An overview of the transmission and distribution network of New Zealand

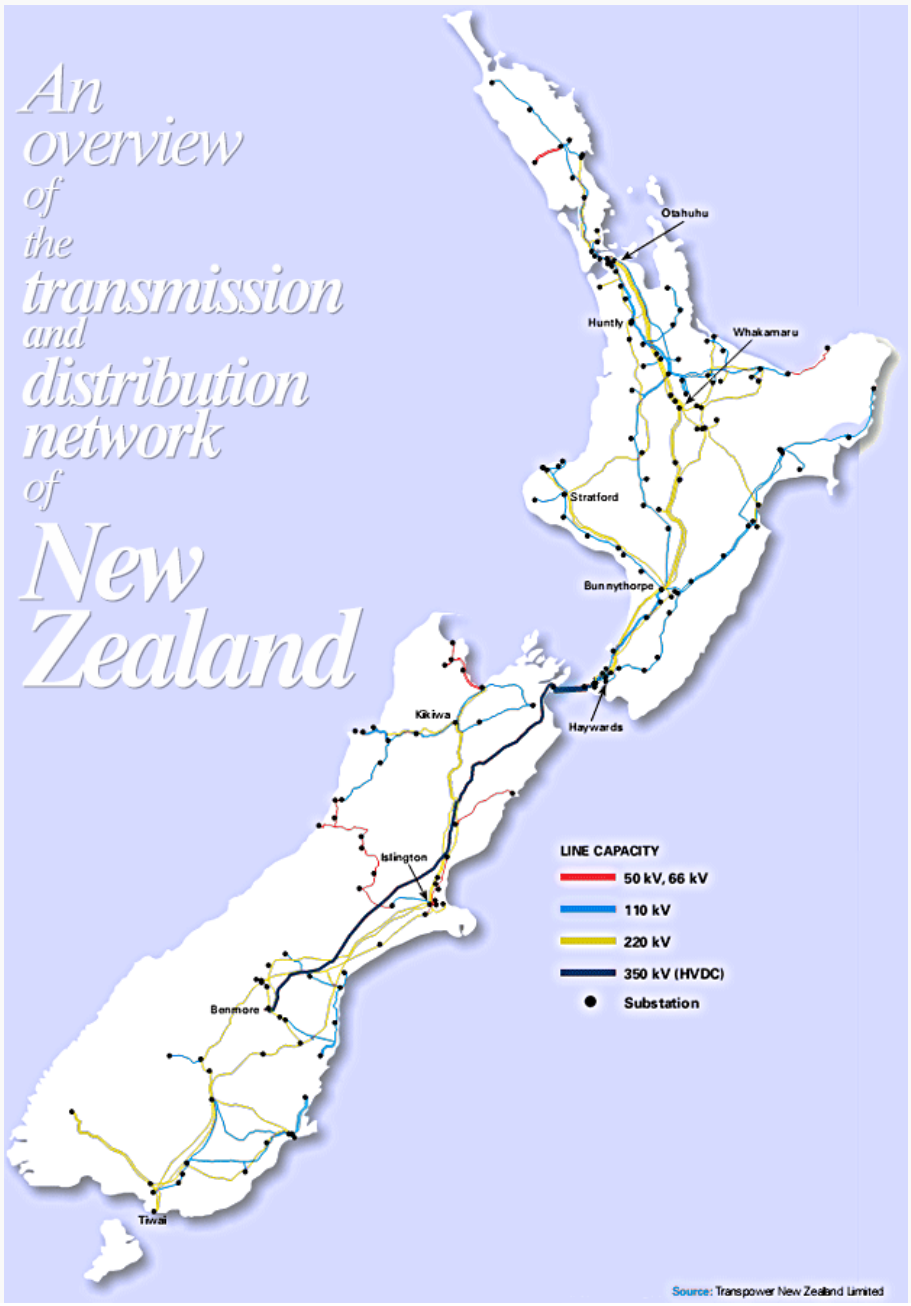


Figure 1 - Transmission network of New Zealand

Transmission

The national grid has approximately ***12,000 km*** of high voltage transmission lines. Most of the grid operates on alternating current (*the HVAC system*), although there is a **direct current (HVDC)**

