

# TRANSFORMERS

## WHAT ARE THEY?

### Transformers do what they say: they transform.

In transporting electrical energy over long distances, it is more efficient to send it as a high voltage because for a given power transfer the lower current that accompanies higher voltages means less heating losses in the transmission cable, Ohms law.

Transforming voltages to these higher values is the work of the transformer. It's a bidirectional device meaning that energy flow can be in either direction. Low voltages can be transformed to higher voltages and vice versa and within the one device. Small transformers are built into appliances to reduce the mains 230V energy to lower values or in the case of a microwave oven to higher voltages of over 1000 volts.

Transformers allowed Nicola Tesla's AC system to win the power war with Thomas Edison's endeavours to have the world run on **direct current (DC)**. DC cannot be as conveniently transformed as AC.

In the street we see transformers as grey steel finned enclosures high up on power poles and in the green painted steel street level louvred

kiosks. Their function is to transform the high distribution voltages of 11,000 to 22,000 volts to 230 volts for the houses and businesses.

The distribution voltages are high to enable high transmission efficiency. Back at the electricity substations this high distribution voltage is the result of the transformation of even higher long distance distribution lines. The very large transmission lines we see spanning great distances operate at between 132kV and 330kV and transport huge amounts of energy.

Energy needs to be transported at high voltages to have acceptable efficiencies. A side point about grid efficiency: The eastern Australian grid loses 10% of the energy generated in heating the transmission wires despite the care taken to ameliorate the losses.

In perspective the Tomago Aluminium smelter near Newcastle uses 12% of the energy generated in NSW (950kW). It is NSW's largest consumer. They say that because of the vast amount of electrical energy used in the production of aluminium that aluminium is solidified electricity.

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