

Electric lamps

Electric lamps promised much that the flickering flame could not. They were to be cooler, brighter, steadier and more pleasant to the eye without releasing toxic, noxious or dirty by-products. However, they did not start that way.

By Nigel Isaacs, BRANZ Principal Scientist

In 1802, Sir Humphrey Davy demonstrated that a platinum wire could be heated to incandescence. Six years later, he showed that an electric arc between two carbon rods could also be used to produce light. By 1848 a carbon arc lamp lit the National Gallery in London, and in 1878 'electric candles' lit streets in London and Paris. However, carbon arc light was intense, smelly, noisy, prone to flicker and very harsh.

Incandescent lamps offered a softer option, but the filament had a very limited life. This was solved in 1875, when Sprengel's mercury vacuum pump could be used to remove the oxygen that caused the problem. Glass bulbs offered a container that could withstand vacuum and heat.



Featherston Street lamp commemorating the street lighting of Wellington in 1889.

In 1879 Joseph Swan (England) was closely followed by Thomas Edison (USA) in the invention of the incandescent lamp, but both used short life, inefficient carbon filaments. In 1883 Swan patented the squirted filament – also the basis for rayon, the first man-made fibre. After the expiry of Edison's and Swan's patents in 1893, other inventors turned their skills to developing better filaments, and in 1906 tungsten was first used. Technology provided straight, drawn tungsten wire by 1911 which could be 'coiled' to increase the surface area available to give off light. Today's tungsten 'coiled-coil' was developed in the mid-1930s.

1880s sees electric lighting in NZ

Electric light quickly became available here, with a demonstration at the 1880 Christchurch Industrial Exhibition. At first, electric light was a novelty in a few private homes and some businesses.

The first use of electric street lighting was in the gold mining town of Reefton, which offered an ideal opportunity for electricity as it lacked the competition of a gas company. A local company was established, and in 1888, a 110 V DC hydro-electric plant was commissioned to power the lighting.

Mr Samuel Brown, Mayor of Wellington, viewed the scheme under construction, and returned home to promote the local use of electric light. A tender was awarded on 31 May 1888 to the Gülcher Electric Light Company for 480 Swan-Edison incandescent lamps of 20 candle power operating from dusk to dawn. The Gülcher electrician, Mr A.J. Suckling-Baron, proved to be a tireless promoter of the benefits of electricity, giving public talks and newspaper interviews. In 1891 he self-published a

16 page pamphlet entitled *Electricity at home* for free distribution. His home was described in an 1893 article as 'a marvel of 19th century illumination. Students' lamps, bull's eye lanterns, travelling lamps, vest pocket illuminators, candelabras, and a host of other inventions, all run by electricity, are scattered loosely about the place'.

The Wellington lighting installation had problems, but in the early morning of 1 June 1889 the first trial demonstrated the 'brilliance of the illumination'. 29 June 1889 saw Wellington bask in the glory of being the first city in New Zealand to be lit by electricity – although the lamp stand donated by Mr Brown (and still standing on Featherston St) gives the year as 1888. There was one major problem – the municipal water supply provided to the hydro-electric generator was inadequate to support all the lights, and after 2 years water was replaced by steam generation.

The Gülcher Company was by a year later re-organised to become the New Zealand Electrical Syndicate Ltd, and was soon providing electric lighting to government and private customers. Electric street lighting was shortly in use around the country – Gore was next in 1894 with Christchurch, Dunedin and others following. Auckland City was the slowest, with the supply from the electric tram company's generating plant being used in 1903 to run arc lights in Queen Street.

Early lamps extremely fragile

Early incandescent lamps were not without their problems. Carbon filament lamps were inefficient in the conversion of electricity to light. While squirted filament lamps were four times more efficacious, it was reported their extreme fragility required two people to carry

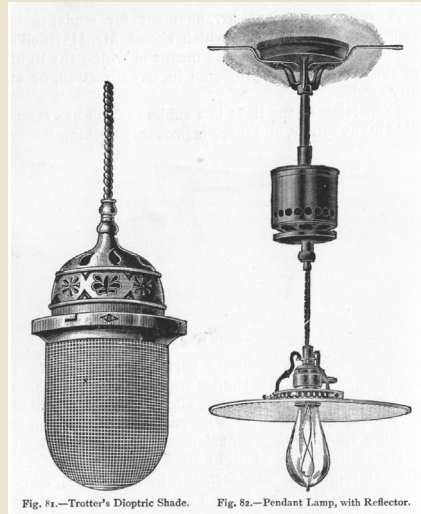


Household arc lamp (cover removed) 1902.

a box of lamps – one to carry and the other to protect the carrier from the jolts of passers-by. A 60 W squirted filament lamp sold in 1909 for 6s 6d (\$44 in 2007 dollars). By 1961 the very much more efficacious gas-filled, coil-coiled tungsten lamp was 1s 9d (\$2.57 in 2007 dollars) – today a similar bulb would cost just over \$1.

NZ lamp manufacture starts in 1938

The demand for electric lamps grew rapidly – by 1918 approximately half a million lamps were imported. Imports were the sole supply until 1938 when Electric Products Ltd commenced manufacture in Auckland. The company became part of Thorn Electrical Industries (NZ) Ltd in 1956, and by 1961 it was supplying about 20% of the market. It closed in the mid-1980s.



Incandescent lamp and shades 1902.

Unhappy with a local manufacturing monopoly, in 1940 the Government asked the British Electrical Lamp Manufacturers Association if it would be interested in establishing a plant. After some negotiations, New Zealand Electric Lamp Manufacturers Ltd was formed, which adopted the trademark ZELMA.

The company's factory was located in the Wellington suburb of Miramar. War time conditions made start-up difficult, with specialist staff and equipment trapped in Europe. The factory commenced operations in December 1940, and 130,000 incandescent bulbs came from the production line in the first two months of operation, with a planned rate of 1.9 million per year. This ultimately increased to 13 million per year. All components were imported from

America during the war years, then Europe and eventually in part from Australia. A name completed the manufacturing process – the only difference between bulbs of trade names Osram, Crompton, Mazda, Metro-Vic, Ediswan, Siemens, Philips, Pope, Stella or Condor.

The manufacturing process used both electricity and town gas, converting in the 1980s to natural gas. Production was seasonal – the four machines working longer hours in autumn in preparation for the darkness of winter. Eventually the factory also manufactured fluorescent tubes.

ZELMA finally closed in December 1999 with 70 staff losing their jobs, and soon after the building was demolished. Some of the plant was exported to Indonesia, and is still used to make lamps sold in New Zealand.

Room for increased efficiency

The latest USA measurements on retail products suggest that although there is a very wide range of performance, modern solid state LED lamps in actual use are becoming as efficacious as compact fluorescent lamps.

BRANZ's HEEP research suggests that in the average home only a small number of lamps are in use a significant amount of time. This means that short-term use fittings, such as in bathrooms, cupboards and bedside lamps, will continue to be best served by incandescent bulbs, but there is still a lot of opportunity for more efficient lamps and fittings. ◀