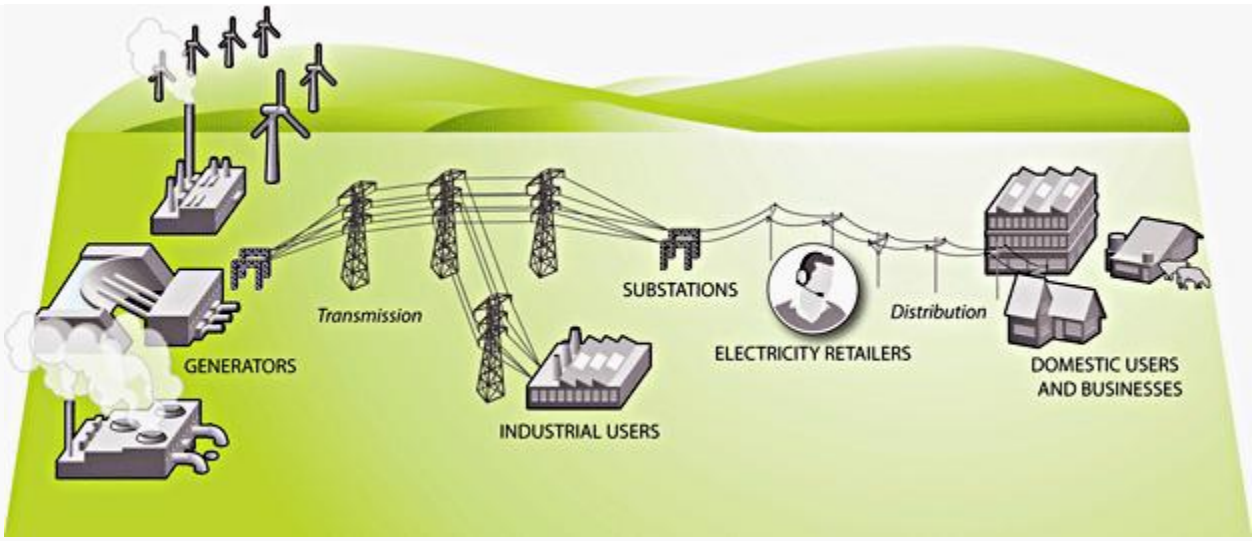
link for long distance transfer of power between Benmore in the lower South Island and Haywards near Wellington.
The HVDC link includes the set of cables running under Cook Strait, and is sometimes referred to as the '***Cook Strait cable***'.

Figure 1 above displays the ***New Zealand Transmission Network***. The national grid transports electricity from ***over 50 power stations***, and connects with distribution networks or major industrial users at ***around 200 grid exit points (GXPs)*** around New Zealand.

Because of New Zealand's geography, the transmission grid comprises a long trunk with smaller side branches serving areas such Westland and the Hawkes Bay. This structure means that there are few alternate paths for electricity to flow from source to destination, in contrast to many overseas power systems, which provide multiple paths between generators and demand centres.

This characteristic can be particularly important when a transmission line outage occurs.
Another effect of New Zealand's geography is that there are often long distances between generation and the main demand centres – especially for hydro generation in the South Island. This results in higher electrical losses on transmission lines.

Losses, which ***average about 3 percent*** (*but can be as much as 7 percent*) of power transmitted, occur because transmission lines have resistance, causing some energy to be lost as heat. As a remote island nation, New Zealand cannot import electricity from or export electricity to other countries, so must be entirely self-sufficient in meeting its needs. In contrast, many other countries that are interconnected to other nations can import power if needed, such as in the event of a dry hydro situation.
They may also export power, such as when there is excess hydro or wind generation available which may otherwise be wasted



Electricity ndustry of New Zealand (source: med.govt.nz)

Distribution

There are two types of **distribution networks**, local networks that are connected to the grid, and secondary networks, such as within a large shopping mall that are connected to a local network.

Distribution networks transport power to consumers through a network of overhead wires and underground cables (generically referred to as lines). In total, there are over 150,000 km of distribution lines in New Zealand.

The distribution networks also include substations which convert electricity to lower voltages.

Almost all consumer premises in New Zealand are connected to a distribution network. There are also some generators, known as embedded generators, which are linked directly to distribution networks.

Retailers

Retailers buy electricity ***at connection points to the grid*** and on-sell it to consumers at individual customer connection points.

The retailer is responsible for the installation of appropriate metering, meter reading, billing and payment collection. The retailer pays distribution companies for***distribution service*** (*which includes transmission charges paid by distributors to Transpower*), and also buys electricity from the wholesale electricity market.

