Energy Efficiency Information Grants

Pumps in the Australian Cotton Industry

Improving Energy Efficiency on Irrigated Australian Cotton Farms

The Improving Energy Efficiency on Irrigated Australian Cotton Farms project aims to deliver an industry-wide awareness campaign that provides tailored energy efficiency information and tools to irrigators and their advisors. This activity received funding from the Department of Industry as part of the Energy Efficiency Information Grants Program.

Irrigation Pump Efficiency

Pumps are simple machines that turn pump shaft rotational speed and torque into fluid energy in the form of elevation, velocity and pressure energies. The efficiency with which they complete this energy conversion gives rise to the important pump performance measure, pump efficiency. Pump efficiency is an inherent characteristic of any particular pump design, and is greatly influenced by the shapes of impellers and volutes (enclosure) and physical clearances between these two components.

The Australian Context

Australian cotton farms are more often than not designed with on-farm ring tank storages close to pump stations that receive water from overland flow, stream floodwater and irrigation tail-water return channels.

On Australian surface irrigated cotton farms the greatest proportion of on-farm energy use is consumed through the motors that drive the large, cheap, agricultural, mixed flow "china" pumps, which are widespread across the industry. This type of pump is favoured because of their cheapness, robustness and servicing simplicity. The more appropriate axial pump types are perceived to be fragile in service ("can't pump iron-bark fence posts in floodwater") and are typically more than twice the cost. The large "china" pumps are so common as to represent more than 90% of the large pump types in Australian surface irrigated cotton sector.

Pumping Energy Use

These pumps are mostly driven by a mix of older mechanically injected diesels and more modern electronically injected diesel motors. Mechanically injected motors convert around 35% to 40% of the chemical energy in diesel to motor output drive shaft rotational speed and torque. Electronic diesels are capable of around 45% energy conversion. The other important component in any pumping system is the drive-train, in the form of a pulley and belt drive-train, or mechanical gearbox, which reduces the 1,500 to 2,000 rpm motor shaft speeds down to the tractor PTO speed range at which these mixed flow pumps must operate. These drive trains also lose some energy through conversion to belt slip, bearing and gear wear and heat.

Overall, readers can see that pumping stations simply convert energy in the liquid diesel form you have delivered into fuel storage tanks, over to water energy in the forms of elevation, velocity and pressure energies.

How well each of the motor, drive-train and pump components convert the energy they receive into their output energy form, from diesel through to water energy, determines the overall pumping station efficiency, and therefore the impact on your pumping costs.

For further information on Energy Use in Cotton or the Improving Energy Efficiency on Irrigated Australian Cotton Farms project please contact the Cotton Research and Development Corporation on 02 6792 4088 or the CottonInfo Team member in your area.

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