a number of buildings to the actual composite demand of the group.

Types of Rates

- A. Flat Rates.
 1. Radiator surface charge. *Obsolescent*.
- B. Meter Rates.
 1. Straight-line.
 2. Step. *Obsolescent*.
 3. Block.
 - (a) Class rates.
- C. Demand Rates.
 1. Flat demand.
 2. Wright.
 3. Hopkinson.
 4. Doherty (or Three charge).

Straight-Line Meter Rate. The price charged per unit is constant, and the consumer pays in direct proportion to his consumption without regard to the difference in costs of supplying the individual customers.

Block Meter Rate. The pounds of steam consumed by a customer are divided into blocks of M lb each, and lower rates are charged for each successive block consumed. This type of charge predominates in steam heating rate schedules for it has the advantage of proportioning the bill according to the consumption and the cost of service. It has the disadvantage of not discriminating between customers having a high load factor (relatively low demand) and those having a low load factor (relatively high demand). The utility company must maintain sufficient capacity to serve the high demand customers and the cost of the increased plant investment is divided equally among the users, so the high demand customers are benefitted at the expense of the others.

Demand Rates. These refer to any method of charge based on a measured maximum load during a specified period of time.

The *flat demand rate* is usually expressed in dollars per M lb of demand per month or per annum. It is based on the size of a customer's installation, and is seldom used except where a flow meter is not practicable.

The *Wright demand rate* is similar in calculation to the block rate except that it is expressed in terms of hours' use of the maximum demand. It is seldom used but forms the basis for other forms of rates.

The *Hopkinson demand rate* is divided into two elements:

- (a) A charge based upon the demand, either estimated or measured;
- (b) A charge based upon the amount of steam consumed.

This rate may be modified by dividing the quantities of steam demanded and consumed into blocks charged for at different rates.

Demand rates are comparatively new and are not yet widely used; though they are equitable and competitive they are difficult for the average layman to understand. They are of benefit to utility companies and to consumers because the investment and operating costs can be divided to suit the particular circumstances into demand, customer, and consumption groups through the use of some modification of the Hopkinson rate.

Fuel Price Surcharge. It is usually desirable to establish a rate upon a specified basic cost of fuel to the utility company. Where there are wide variations in the price of fuel, it is also desirable to add a definite charge per M lb of steam sold for each increment of increase in the price of fuel. This surcharge automatically compensates for the variations without necessitating frequent changing of the whole rate structure.

REFERENCES

- Pipe Line Design for Central Station Heating, by B. T. Gifford (A.S.H.V.E. TRANSACTIONS, Vol. 17, 1911, p. 84).
- Engineering and Cost Data Relative to the Installation of Steam Distributing Systems in a Large City, by F. H. Valentine (A.S.H.V.E. TRANSACTIONS, Vol. 22, 1916, p. 547).
- Transmission of Steam in a Central Heating System, by J. H. Walker (A.S.H.V.E. TRANSACTIONS, Vol. 23, 1917, p. 161).
- Efficiency of Underground Conduit, by G. B. Nichols (A.S.H.V.E. TRANSACTIONS, Vol. 23, 1917, p. 173).
- Economical Utilization of Heat from Central Plants, by N. W. Calvert and J. E. Seiter (A.S.H.V.E. TRANSACTIONS, Vol. 30, 1924, p. 21).
- Standard Connections for Condensation Meters, (N.D.H.A. Proceedings, Vol. XII, pp. 63-76).
- Installation and Maintenance of Steam Meters, (N.D.H.A. Proceedings, Vol. XIII, pp. 177-183).
- Inaccuracy in Flow Meter Calculations, (N.D.H.A. Proceedings, Vol. XIII, pp. 183-193).
- Testing of Steam Meters, (N.D.H.A. Proceedings, Vol. XIV, pp. 272-276).