Farm energy forum

Energy Efficient irrigation

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Irrigation energy costs in context

- 100 hectare irrigated pasture two 8 span centre pivots
- pump 600 to 800 ML annually
- Power cost can vary from \$20,000 to \$80,000 pa
- Why is there so much variation ?
- Is your system close to optimal ?
- Are there simple energy savings ?
- How do you know ?



Why neighbouring farms can have such different energy costs

- Pipe hydraulics original design, change over time
- Pumps, motors and controllers Designed for current job ?
- Field/irrigator pressure and productivity
- Your management when is water required and how much is enough ?
- Irrigation System Capacity can you utilise off peak tariffs ?

Partially beyond your control - elevations, distance piped, decades of old irrigation infrastructure

1/ Pipe hydraulics - forcing water through undersize pipe burns energy !

Low flow systems and cheaper power- pipe sizing was not a priority

High flow systems - high water velocities, laminar flow becomes turbulent ... resulting energy loss. (< 1.5ms)</p>

Know, and manage, the diameter and efficiency of: Mainlines

Pivot spans

Pump suction and supply lines

2/ Pump/ Motor and the control unit ... Operating outside efficiency range costs a lot

Are the pumps matched to their pressure and flow "duty"? Appear OK, but operating at 50% energy efficiency !

- Electric motors ... modern electric pump motor efficiency is quite high and stamped on motor.
- Big energy costs if the power rating of the motor (KW) has been over specified for the pumps power requirement
- Pump starter/controller Fixed speed soft starters (Star Delta) traditionally. Variable Speed Drive drives do have a role in saving energy.

3/ Irrigation system type - Pressure in the paddock determines your electricity bill



4/ Your irrigation management ...

When is water required and how much run time is enough?





5/ System Capacity - Your system allows you to use off peak tariffs ?

- Bike shift, pods, travellers, fixed sprinklers often designed to irrigate 6 to 10 hrs off peak, apply 30-40 mm
- Centre Pivots so big, can only get a certain flow rate through pipe. Sprinkler packs limited to 7 -12mm/day over the entire area in 24 hour period.
 - These CP systems don't have the capacity to utilise off peak tariffs without compromising yield.

1/Irrigation energy audit (a bit methodical, but 4 steps !)

Nuts and bolts - Record and map the irrigation system from the river foot valve to sprinkler in paddock

Energy wastage can be quite visual:

- Short restricted pipes,
- Throttled pumps,
- Excessive pressures at sprinklers,
- More and more fittings (gate valves, taps, elbows)
- Airlocks, air valves, fitting installation
- Worn and cavitating pumps.

2/ Audit - Are your pumps designed to do the job they are doing ?

Record pump,

Impeller,

Pressure and

Flow rates

The only way of knowing if the pump operating at 40% or 70% efficiency !



CENTRIFUGAL PUMP PERFORMANCE DATA

ISO2858 END SUCTION PUMPS 50Hz PERFORMANCE

SELECTION CHART 1450/2900 출



3/ Calculate energy use: Does this align with your power bills ?

Calculate energy use on paper ... known pump, pipe, elevation, pressure and flow data current system efficiency (and inefficiencies) can be calculated.

Identify the major energy losses/cost effective changes ?

Does calculated energy requirement align with your power bill ?

If not something is not as expected ... slimes, sludges, rust, gravel mineral build up in pipes, blockages air leaks, airlocks, worn pumps, sprinklers/irrigators outside their design specifications ...

4/Audit conclusions: identify efficiency gains, costs and payback times.

- Defined pump efficiencies allow you to prioritise change
- VSD pump control Does it have a logical fit in your system?
- Mainline pipe capacity/diameter investment versus payback
- If further irrigation system investment ensure a focus on: minimum pressure in field,
- maximum field uniformity and capacity to manage/ schedule.
- Alternative energy sources ... the output has to be used well if its to make senses !

The theory:

- Bills are really significant
 Energy efficiency is highly variable
- There's potential for significant energy savings
- In real life...energy savings are often not that complicated !
- Talk through a dozen slides



Pipe - mainlines in the field

4 inch angus feeding centre pivot mainline



Pumps throttled at discharge



Pump suction lines...

River pump and suction line



Design with energy cost in mind



Is your 'standard' pump efficient and considering the new options

Twin, vertical multistage pumps



Variable Speed Drive



Always consider pressure required at sprinkler

Travelling gun - 100 psi, 50m throw, 60 % uniformity

Centre pivot 'spinner' - 15 psi, 5m throw, 90 % uniformity





Farm energy sources - for this sort of investment power has to be used efficiently