In most cases, the consumer is billed only by the retailer.

Electricity consumers

Electricity consumers range from large industrial sites down to individual households. Total electricity consumption in New Zealand is ***about 40,000 gigawatt hours (GWh)*** per annum. Electricity consumption has increased at approximately 2 percent each year in recent years and is strongly related to economic growth and population size.

Demand for electricity varies from moment to moment and supply must change to meet changes in demand.

Consumption follows strong daily and seasonal patterns. At low demand times such as a summer night, total demand may be as low as ***2,600 MW***, whereas at peak times (*winter evenings*) it can

exceed ***6,500 MW***. While electricity use has historically been highest on cold winter evenings, some regions now have a summertime
peak demand as a result of increasing use of farm irrigation and domestic air-conditioning. Figure 2 shows a 'typical' demand profile for a domestic consumer for a 24-hour period during winter.

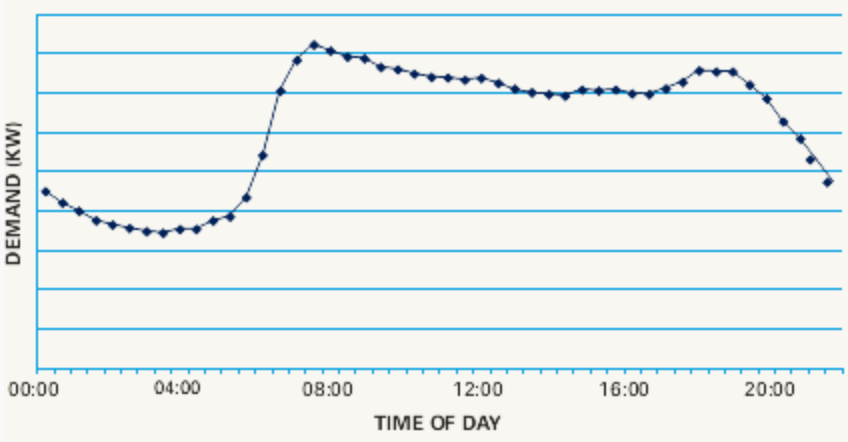


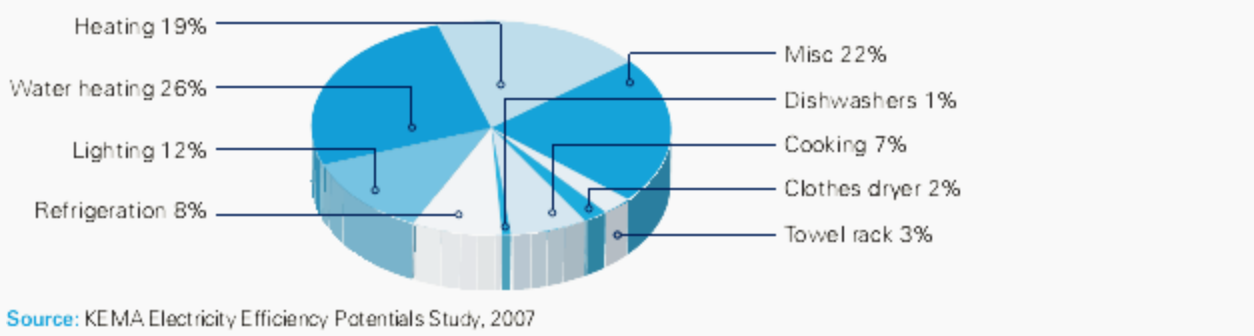
Figure 2 - Typical residential daily demand profile

Residential users make up about one-third of total consumption, with the majority of residential demand being for water heating, space heating and lighting as shown in Figure 3.

Technological progress has an impact on electricity consumption as well as generation. There has been growth in electricity-using technologies over time such as computers and air-conditioning, but there have also been improvements in efficiency.

Residential electricity use

Percentage of residential energy consumption by end-use



Percentage of residential energy consumption by end-use

For example, modern electric lighting, heating appliances and motors are significantly more efficient than their predecessors.

Improved electricity efficiency is expected to play an increasingly important role in future security of supply and achieving sustainability objectives.

Reference: *Electricity Commission – Electricity Commission Te Komihana Hiko (www.electricitycommission.govt.nz)*

Source:

http://electrical-engineering-portal.com/an-overview-of-the-transmission-and-distribution-network-of-new-zealand