Steam power plants play a key role in electric power generation. Therefore the Rankine steam power cycle is one of the most important cyclic processes used in industry.

The efficiency of electrical power generation has been increased in the last few years due to process optimisation. Nowadays a total efficiency of approx. 45% can be reached. For this reason the steam power cycle plays an important role in engineering education.

This important field in engineering education can be explained in a practical way with GUNT steam power plants for laboratory and experimental operation. The behaviour of steam power plants at different operating conditions can be investigated. Due to the use of real components aspects such as maintenance, repair, measurement and control technology can be addressed.

The simplest steam power cycle consists of four changes of state:

1–2: Liquid pressurised water is evaporated in a boiler by input of heat
2–4: The steam expands associated with mechanical power output. In power plants the mechanical energy is transformed into electrical energy by a generator.
4–5: The expanded steam is condensed to water with associated heat output
5–1: The condensed water is pressurised by a feed pump and delivered back into the boiler

In reality the process is more complex. The steam temperature at turbine inlet should be as high as possible to increase the efficiency. Therefore the steam is superheated in a superheater (2–3). Pre-heating of feed water (5–6) can also raise the efficiency. Steam from various pressure stages is used for pre-heating. In the example illustrated part of saturated steam at boiler pressure is used.

The larger GUNT steam power plants use a typical, industrial steam turbine as shown above. This is an impulse turbine with a so-called 2C wheel (Curtis wheel). The pressure energy of the steam is completely transformed into kinetic energy by fixed nozzles (1). Kinetic energy is transformed into mechanical work by changing the direction of the steam flow in the Curtis wheel (2). The rotor shaft (3) with centre-fixed rotor is mounted on two ball bearings (4). The turbine is equipped with a speed governor (5), which controls the steam throttle valve (6). The turbine is designed to drive pumps and generators and has no reduction gearing.