Nursery & Garden Industry Queensland

australis PLANTS
innovative horticulture

Australis Plants: Improving Water & Pumping Efficiency

"We were looking for ways to save energy and water so we could expand our production facilities to meet demand for our products"
Greg O'Sullivan

Australis Plants is owned and operated by Greg O'Sullivan, and specializes in olive and other fruit trees, as well as the production of grafted native plants. The main market is commercial growers and wholesale nurseries throughout Australia, and to a lesser extent overseas clients.

The nursery was originally built in 1993 and had been upgraded over the years until the Lockyer Valley floods in 2011, when the nursery was destroyed. Greg purchased the nursery in January 2014 and began rebuilding the site to develop a specialised fruit tree nursery.

Australis Plants produces the largest range of olive varieties and tree sizes in Australia, from tubestock to ex-ground, as well as avocados, mangoes, blueberries apples, pears, pecans, figs, kiwi berries and citrus. All olive varieties are propagated from mature motherstock trees that have been verified as true to type using DNA or morphological techniques. Australis Plants also specialises in production of a range or Australian native plants including tropical hybrid grevilleas, grafted grevillea standards, waxflower and a range of grafted Brachychiton hybrids.

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" As soon as we implemented the energy saving measures we noticed an immediate reduction in energy use"
Greg O'Sullivan

Australis Plants has two water sources - a 6750 L/hr bore, and a licence to irrigate four hectares from Lockyer creek. The bore provides the majority of water for nursery production and is of generally good quality, but does have levels of iron that require treatment. The water used for irrigation is pumped from the bore through a spray bar into a holding tank to remove iron using aeration and settling processes. From the storage tank the water is pumped to the nursery through a media filter to remove the iron sediment from the water.

The growing areas are a mixture of covered igloos used for propagation and some production, a shadehouse, and open growing areas. Some of the structures were in poor condition due to flood damage, and part of the improvement strategy is to upgrade these structures when they are required for production.

A sub-surface drainage system is installed, which collects drainage water from the growing beds before draining through a system of pipes and open drains to a holding dam. This water is not recycled but is used to irrigate pasture and motherstock trees

In 2014 Greg took up the offer to be involved in the Queensland Government funded Rural Water Use Irrigation Futures project (RWUE-IF). This project was based around developing an Irrigation Drainage and Energy Management Plan (IDEMP) for Australis Plants. The outcome of the project was to develop an action plan to improve the water use efficiency of the business.

Over the course the RWUE-IF project new growing areas were installed to Best Management Practice standards, and efficient sprinkler layouts using Antelco Rotormax sprinklers were installed in all areas. Growing areas were increased by 13.2%, which resulted in an increase in water use of 0.99 ML/annum (11%). However, the water used/ha/annum was reduced by 1.9% showing the new systems were more water efficient.

The enlarged production area resulted in increased production of $52111/annum. Productivity/ML

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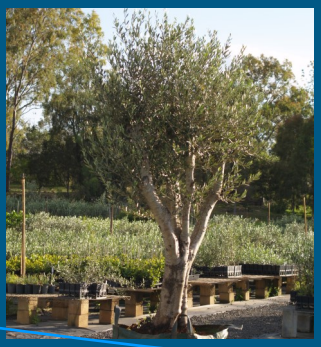
increased by $871 with productivity improving from $43839 to $44709/ML. While the changes have resulted in modest gains, the improvement process is ongoing leading to substantial improvements building year on year. Consistent and sustained improvement programmes can have a significant effect on productivity, efficiency and profitability.

Electricity use is an area that had not previously been investigated thoroughly, so Greg also took the opportunity to become involved in the Queensland Government funded Energy Savers Plus Program Extension (ESPPE) project. In this project an energy audit was conducted on all systems, not only the irrigation system. From this audit a number of recommendations were made on changes that could be made to improve energy efficiency and reduce electricity costs.

The energy audit found pumping used 55% of the electricity used on site. Greg expects that electricity demand will continue to increase due to planned nursery expansion plans, with an annual increase of 15%/annum for the next three years. This increase in the size of the production facilities was predicted to increase overall electricity use by at least 40%.

As pumping is the major user of electricity on-site it was the first area to be analysed. The details of the bore were unknown. The bore had not been serviced for over 10 years and had been flooded in 2011, so the first recommendation was for the pump to be removed for servicing or replacement. Some estimated data from the IDEMP conducted in 2017 estimated the flow rate of the bore was 6750 L/hr, with the bore pump operating for 12 hours/day. The energy audit estimated electricity consumption for the bore at 4805 kWh/annum.

As tank filling is not time sensitive, it was determined that solar power could be used as the major contributor to powering a new bore pump. If the pumping capacity was increased to enable all the pumping to occur during daylight hours savings from installing a solar photovoltaic system were estimated to be $1500/annum.



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The irrigation pump was approximately 3 years old and in good working condition. However, this pump was originally designed to operate a small growing area, and did not have the capacity to supply a system with higher flow and pressure requirements. This meant the pump would have been working beyond its best efficiency point (BEP) when irrigating larger areas. From this assessment it was found that the pump did not have the capacity to meet future production levels.

During the analysis of the pumping system it was determined the main irrigation line would also not be able to accommodate the higher flow rates required for the expansion of the growing areas.

