gTET Hot Wire

The Heat Transformers

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News & Updates from Green Thermal Energy Technologies

Turn-key solutions to transform waste into useful energy, delivering economic and climate change benefits

gTET specialises in innovative solutions at industrial scale for thermal energy management, in particular redeploying waste or renewable streams to reduce opex and carbon footprint.

gTET's revolutionary ORC generators enable thermal energy to be effectively converted into electrical power where this is the most efficient and effective use of the energy.

As we like to say here "*WASTE* is the new *OIL*"

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1. Projects:

Winton QLD Geothermal

Winton Shire Council in outback Queensland have historically been innovative thinkers when it comes to projects that benefit the locally community, and the geothermal power station is no exception. Water from the Great Artesian Basin is brought to the surface at 84°C - 86°C and must be cooled to around 40°C - 50°C for the town water supply. Winton has 4 bores, some of which were drilled in the 1800's, of which only 2 are used now with one primary bore for the town water. Cooling ponds have been used to provide a means of cooling the extracted water prior to supply to the town.

gTET was assigned as principle contractor for the geothermal power station incepted for the purpose of providing power to council assets from the otherwise wasted heat in the town water supply, at the same time as minimizing the energy needed to cool the water. This meant that the power station needed to automatically modulate the power generation to match the town water consumption. The result is a fully automated system that routes water through the power station during operation, otherwise bypassing the power station, and which cools water from 86°C to 50°C while generating up to 300kWe.

The installation comprises two 150kWe ORC generators each incorporating 3 high speed turbo-alternators using R152a working fluid. Power quality is measured at a local switchboard as well as at the grid connection some 200m away and a 70kW battery backup system allows for the power station to be isolated as a micro grid. Parallel cooling towers and pumps are used to provide cooling water for the generators which are also controlled by variable speed drives integrated into the ORC generators.

Civil works comprised backfill to ensure the site was above the 100 year flood line, pier and floating slab concrete footings and building capable of coping with the high wind loadings in the Winton area.

Commissioning of the power station has now been completed with testing currently underway to ensure that the Ergon power quality requirements are met.

Installation at Winton Shire Council

2. Technical Brief:

Benefits of Inverter Power Factor Control

Power factor represents the efficiency of a sites usage of the electrical power that it consumes. It is the difference between the Volt Amps (kVA) you pay for on your bill and the work (kW) actually delivered in the motor, light or electrical load. The difference is called the Reactive Power.

When AC power is consumed by a device it will load the AC power supply so as to displace the current waveform either leading or lagging the voltage waveform as depicted in figure 1. An inductive load, such as an inductive motor, will cause the current to lag the voltage whereas a capacitive load, such as buried cables or motor starters, will cause the current to lead the voltage. A resistive load, such as an electric heater or light bulb, has no impact on displacing the current waveform.

The extent that the current leads (positive) or lags (negative) the voltage is called Power Factor (PF) with 100% in-phase being PF=1 and entirely out of phase being PF=0. The delivered power (kW) is kVA x PF. You will pay for Voltage x Current, or kVA, but you only get value from kW delivered at your device. Therefore a typical industrial site PF of 0.7 means you only receive 70% of the power that you pay for from the grid.

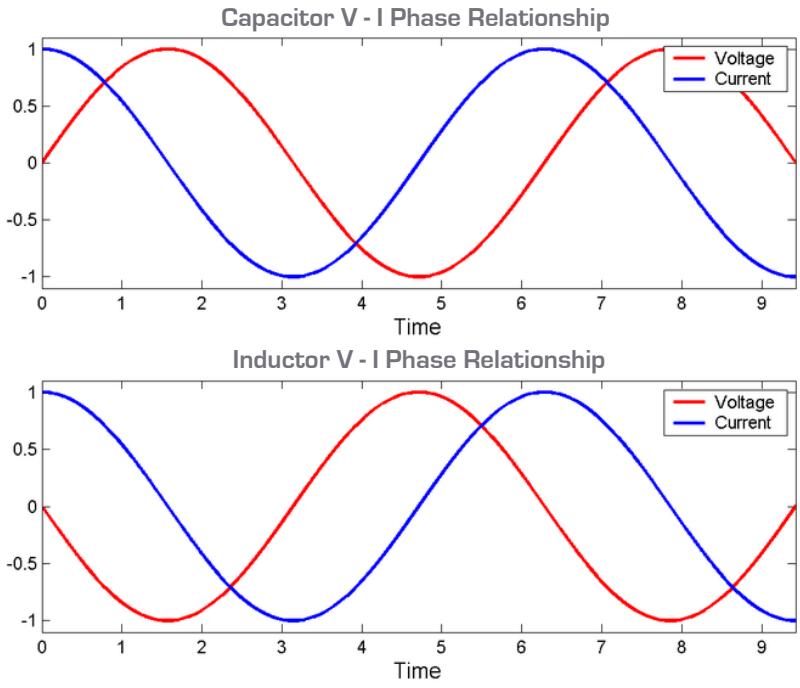

Figure 1: Inducive vs Capacitive Power Factor

Many industrial sites will have a mostly inductive power factor due to the number of inductive motors. Consequently it is quite common for sites to install power factor correction devices, which are banks of capacitors, to drag the lagging power factor closer to 1. These devices are costly but generally provide economic benefit when the existing PF is low.

