

## POWER PRODUCTION IN ISOLATED PLANTS AND COSTS.

In a paper presented to the American Institute of Electrical Engineers, Mr. P. R. Moses gives some interesting figures on the cost of making electricity. The following is abstracted from his paper:—

If heating is a negligible matter, as it is in tropical countries and in many manufacturing and industrial establishments, the choice of a prime mover is governed by the balance between investment and efficiency.

The high efficiency modern producer gas engine and the oil engine by their simplicity and reliability offer many advantages over the high pressure steam plant, and where steam is not used for other purposes to an extent proportional to the power requirements, the tendency is rightly, I think, toward this type of plant.

Two producer gas engine plants recently installed have given results fully equal to the guarantees, and a kilowatt-hour can be and is regularly produced at the switchboard under regular operating conditions for about two pounds of No. 1 buckwheat anthracite or pea coal, and this in plants of a few hundred kilowatts capacity.

One of these plants, of 175 kw. capacity, of which the load curve is given, is making current for 1.14 cents per kilowatt hour, including fixed charge on a power house, etc., for a duplicate equipment. These are the owners' figures and include all charges.

The other plant, a 600-kw. plant, divided into three units is using 1.75 pounds of pea coal per kw.-hr. under regular working conditions, including all fuel used for banking.

As the cost of the gas producer plant is no higher than that of a high efficiency steam plant, the relative merits under the conditions outlined hardly need elaboration.

On the other hand, in another plant, belonging to the same company for which the gas engine plant was installed, the steam engine offered the correct solution for at least part of the plant, because the electricity was practically a by-product of the concentration and evaporation of the sugar solution.

In many instances a combined steam engine and producer gas or oil engine plant offers the best solution, the steam plant being installed to such extent that its exhaust may be fully utilized.

With such equipment, with the exhaust gases from the gas engine used to heat reed water from the boilers, an almost ideal operating condition exists for at least part of the year.

I have investigated a number of isolated plants, operated by oil engines, and find particularly in the small plants that they are giving remarkable service. Almost universal testimony is to the absence of trouble and the reliability of the small sets. With the large units the heavy parts and the unfamiliarity of the operators have given some trouble, but in general the results are satisfactory.

The necessity for steam boilers and the space conditions in city buildings usually preclude any type of plant but steam unless the building is planned from the inception for the gas engine or oil engine equipment. As the engineer is frequently not called in until the general plan is adopted and as space beyond a certain amount is often extremely precious, the usual isolated plant in city buildings in the East is a steam plant.

**Costs of Making Electricity.**—Some kilowatt-hour costs in buildings follow: These costs are derived by deducting from the total operating cost of the building with an electric

plant, the cost of operating without an electric plant. This latter cost is either actual or estimated, depending upon whether street service had been used prior to the installation of the private plant or not. In each instance the fact is stated. I do not go into particulars of each plant because there have been many such figures printed. They are, however, as closely correct as I can make them and are taken from the regularly monthly plant reports.

Where the costs are given for different seasons, the variation is due, of course, to the high cost of supplying heat and engineers services, etc., during the winter and the relatively low cost of these services during the summer.

The kilowatt-hour costs do not include fixed charges unless otherwise stated.

My reason for excluding fixed charges is that each case presents a different condition. Money may be worth 25 per cent. to one man and 3 per cent. to another. With the cost of making electricity before him, each man can then decide if this cost is sufficiently less than the central station charge to warrant investment.

### Kilowatt-Hour Costs.

Loft building.—100 by 100 ft. (30 by 30 m.) 12 stories and basement.

Month.	Kw.-hr.	Total cost.	Basic cost.	Mfg. cost.	Mfg. cost per kw.-hr.
April . . . . .	15080	756.81	300	456.81	\$0.03
January . . . . .	18450	936.26	470	466.26	\$0.0252
October. . . . .	17810	884.76	300	484.76	\$0.0328
July . . . . .	12060	680.26	200	480.26	\$0.04

Cost of plant \$12,000. Fixed charges per kw.-hr. approximately  $\frac{3}{4}$ c.

Loft building.—185 by 200 ft. (56 by 61 m.) 12 stories and two basements.

Month	Kw.-hr.	Tl. cost	Basic cost	Mfg. cost	Mfg. cost per kw.-hr.
April . . . . .	36930	1830.25	750	1080.25	\$0.029
January . . . . .	41950	1841.82	950	891.82	\$0.0212
October . . . . .	39480	1643.07	750	893.07	\$0.0226
July . . . . .	31800	1543.04	650	893.04	\$0.0281

Fixed charges:  $\frac{1}{2}$  cent per kw.-hr. Plant cost, \$20,000.

Apartment house: (free light); 36 apartments, high class refrigeration; best service.

Month	Kw.-hr.	Tl. cost	Basic cost	Mfg. cost	Mfg. cost per kw.-hr.
April . . . . .	17450	1359.86	1016.85	343.01	\$0.0197
January . . . . .	21620	1360.84	1052.29	308.55	\$0.0142
October . . . . .	13500	1208.67	900.75	307.92	\$0.0228
July . . . . .	9350	1074.03	709.82	364.21	\$0.0389

Apartment house: (Electricity sold to tenants; 87 apartments; high class refrigeration; best service; large quantity public lighting.)

Month	Kw.-hr.	Tl. cost	Basic cost	Mfg. cost	Mfg. cost per kw.-hr.
April . . . . .	18154	2224.59	1749.18	475.29	\$0.0261
January . . . . .	14885	1920.56	1507.34	413.22	\$0.0278
July . . . . .	11254	1731.54	1226.66	504.88	\$0.045

These items are all higher than usual because last year the plant was completely overhauled, new plates installed in storage battery, new condenser for refrigerating plant, new hot water tank etc., all of which is charged off during 12 months from date of expenditure.