## LandEscape Farm "Spagazer" Hot Tubs Renewable Energy Based Water Heating and Sanitisation System

The LandEscape Farm SpaGazer Hot Tubs are heated and sanitised by a totally unique renewable energy based integrated system made up of several game changing products as well as some elements of our own design and construction.

THE RENEWABLE ENERGY BASED HEATING SYSTEM

We intend to offer our guests a quiet and peaceful hot tub experience located with as much privacy and isolation as economic infrastructure installation allows. We have therefore chosen to use jet and bubble free hot tubs as our **SPAGAZERS** and the locally made tubs by Stoked Stainless are perfect for our purposes. Beautiful to look at, beautifully made, robust and simple we are proud to work with and showcase the products of this outstanding Wanaka Company. Local for Local where possible is a fundamental tenet of the LandEscape philosophy!

Initially at least our biggest energy load by far at LandEscape Farm will be *THERMAL*! We have gone to great lengths to insulate the tubs, pipes and balance tanks as thoroughly as possible but there will still be significant thermal loss and it is antithetical to our philosophy to supply that make-up energy from any fossil fuel based heating system - enter renewables. We will heat the water in our hot tubs with a hybrid system wherein SOLAR THERMAL will be the PRIMARY ENERGY source and this will be backed up (during cloudy and very cold weather) by an individual small-scale, pellet-fired WOOD GASIFICATION BOILER at each SpaGazer installation. Wood pellets are generally made from post industrial waste streams and these sensational boilers burn them at up to 96% conversion efficiency with virtually unmeasurable gaseous and particulate emissions. These twin heat sources will be accumulated in an amazing heat storage system called a Temperature Stratified Thermal Energy Buffer Tank that will give us unique thermal energy management capability.

THE ENVIROSWIM "DRINKING WATER STANDARD" TREATMENT SYSTEM The water of our hot tubs is sanitised by a revolutionary pool and spa water cleansing system from Australia called EnviroSwim. This is a chlorine and bromine free protocol that produces crystal clear water in the tub/balance tank system by utilising a mixture of copper and silver ionisation, oxidation via electrolytic hydrolysis and ultra-sonic bombardment that results in hot tub water that complies with national and international drinking water standards.

## THE HOME GROWN "BALANCE TANK"

The water reticulation system required an in-ground balance tank to receive excess water from bather displacement and to increase the water volume and thermal inertia of the whole system. No suitable tank with ultra-high insulation could be found in-country so we innovated and fabricated our own. Our solution was a New Zealand made 3,300L concrete septic tank (new ones you'll be pleased to hear!) sitting within a huge plywood box. The tank was settled onto 110mm of sheet foam insulation and then the void between tank and plywood box was filled with pourable expanding foam insulation to provide over 100mm of all-round thermal insulation. The outside of the box is fibreglassed to render it suitable for in-ground installation and a very large hole is dug! Complete this with an insulating lid and we now have the **externally insulated charged thermal mass** of almost 4,000L of water plus 2.5 tonnes of concrete as thermal inertia within the system. The tub overflows to the balance tank and a submersible pump pushes the water from there through the treatment and heat exchange system and back to the SPAGAZER with very accurate temperature control.

The inclusion of temperature stratified thermal energy storage tanks as part of our system gives us the unique ability to add renewably generated heat to the hot tub system at any time with very accurate control over the constant temperature. We will also have a significant amount of stored heat immediately available to continuously service the rinse-off shower, heat the change room micro buildings and then reheat the tub water after scheduled system back-wash and replenishment cycles. Perhaps most interesting of all ... with the ability to put heat into the tank as well as take heat out, we will be able to vary the temperature of the whole system during the day. We can start at 38.5°C for a chilly sunrise session then lower the water temperature over a period to, say, 26°C for a hot summer midday "Tepid Tub" session and then raise it back up to 38°C again as the sun sets and the 10°C Otago temperature drop hits. This heat is not wasted - it is simply moved at will via heat exchangers into and out of storage in the temperature stratified storage tanks as the water is continuously pumped through the treatment system.

## THE SPAGAZER HOT TUBS

<u>THE TEMPERATURE STRATIFIED THERMAL ENERGY BUFFER TANK</u> Essentially a battery for storing thermal energy - heat - derived from different sources and arriving at different temperatures. Almost the definition of elegant simplicity being the epitome of genius in design, these heavily insulated tanks, which range in size from 500L to over 100,000L, hold a captured volume of water in which the thermal energy is stored. Heat arrives from the source (say the roof top solar thermal collectors) in a pumped transport loop and is introduced into the tank via a downward descending spiral heat exchanger of corrugated stainless steel tube. The heat is transferred from the tube according to the prevailing thermal gradient and so deposits heat at the top of the tank and exits the bottom cold. Heat is taken from the tank in an upward ascending heat exchange loop and is sent to the load which, in our case, is the hot tub water, the hot water for the rinse-off shower and the heating radiators in the change rooms. This method of thermal exchange avoids ending up with a tank full of luke-warm water due to convective mixing. Instead, a very sharp and well defined thermocline is established within the tank so that the top might be at 80°C with the bottom being as low as 20 to 30°C.

Heating Buffer Vesse Sterilisation Filter

Cold Water Mains

## DIURNAL TUB WATER TEMPERATURE CHANGES AND CONTROL