An electronic inverter generates the voltage and current waveforms that it transmits onto the site power grid. Most inverters do this by rapidly (e.g 6kHz) switching a DC power source using an array of power transistors that modulate the on and off time so that the average voltage waveform reflects that of the grid i.e 50Hz/3ph 415V. The inverter uses electrical filtration to result in a clean 50Hz sinusoidal waveform. In changing the point that the transistor switches during the grid voltage waveform with which it is synchronised, the inverter can translate the current phase relative to the voltage thereby generating reactive power. Each transistor is protected by diodes (free wheel diodes) that act to absorb reactive power. Consequently the inverter has the ability to generate or absorb reactive power to counteract the reactive power on the grid it is connected thereby functioning to force the sites PF closer to 1 with the associated economic benefits.

gTET's ORC generators use an asynchronous high speed turbo-alternator that connects to the sites power grid via variable speed drives and an inverter in a single integrated package. The grid connected inverter, which complies with most of the worlds relevant grid connection standards, provides power factor control as a programmable function together with many other grid protection parameters. A schematic of the typical drive arrangement on gTET's ORC generator is shown in figure 2. The grid inverter adjusts reactive current based on a measurement of the power factor on the grid.

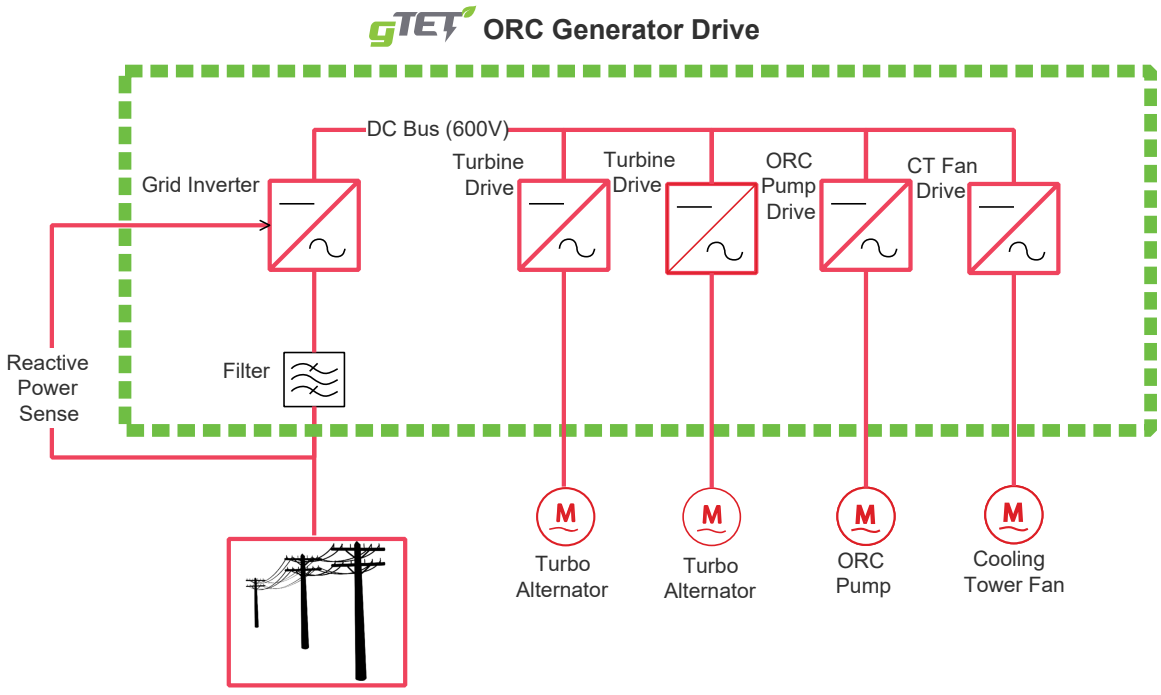

Figure 2: gTET ORC Generator Drive Arrangement

When considering the economic benefits that waste heat recovery can provide to a site using gTET's ORC generators the economic benefit of power factor control should also be considered.