The first recommendation from the energy audit was to replace the main irrigation pump with a larger, multi-stage, variable frequency drive (VFD) pump with twice the current pumping capacity. This upgrade would enable current pumping needs to be met, while providing irrigation capacity sufficient to meet the demands from the increased production area. Another advantage of using the VFD was its ability to accommodate varying flow rates for different growing areas while not decreasing energy efficiency. One of the additional requirements of the new system Greg wanted was to reduce total irrigation times to enable the irrigation to be completed during working hours. With the current pumping system this was not possible, but replacing the irrigation pump and mainline provided an opportunity to install a system that would be able to meet this requirement.

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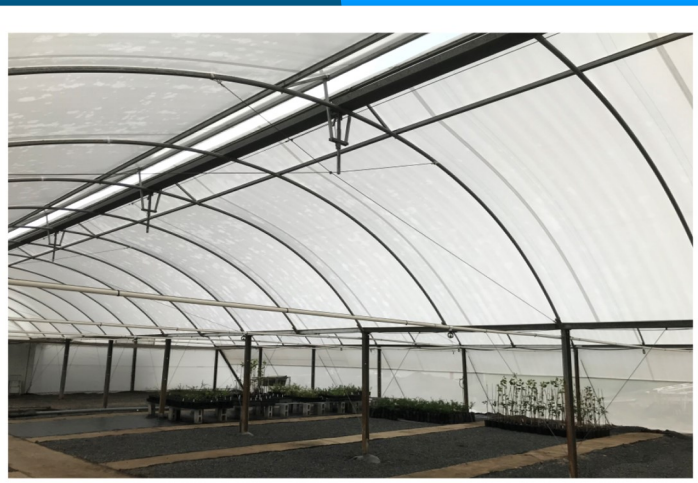

Upgrading the mainline to 90 mm was also recommended in the energy audit to accommodate the increased flows from the added production area and reduced total irrigation time, and to reduce energy use by reducing friction losses in pipes.

Another recommendation from the energy audit to reduce overall electricity costs was to install a 30 kW solar photovoltaic (solar PV) system. Initially this system would generate more electricity than was being used, but once the planned expansion of growing areas, including a new heated propagation house, are in production the system will offset the additional electricity requirements and reduce demand from the grid beyond the year 2022. Solar PV is a good fit for reducing the demand from the grid at Australis Plants, as irrigation activities are generally completed during daylight hours, so much of what is generated can be used on-site.

Upgrading the irrigation pump and mainline were estimated to have a payback period of 6.7 years, with a return on investment (ROI) of 14.8%. Upgrading the bore pump was estimated to have a 3.2 year payback and ROI of 31.6%. While the ROI of upgrading the pump and mainline is relatively low, it should be noted that not making this change will have effects on productivity and efficiency in the long term, including reduced flexibility in irrigation scheduling.

The old bore pump motor was estimated to be 2-kW, but when it was removed it was found to be 1.1 kW. The existing bore pump was replaced with a 2.2 kW unit with the aim of being able to refill the tank in half the time, and enable the tank to be filled during the solar PV generating period. There was a spray bar installed in the tank to aerate the water for iron management, but the number of jets was not increased when the pump was upgraded, which resulted in the tank fill times not changing. Once the spray bar was upgraded to utilise the additional flow more effectively, and the system only allowed to run during solar PV generating periods (8 am to 5 pm), there was no electricity drawn from the grid by the bore pump.

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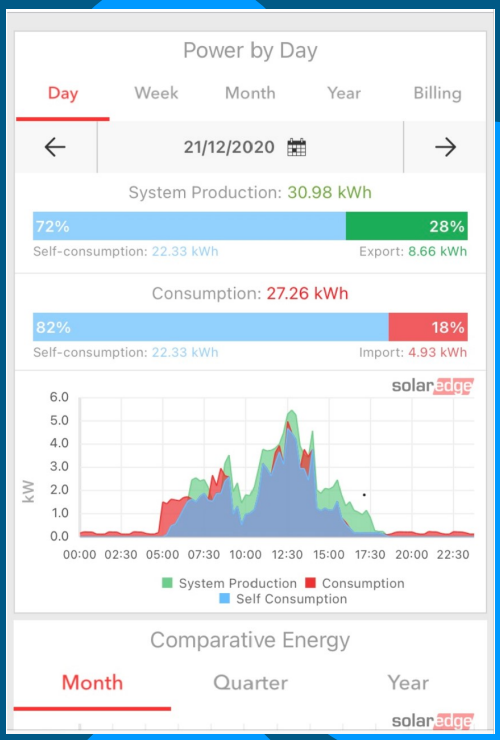

The installation of the new nursery VFD pump has resulted in energy use from pumping falling to 60% of the previous use, even before the installation of a larger diameter mainline, which would further improve energy efficiency.

The 30 kW solar PV system is being installed as a two stage upgrade, with each stage being 15 kW. The two stage installation was necessary as current energy use meant that more energy would have been produced than could be fed back into the grid. As the nursery is expected to increase production areas by 15%/annum, the kWh/annum used will also increase. The other 15 kW system will be installed in one to two years after further expansion of the growing areas has occurred.

Energy savings to date from the 15 kW solar PV system are 13691 kWh/annum amounting to $3252/annum. The previous pumping and delivery system would not have been able to effectively irrigate the increased production area, and the effect of this on productivity hasn't been factored into the overall savings.

Greg is pleased with the early outcomes from the upgrades to the pumping system and the installation of the solar PV, and looks forward to the next few years of increasing production levels with an efficient irrigation system, and solar PV providing the electricity to run it.

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