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SWEB's Pocket Power Stations

by John Gale

40 YEARS AGO - THIS DECEMBER

Introduction

In the years between 1959 and 1965, SWEB installed a number of small unmanned power stations at remote points on its system. They fulfilled the dual purposes of peak lopping and system security and came to be known as "Pocket Power Stations". Each unit consisted of a turboprop aero-engine driving an alternator, together with the control gear and switch-gear and associated oil storage tanks. The sets could be started and stopped remotely via a telephone line and could be run up and put on load in minutes. These pioneer power stations led the way to the use of aero-engines for power generation and were the fore-runners of the large gas turbine sets in use today.

Concept

The Pocket Power Station arose from an idea of Mr. A.N. (Bill) Irens, the SWEB Chairman (1956-1973). In his previous employment as the Chief Electrical Engineer for the Bristol Aeroplane Company, he had seen generators used to load engines under test (as dynamometers to measure the power output). In such cases the output was usually dissipated in resistance banks. However he realised that aero-engines could be used for power generation.

At the time that Mr. Irens joined SWEB as Chairman, the tariff for electricity levied by the British Electricity Authority (later the Central Electricity Generating Board) incurred a high charge based on peak demand This peak demand occurred for a relatively short time during the winter and Mr. Irens reasoned that if SWEB could reduce this peak a considerable advantage could be gained. For this purpose small, remotely-controlled generators, which could be started and put on load within minutes, would be required- A gas turbine powered generator would be ideal for this purpose. Such a generator would also be ideal to provide an alternative supply at remote parts of the SWEB system, where amenity problems made the provision of additional circuits difficult. Thus the pocket power station was conceived.

However SWEB were not allowed to generate electricity under the rules of nationalisation, and an approach to Parliament was needed to change the legislation. Thanks to the persistence of Mr. Irens, SWEB were successful and the new Electricity Act of 1957 gave the Area Boards the opportunity to operate generating stations in certain circumstances.

The Engine

The engine chosen was the Bristol Siddeley Proteus. This was originally developed for the Bristol Brabazon and the Princess Flying Boat, but both projects were abandoned before the engine had finished its development. The Proteus was then adapted to power the Bristol Britannia, which has had a long and successful career-

The Proteus is a 4,250 SHP (shaft horse power) turbo-prop engine. It uses the free turbine principle, in which the compressor-driving and power turbines are mounted on concentric, but mechanically independent shafts. Tiffs arrangement enables each system to run at its optimum speed under all conditions. It has two valuable advantages in the turbo-generator applications. Only the compressor system needs to be rotated by the starter and flus enables a relatively small battery to suffice. Also the alternator is coupled to a refit of low inertia, which facilitates automatic synchronisation.

Reduction gear, similar to that used on the Proteus aero-engine is used to drive an alternator at 1,000 RPM.

A Typical Power Plant

This consists of a 4,250 SHP Proteus engine coupled to a 1,000 RPM, 3.2 MVA, 3 Phase, 50 Hz, 11,000 Volt Electric Construction Co. alternator and exciter. This, together with its switch-gear and controls, is housed in a small building on light foundations and is remotely controlled- There is no cooling water requirement or need for manning of the plant.

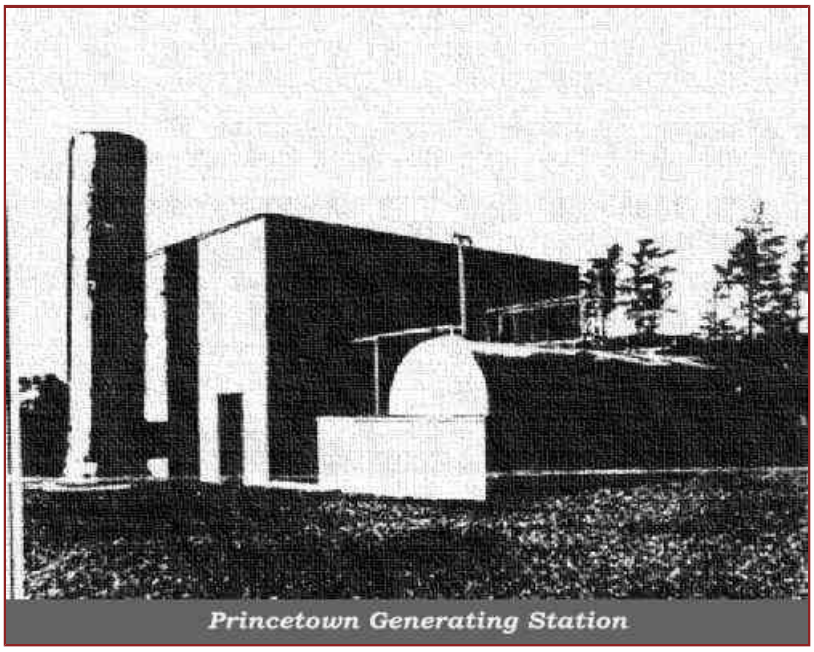
Initially two sets were constructed, one for use at Bristol Siddeley's Patchway Works and the second for installation at Princetown on Dartmoor.

