

Mastering meters

Once electricity and then gas became available for public supply, meters were needed to measure how much people used. Prepaid options were a fairly early innovation.

WHEN ELECTRICITY or gas is provided from your own resources, keeping a detailed record of use may not be very important. However, a commercial provider has a strong incentive to ensure they receive appropriate payment.

Many meters indicate the current voltage or gas pressure, but for billing purposes, the meter has to add up the use over time. Later billing meters added the ability to prepay - the famed coin-in-the-slot meter, now replaced by its electronic equivalent.

Electric meters evolved

Over time, five types of electric meters have been explored - electrolytic, thermal, clock, motor and, more recently, electronic meters. Motor meters, considerably evolved from their earliest 1880s ancestors, are still found in most houses. Larger customers have electronic or smart meters. The modern disk induction meter uses two electromagnets that drive an aluminium disk at a speed related to the power use, which in turn drives a counter calibrated in kilowatt hours (kWh).

The supply of electricity meters was made more complex by the mixture of voltages and frequencies. It was not until 1920 that today's three-phase, multiple-earth-neutral 50 Hz system became the national standard and some time after that before 230 V was accepted as the standard. In 1932, Wellington completed the shift from 105 V 80 Hz - a shift requiring the rewiring of 1,831 electric irons. Three years later, in 1935, Rotorua moved from 110 V to 230 V.

Wet meters followed for gas

Although the first English centralised town gasworks dates from 1804, it was not until 1817 that the first efficient gas meter was



Figure 1: Cowan gas meter demonstration model.

invented. Town gas is made by the destructive distillation of coal, producing a dirty, smelly but potent gas.

The first gas meter had a freely revolving measuring drum, divided into a number of equal compartments and mounted in an outer case half filled with water - hence the name wet meter. Gas enters one of the compartments, which revolves to float above the water, releasing the gas to flow out while providing another empty compartment for more gas to flow into. As the drum revolves, it increments a counter calibrated in appropriate units.

Wet meter use continued in New Zealand until after World War II, and they were not completely removed until the 1960s.

Enter the dry meter

The wet meter had many disadvantages, and effort was put into developing a meter that would be light, portable, have no need for water - which could spill or freeze - release no odour and need not be kept perfectly horizontal to protect against theft or undercharging.

This was the dry meter, which consists of a counting mechanism and two bellows (see Figure 1). Gas enters one bellow, filling it, pushing out the diaphragm and incrementing the counter. This gas is then released, allowing the other bellow to be filled and in turn increment the counter.

Originally a diaphragm made of Persian sheepskins treated with almond oil provided suitable resilience against the corrosive nature of town gas, although nowadays synthetic, longer life, materials are used with the drier, cleaner natural gas. Unfortunately, the early dry meters were not as accurate or reliable as the wet meters, but their accuracy has improved.

Penny-in-slot meters popular

Walter Hole, in his 1907 book *The distribution of gas*, explains that, while there is no problem in the supply of gas to the upper classes 'to whom economy has been quite a secondary consideration', for those at the other extreme of the social scale, the ability to purchase small amounts of cheap lighting oils was preferable to a large gas bill. The solution was the prepayment meter.

It took until 1890 for the first practical prepayment mechanism. From then, the prepayment meter was subject to regular patents and improvements, with Hole's 1912 edition listing 10 gas prepayment mechanisms.

The prepayment meters were soon promoted in New Zealand. In 1893, 3 years after the patent, W & B Cowan's penny in the slot prepayment gas meters were shown in Christchurch and Napier. By 1898, the Napier Gas Company had some 300 prepayment meters and was adding 100 a year.

New Zealand develops its own

At least one New Zealand inventor was also interested in prepayment systems. In July 1905, Charles Edwin Hibberd patented his coin-freed machine, allowing different denominations of coins to be used by the same meter. In November 1906, Mr Hibberd left for London and reported success demonstrating it to gas and electricity suppliers.

Prepay electric meters followed, with a 1917 book listing 12 different meters, including one based on a coin's worth of copper strip being dissolved to provide the purchased electricity.

Paying in the digital age

Nowadays, the gas prepayment meter has fallen out of favour, while prepaid electric meters no longer use a coin-in-the-slot mechanism, preferring the more modern electronic systems, which can be topped up through the internet, smartphones, dedicated payment card or by telephone. ◀