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Going with the flow: Smarter VSD control using flow automation

Can flow-controlled pump automation improve irrigation performance while reducing energy use and labour?

A travelling hard-hose spray irrigator operating over steep terrain needs very different pump pressure at the top compared to the bottom of an irrigation run. This demonstration is testing pump control approaches to assess whether a magnetic flow meter can provide a more stable input for a variable speed drive than the conventional method of pressure measured at the pump.

Hosts: Stuart Jennings, Jennings Potatoes
Trial location: Thorpdale, Gippsland
Farming System: Potato and sheep

Background

The demonstration site contains significant elevation changes across irrigation runs. To operate effectively, the pump must provide sufficient pressure to overcome the highest lift and maintain the operating pressure required at the travelling irrigator.

However, when irrigating lower areas of the farm, the same pump settings can result in excess pressure, increased energy consumption, uneven irrigation and unnecessary wear on irrigation infrastructure.

Pressure measured at the pump does not always reflect conditions at the irrigator because elevation changes, pipeline length and friction losses vary between irrigation runs. This project is testing whether controlling a variable speed drive using flow measurements rather than pump pressure can improve system performance across a range of operating conditions.

Key focus areas

This project will investigate whether flow-controlled VSD operation can:

- Maintain a stable target flow to the travelling irrigator
- Adapt to changing elevation and pipeline conditions
- Reduce excess pump pressure on lower ground
- Lower electricity use per megalitre pumped
- Improve irrigation application consistency
- Provide a practical return on investment



Stuart Jennings, potato grower, Thorpdale

Method

The project compares pump performance under three control approaches:

- Fixed-speed pumping
- Pressure-controlled VSD operation
- Flow-controlled VSD operation using a magnetic flow meter

A magnetic flow meter supplies the control signal to the VSD. The drive adjusts pump speed to maintain the nominated flow as the irrigator moves across runs with different elevation and hydraulic requirements.

Pressure will be logged at key points so the team can confirm that

the required operating pressure is maintained at the irrigator while avoiding unnecessary pressure at the pump.

Comparable irrigation runs will be assessed for flow stability, pressure, energy use, application performance and operator experience.

Pump and motor performance
Pump curve information and operating data will be used to understand the duty range and how pump speed changes under each control method.


Installing the magnetic flow meter

Flow monitoring
The magnetic flow meter will record the delivery rate and provide the control input used by the VSD.

Pressure monitoring
Pressure transducers will track conditions at the pump and irrigator to show how elevation and system losses affect delivery.

Energy use
Electricity consumption will be compared under similar operating conditions and expressed against the volume of water pumped.

Irrigation performance
System assessments will examine pressure, flow and application performance before and after flow control is introduced.

Operator experience
Farmer observations will document operator intervention, system adjustments and operational issues to assess the practical benefits.

Economic analysis
Installation costs and measured energy savings will be used to estimate the likely payback and value of the approach.


The hilly terrain of Thorpdale

Potential benefits for irrigators

The project will provide practical information to help irrigators:

- Choose an appropriate pump control strategy for variable terrain
- Understand the limitations of relying solely on pressure measurements at the pump
- Reduce excess pressure and pumping energy use
- Maintain reliable irrigation performance across varying operating conditions
- Compare fixed-speed, pressure-controlled and flow-controlled pumping systems
- Assess the costs, benefits and likely return on investment

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This farmer-led demonstration is part of the Learn.Irrigate.Grow program, delivered in partnership by Agriculture Victoria and WGCMA.

The program uses on-farm trials to help local farmers explore new ways to irrigate smarter, improve productivity and protect our waterways.

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We acknowledge and pay our respects to the Traditional Owners of the region, the Gunaikurnai, the Bunurong, the Boonwurrung and the Wurundjeri Peoples and pay respects to Elders, past, present and emerging.

VICTORIA State Government
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