Early installations were equipped with exhaust silencers consisting o£ rockwool lined chimneys, which were effective, but suffered from corrosion. Later installations were fitted with more effective silencers.

Princetown

The first installation was at Princetown on Dartmoor. This site was chosen for two main reasons, firstly Princetown was on a single 11 kV supply, which was often at risk of loss of supply due to the bad weather, and secondly there were problems of voltage drop at high loads.

The Princetown generator thus fulfilled three functions:-
Peak Lopping, Security of Supply and Voltage Support.



Princetown Generating Station

The plant was remotely controlled over the public telephone system by Datofonic control and could be started and stopped from a control panel in Electricity House. When up to speed the alternator was automatically synchronised to the system. The remote control was later moved to the SWEB control room at Avonbank and in later years was transferred to the SWEDAT system.

Princetown was commissioned on 11th December, 1959. The output was 3.0MW, later restricted to 2.7MW. The engine imtially ran on diesel fuel, but problems with wax in cold weather led to change to kerosene

Princetown is claimed to be the world's first unmanned power station. It is still in use today, but will be decommissioned, when system reinforcement allows.

Other Installations

Over the next five years SWEB installed and commissioned sets at a further four sites. All were at sites with a single supply and remote from the main system and, as with Princetown, they fulfilled the functions of peak lopping, security of supply and voltage support.

Lynton had a single turbo-generator unit and was commissioned in the autumn of 1960; Porlock was similar and was commissioned in 1963 at Roseland in Cornwall, commissioned on the 4th November 1964, had two sets, as did Mevagissey in Cornwall, which was commissioned in 1965.

Much credit is due to Cyril Waller, John Lycett and John Dethridge, who were involved in the installation and maintenence and to the Central Construction Department, who carried out the site work.

Maintenance

SWEB maintained the engines and generators with their own staff. A spare engine was kept at Temple Back in Bristol and this enabled an engine to be replaced and returned to Temple Back for maintenance or repairs. Thus always having ready a spare engine at Temple Back for the next maintenance.

The Future

The Pocket Power Stations were originally designed to last for ten years. However some are still in use 40 years later. Due to their duty, the running hours achieved were not high, Lynton managed some 2000+ hours, but some were as low as 500.

Of the other installations, Lynton was decommissioned in 1993 and the Proteus installation was replaced by diesel engines, Mevagissey was decommissioned in 1997, the remainder are still in use, but will probably be decommissioned as system reinforcement permits.

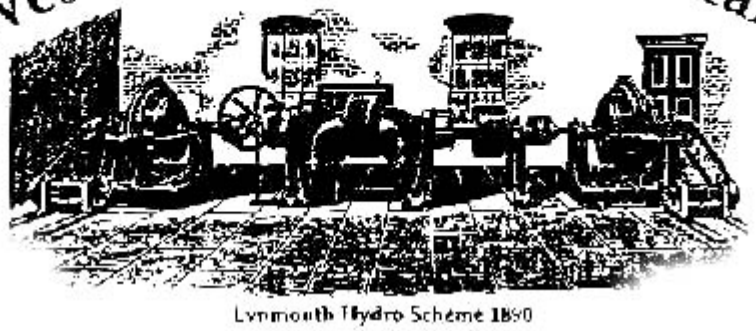
These stations pioneered both the concept of unmanned power stations and also the use of gas turbines for power generation and paved the way for the much larger sets of today.

John Gale

4th October 1999

See April item

South Western Electricity Historical Society



Lynmouth Hydro Scheme 1890

This document comes from the
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Do visit the site – you may find more items of interest.