

No less than 59 plants report the successful operation of storage facilities to provide for increased flow at low-water periods. Among government undertakings of this nature may be mentioned the three large reservoirs at Lakes Timiskaming, Kipawa and Quinze to regulate the flow of the Ottawa River; La Loutre reservoir on the St. Maurice River; Lake St. Francis dam for the St. Francis River, Que.; the extensive system of smaller conservation reservoirs on the Trent River, Ont.; Lake Minnewanka, on the upper waters of Bow River, Alta.; and the reservoirs on Jordan River and Goldstream, near Victoria, B.C. Most satisfactory results have been obtained from storage undertakings, the capacity of plants being frequently doubled or more than doubled.

#### Generating Data

"Practically all energy for distribution is generated as alternating current," says the report. "The types of generators comprise various phases, frequencies and voltages. All large plants and a great many of the smaller plants operate at three-phase; a number of the older plants, some of a fair size, still use two-phase, while the single-phase systems are confined to small plants which have also been installed for some time.

"The principal frequencies used are 60, 30 and 25 cycles, while frequencies of over 100 cycles are still found in the older plants of small size. There is naturally a great variety of generator voltages, these being adapted to suit the most economic power plant design. In plants supplying distribution systems direct at the generator voltage, we find 2,200 volts predominates; also 550 volts where a large amount of motive power is supplied near the plant; also 12,000 volts in plants where all or a portion of the energy is transmitted a certain distance at this voltage.

"With the exception of electric railway service and, in a few places for a portion of the industrial power service, direct current generation is practically confined to very small plants. Such plants sometimes use storage batteries to provide continuous service, while the generating units operate only a portion of the time. In this connection, storage batteries are very convenient, but often too little attention is given to the batteries. Such lack of care results in rapid deterioration and the batteries soon become very inefficient if not almost useless, whereas, if proper attention had been given, satisfactory service could have been expected.

"The aggregate maximum demand on the plants included in this report is 1,078,298 k.w., of which 1,003,955 k.w. is on hydro-electric, 69,924 k.w. on steam, and 4,419 k.w. on internal combustion engine plants. The division between the various services, such as lighting and power, could not be obtained from all plants and systems, but available data indicate that 31% is used for lighting, 59% for power and 10% for miscellaneous. The load factor on the larger plants is stated in the report, but, in some instances, such information respecting the smaller plants was unobtainable. For the larger hydro-electric plants, the load factor usually varies from 50 to 80%, while in plants supplying large blocks for metallurgical or chemical purposes, it may reach from 90 to 100%. On steam plants of fairly large size, 30 to 40% power factor is usually recorded, but 60% may be reached in exceptional cases where the load comprises mainly mining or other industrial operations requiring 24-hour power.

#### 274 Continuous Service Plants

"Of the various plants, 274 give a continuous service, night and day, while 220 give only a night service, but, as the latter only comprise small installations, their total capacity is relatively unimportant. The remaining 71 plants are used as auxiliaries.

"It is very difficult to obtain accurate data on cost of generation which could be used to compare conditions at various plants. An attempt to keep a record of this information is made in most plants, but the manner of arriving at it varies greatly. The chief difficulty lies in the inclusion for certain plants and omission in others of various items which are comprised in the total cost given. In some cases, the overhead charges are left out, which leads to most

erroneous figures, especially in hydro-electric plants; in certain steam plants, only fuel and oil costs are considered.

"On the other hand, some plants keep this information in a very accurate and detailed manner. Such plants include all chargeable items, sub-dividing the total cost into various parts and extend it to the transmission and distribution costs. The cost of generation for hydro-electric plants is usually given in dollars per h.p.-year, and among the lowest reported is a cost of \$8.50 per h.p.-year, the plant being only some 10,000 h.p. capacity, but operating under a 90-foot head; for very large plants, the cost should be even substantially lower, while for plants of the same order it varies from \$8.50 to \$15 per h.p.-year; in smaller hydro-electric plants, \$30 to \$40 per h.p.-year may be reached.

"Steam plant costs are more often expressed in cents per k.w.h. and they vary greatly with the service, size of plant and with its geographic situation, as affecting the price of fuel; in steam plants of over 500 h.p. capacity, the reported generation cost varies generally from 0.7 cents to 5 cents per k.w.h., while in smaller plants it varies from 3 to 15 cents per k.w.h."

#### O.L.S. ANNUAL MEETING

**I**N the lecture room of the Engineers' Club, Toronto, last Tuesday, Wednesday and Thursday, there was held the twenty-seventh annual meeting of the Association of Ontario Land Surveyors, H. J. Beatty, Pembroke, presiding.

Several standing and special committees met Tuesday morning and discussed their reports. In the afternoon the president's address was delivered, and also the reports of the secretary-treasurer, and the committee on topographical surveys. E. T. Wilkie, Toronto, read a paper on right-of-way surveys and descriptions; W. E. Taylor, Toronto, on the design of concrete arches; and Lt. J. H. McKnight, C.E.F., on the operation of light railways in France. Lt. McKnight's paper appears in full on page 264 of this issue.

A. R. Davis, Toronto, delivered an address on "Surveys and Reconstruction" Tuesday evening, in which he discussed the soldier-settlement problem. This was followed by an address on the "History of the Madoc Gold Excitement in 1866-67," by C. Fraser Aylsworth.

Various committees reported Wednesday morning, and there were discussions on permanent survey monuments, legislation, governing lines and surveyor's tariffs, following which Nolan Cauchon, Ottawa, gave an illustrated address on town planning.

Drainage matters and construction of roads and pavements were the subjects of discussion Wednesday afternoon, following a paper by H. T. Routly on road work in Coleman Township, Ont., and on "Drainage Matters," by G. A. McCubbin.

The usual informal dinner was held Wednesday evening at the Engineers' Club, with representatives from other technical societies as the guests of honor.

The meeting was concluded Thursday morning by the election of C. Fraser Aylsworth, Madoc, as president; T. D. Lemay, Toronto, vice-president; L. V. Rorke, Toronto, secretary-treasurer; D. D. James, Toronto, and John Van-Nostrand, Toronto, auditors.

There are six nominations for executive council, two of which are to be elected by letter ballot before April 1st. The nominations are: E. N. Rutherford, St. Catharines; E. T. Wilkie, Toronto; J. J. Newman, Windsor; R. R. Grant, Toronto; J. M. Watson, Orillia; and G. A. McCubbin, Chatham.

The annual luncheon for surveyors who received their final certificates prior to 1887 was held Thursday noon at the Engineers' Club, and was attended by nineteen veterans, who much enjoyed reminiscences of their early adventures.

Queen's University intends to establish a highways engineering course under the direction of Prof. Thos. Scott, who has been in Halifax for the past year in connection with reconstruction work, but who is now returning to the university.