

# ENERGY EFFICIENCY

This factsheet is a joint initiative between Cotton Australia, NSW Irrigators' Council and the NSW Office of Environment and Heritage

## For more information

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## PUMP PERFORMANCE AND EFFICIENCY

Infrastructure upgrades may be required to increase the performance and efficiency of your irrigation pump and electrical motors. These upgrades can be effectively 'paid for' through reductions in your electricity bills. The upgrades may include the installation of power factor correction equipment, variable speed drives or soft starters.

### Power Factor Correction Equipment

The 'power factor'<sup>1</sup> of an electrical irrigation pump motor is important as it provides a measure of how effective the motor is using the supplied electricity. It is calculated by your network service provider and is generally shown on your electricity bill as a number between zero and one - where one represents the most effective or efficient use of electricity<sup>2</sup>.

A power factor of less than 0.9 is generally regarded as low, meaning the equipment is drawing more energy than ideally required to run the motor. Networks 'penalise' this inefficiency with higher electricity demand charges.

To increase the power factor, a user needs to remove or compensate for the reactive power component of their electrical loads. This can be improved through the purchase of power factor correction (PFC) equipment.

PFC equipment can reduce monthly maximum demand and capacity charges by reducing peak energy use rates that occur during motor start-up or sudden load changes.

The cost of PFC equipment varies depending on the nature of your pumping requirements and the size of the pump and motor. Costs can range from hundreds to thousands of dollars. Due to requirements varying according to individual farm set up, it is recommended that farms engage a specialist irrigation or electrical motor engineer. The specialist will also advise on the suitability and cost effectiveness of PFC as an energy saving solution.

<sup>1</sup> Power factor is the ratio of real power (kW) to total power (kVA) where total power includes reactive power (kVAR) and real power (kW).

<sup>2</sup> Note that you might have multiple pump sites on one meter which skews your power factor.

## Variable Frequency Drives

Variable Frequency Drives (VFD) are electrical motor control devices that regulate the speed and rotational force of an electric motor. A VFD can control the speed of an electrical motor during the start and stop cycle and throughout the run cycle. It smoothes peaks and troughs in electricity use, drastically reducing the peak energy requirement.

Where the combination of flow and head requirement changes between irrigation sets, electrical irrigation pumps will generally benefit from VFDs. This is because they control the frequency and voltage supplied to the motor, changing pump flow rates. Using a VFD to control flow rate rather than a throttle mechanism can reduce hydraulic head losses. This decreases energy consumption and reduces the draw from the electricity grid. Other benefits generated through the installation of VFD's include:

- Soft start capability and controlled motor deceleration, that reduces equipment wear and tear
- Improves power factor
- Greater ability to adjust pump pressure and flow for different irrigation sets

Not all pumps are suitable for installation of VFDs – there are a number of factors that will need to be considered to ensure optimal VFD performance is achieved. Factors to consider include:

- Not all older motors will tolerate installation of a VFD, and it may be a more appropriate consideration at pump end of life
- Installation of enhanced electrical motor cooling system may be required on motors under continuous VFD reduced speed control, as they will operate to hotter temperatures than motors operating at full speed.

It is recommended that you contact a specialist irrigation or electrical motor engineer to see if a VFD is suitable for you.

## Soft Starters

A soft starter controls the acceleration of an electric motor through the modification of the applied voltage. A soft starter helps protect the motor and connected equipment from damage by controlling the terminal voltage. This limits the initial rush of current and reduces the mechanical stress associated with starting a motor, providing a more gradual ramp up to full speed. This reduces spikes in energy demand and electricity demand charges generated by peaks in energy use.

## Comparison of VFD's and soft starters

The choice to install a soft starter or VFD will depend on your pump set up and your water source – as mentioned previously VFD's are not suitable where high static head occurs e.g. in groundwater pumping applications.

Soft starters are less expensive than VFDs, especially for larger pumps. Soft starters are also smaller meaning that they occupy less physical space.

A VFD will involve greater initial capital outlay. However due to greater overall energy savings than soft starters, VFDs may offer greater potential to reduce your electricity costs over the life of the equipment.

It is worth noting that the combination of power factor correction and soft starters may prove to be a better option than VFC to reduce the demand component of your electricity bill. Your irrigation system and energy use may be better optimised through variation of flow and pressure.

It is recommended that you seek advice from a specialist irrigation or electrical motor engineer to ensure that any modifications best suit your needs. For example, if constant acceleration and torque control is not necessary, and you only require voltage stabilisation during start up, a soft starter could be a more cost effective solution.

**Please contact NSW Irrigators' Council or Cotton Australia for further information.**

