WORKING OUT AN ELECTRIC POWER PROBLEM.

Local conditions often greatly modify the application of general principles in deciding which of two power sources is the more economical for a particular situation. A special case which has some points of practical interest is that discussed in a recent report to a client by F. W. Dean, engineer, of Boston.

This was the case of a retail drygoods store, which required electric current for two elevators, of 15 and 18 h.p. respectively, and for 450 lights of various kinds. Current was being purchased from a central station, and the prospective cost for this was $5,232, and the question was whether an independent generating plant, driven by gas engines, would result in a large enough saving to make the change worth while. Tenants of adjoining buildings assured a market for a yearly total of 20,000 K.W. hours, while the client concern would require 110,000 K.W. hours—a total of 130,000 K.W. hours annually. To provide this current, the plant proposed consisted of one 40 h.p. gas engine with a 25 K.W. generator for the light loads, and two 60 h.p. gas engines each, with a 35 K.W. generator, one for the heavy loads, and one as a spare unit. The installation costs were high because the work had to be done mainly at night; and a further increase came in allowing fixed charges on these costs, on the theory that the excavating and foundations might, or even probably would, prove valueless when the plant had to be renewed. The estimated costs of equipment, installation and operation are given below:

Excavation, foundations, walls, floors, etc...	$1,438	
Two 60 h.p. gas engines	4,993	
One 40 h.p. gas engine	1,940	
Two 35 K.W. generators	1,450	
One 25 K.W. generator	615	$9,798
Switchboard, balance, piping, wiring, erection, etc.	2,295	
		$ 13,531
Add 5 per cent. for contingencies.....	679	679
Total cost of plant		$14,210
Costs of operation were based on a consumption of 31 cu. ft. of gas per K.W. hour, making a total of 4,000,000 per annum, costing under the particular conditions, per year		2,546
Attendance, increase		420
Waste, oil, supplies, etc.		250
Fixed charges 13 per cent. on $14,210		1,847
Total operating cost		5,183
The income from customers, on the basis of their actual consumption at rates paid the central station, $1,995 less 12½% discount, $249, would be		1,746
The net annual cost to Mr. Dean's client would therefore be		3,437
The cost of purchased current would be		5,232
Yearly saving by gas engines		$1,795

How essential to the client was this sale of surplus current will appear from the fact that without such sale, even though a less powerful and less costly generating plant was required, the saving over purchased current would amount to only $672 per year, almost exactly 3 per cent. of the cost of plant, which in Mr. Dean's judgment made the change not worth while. The annual saving with sale of current amounted to more than 12 per cent of the cost of the plant.

ELEMENTS IN THE SELECTION OF A BUSINESS LOCATION.

There are but few kinds of business which demand a particular and restricted location. For this reason it is obvious that in nearly every kind of business a location can be selected which will furnish the best returns for the money invested. With an undeveloped power there need be no feeling that a certain amount having been expended it is a total loss to locate elsewhere. There is nothing to bind a foreign concern to this particular undeveloped power. It has the range of at least a large section of the country from which to make a choice of location, and in case it is necessary to locate on a stream and advantageous to use water power, there will still remain a choice of location.

There are exceptions to this, in cases where the power can be used where the raw material abounds, and the finished product finds a market in the immediate vicinity.

The essential points which must be considered—as to whether an undeveloped power can be developed and used to a greater profit than any particular business or the general run of business could be conducted elsewhere with a different source of power—are enumerated by Charles T. Main, mill engineer and architect, of Boston, as follows:

a. Quantity of water during a dry year.

b. Uniformity of flow during the year, considering the storage capacity, natural and artificial.

c. Head of fall.

d. Conditions which fix the expense of building dam and canal, and flowage of land.

e. Conditions which affect the cost of foundations for buildings.

f. Geological conditions which determine the permanency of the falls.

g. Freight charges for fuel, supplies, raw materials, and finished product.

h. How much low-pressure steam can be used for heating purposes, and whether exhaust steam can be used for those purposes.

i. Is water needed for other purposes than power, and in what quantities?

j. The social and sanitary conditions which make it possible to procure and keep good help.

k. The greater uniformity of speed with steam than with water power.

All the above items except the last two can be estimated approximately in money value.

The power which has the most value is one which has a flow during a dry year which is nearly constant, or which can be made so by storage basins, and which requires no augmentation from other sources. It seems to be fair, in determining the value of such a power, to say that if the business which can be conducted there can be conducted elsewhere, where fuel is cheaper, the cost of that water power can be compared with the cost of steam power at such places which are suitable for the transaction of such business.