A BUSINESS CASE FOR SOLAR POWERED IRRIGATION AND / OR STREAM AUGMENTATION

THE EIFFELTON EXPERIMENT

Spring-fed waterways support ecosystems that are valued for environmental, cultural, economic and community purposes. These ecosystems are placed under stress when groundwater levels are too low to support spring flows. Targeted Stream Augmentation (TSA) is an environmental enhancement concept that comprises the augmentation of a spring-fed waterway using pumped groundwater when spring flows are low or absent.

THE EXPERIMENT

In the lowland waterways /drains of the Hekeao / Hinds Plains, the Eiffelton Community Group Irrigation Scheme (ECGIS) have incorporated TSA into their irrigation scheme design. The irrigation part of the scheme involves pumping water from multiple groundwater bores into lowland waterways and then taking this water out further down the waterway for irrigation purposes. During the irrigation season, more water is pumped into the waterways than is taken out. This ensures irrigators can take their allocated volumes and also provides an environmental flow enhancement at the end of the scheme. During periods of lower groundwater, when the scheme is operational, fish habitat and passage improves. however, when the scheme is not running (e.g., winter months) fish habitat and passage declines again. ECGIS's response to this situation has been to voluntarily augment the waterways out of the irrigation season when flows are low. The energy costs of this action can be significant.

The times of highest demand for stream augmentation are often the times when solar radiation is highest. Photovoltaic (solar) panels are therefore a logical option for determining an alternative energy supply to mains electricity or diesel. Following a pilot study for solar powered TSA in the Raywell Farm Stream tributary of the Waikirikiri / Selwyn River, the Ministry for Primary Industries (through the Sustainable Food and Fibre Futures fund) and ECGIS (with the support of the Hekeao Hinds Water Enhancement Trust) have partnered to add an electricity grid-tied solar array to an existing irrigation and TSA system, then use its operational performance outputs to inform economic analysis of a wider range of potential systems.

THE RESULTS

The trial system used a 44 kW solar array connected to a 50 kW groundwater pump and the electricity grid. Performance data was obtained during the 2021/22 irrigation season. This season at Eiffelton was characterised by high precipitation and lower than average evapotranspiration, resulting in lower-than-average irrigation demand and higher-than-average spring flows. The theoretical economic model predicted a net electricity cost of $7,625 over the November to February period for an average year. The actual net cost of electricity over this period for the 2021/22 year was $1722, providing an "above average" year comparison.

The theoretical model was also applied to smaller (22 kW) and larger (88 kW) systems to support economic analysis for a range of solar arrays supplying irrigation and/or TSA systems. This model assumes that the system has been carefully designed and operated to maximise performance. The table below suggests that there is a solid business case for investing in solar power for all assessed scenarios. For the 21/22 season, Return on Capital was assessed to be closer to 20%, due to the "above average" season (including electricity spot prices).

Solar Powered TSA Business Case (average year)	Return on Capital (%)	Payback (Yrs)
Irrigation only: small - large array	9.3 – 11.6	10.1 - 8.6
Irrigation + TSA: small - large array	9.6 – 11.7	10.5 - 8.5
TSA only: small - large array	8.7 – 10.2	11.6 - 8.8

FURTHER INFORMATION

Further information on this project and its results can be found at:

MPI SFF Futures Projects

www.hhwet.org.nz/technical-data

Eiffelton 44 kW Solar Array