A New Hydro-Electric Power Scheme in Sweden

A FULL description of the hydro-electric power scheme at Krangede, Sweden, which has been in operation for six months, is given in the *Asea Journal* of May and June, published by the Asea Company of Vasteras. Krangede is situated in about lat. 63° N. at the site of a natural fall on the lower part of the Indalsalven, an important river in the Jamtland district of Sweden draining a large area containing many lakes and extending back to the Norwegian borders. The link with the power station lies well up in 'Norrland', and in the south consists of a high-voltage feeder carried direct down to a main substation at Horndal in South Dalecarlia. It is thus within convenient range of Stockholm and is in touch with the large supply networks of central and southern Sweden.

It was anticipated long ago that before 1940 the demand for electrical energy in the southern and middle parts of Sweden would make the delivery of large bulk supplies from the north economically feasible. The great industrial activity of the last few years has accelerated the increasing demand for electrical power. The Krangede scheme was carried out and is owned by a private company comprising several large industrial businesses and the Stockholm municipality. The scheme has several unique features. The whole generating plant is underground, and the equipment is of the most modern design, as it has to deal with a transmission voltage of 220 kilovolts.

Unregulated, the water flow in the river at Krangede is very variable. The maximum flow is about 2,000 cubic metres per second and the minimum is often only about 100 cubic metres per second. Work at present proceeding on one of the lakes near the source of the river on the Norwegian borders is expected to increase the minimum flow by about 40 per cent. The power station is designed for a head of 190 feet, and with the plant at present installed it has a consumption of about 140 cubic metres per sec. The dam has a length of about 240 yards and has four spillways. The generating plant is housed in a chamber blasted out of the solid rock, the machine room floor being 131 feet below the surface of the ground.

To prepare a turbo-alternator for starting, a special switch is operated and a window in it becomes illuminated by a flickering light. Until the lubricating oil and cooling water are circulating properly and other starting devices have moved into the starting position, this light goes on flickering. When everything is ready to start up the turbine, the light becomes steady. The control room is situated on the top story of the building and its windows command a good view over the outdoor switchgear and the dam. A mimic busbar system is provided at the control desk and includes switches and position indicators. On the front of the control desk are push-buttons controlling the operating of the system.

The two generators at present working are each of 35,000 kilovolt ampere capacity when running at 167 revs. per min. The height of each generating unit is nearly 30 feet and its total weight is 427 tons. The main transmission line connects the generating station to the Horndal substation, and as the transmission conductors work at 220 kilovolts, it was necessary to make their diameters large so as to avoid the formation of coronae (brush discharges) on them. The supporting towers are 56 feet in height and the conductors are hung on suspension type insulators with sixteen insulators per string. The normal span is 263 yards and the spacing between the phases 23 feet.

The official tests made on the generators at full load and a pressure of 8,400 volts gave an efficiency of 97·8 per cent at unity power factor. The voltage wave generated is practically sine shaped, the maximum deviation from this form being only about one per cent.

Woods on Private Estates

IN his presidential address as chairman of the Department of Forestry of Section K (Botany) at the meeting of the British Association at Nottingham, the Hon. Nigel Orde-Powlett took as his subject "The Present and Future of Estate Woodlands". Mr. Orde-Powlett first dealt with the value of the existing private woods to Great Britain during the Great War, pointing out that although the Forestry Commission is now planting on some scale, its area under forest is only one eighth of the nominal woodland area of the country, the remainder being privately owned. It is therefore a matter of vital national urgency that it should be made possible for owners to institute a wise forest policy on their estates. There is also the social aspect of the problem—the drift from country to town. This is due to many causes, but Mr. Orde-Powlett holds the opinion that woodlands afford employment which is congenial, and that well-managed woods can afford to give adequate pay to the staff maintained. Since the majority of the private woodlands are not run on business lines they are under-staffed. If properly run, many thousands of additional men could be employed, with an increase of small-holders—and the forest worker forms the best type of small-holder.

The attitude of the private owner of woodlands varies. Most woods are run at a loss and their owners are incredulous as to their financial possibilities; or they are regarded as a nest-egg only to be realized in dire necessity; or the owner is averse from even cutting a single tree. It has been estimated that the average annual output per acre in Great Britain is less than 20 cu. ft., whereas under good management three to four times that volume might be produced.

There are three causes for this position, says Mr. Orde-Powlett, and all of probably equal importance. The first, and it may be asserted in the interests of continuity and good forest management, the most important, is taxation, and especially the death duties. It is true that duties are not payable on the