

Electricity Savings for Irrigation Farmers

“Rising electricity costs could spell the end of irrigation farming in South Africa” – Fin24.com, Jun 24 2011

Reports like this make many involved in agriculture in South Africa sit up. Even though food security is at risk and despite heavy criticism from the agricultural fraternity, tariff increases seem to be unavoidable. The question therefore, on every farmer's mind, is how he can minimise the financial impact posed by electricity tariff increases, without reducing production capacity.

A number of savings approaches, including incentive-based offers, are promoted by Eskom. Says Roger Stones, Senior Energy Advisor for Eskom: "More funding mechanisms are now available from Eskom. Many of the new funding programs are much more user friendly with quicker approvals and implementation. Anyone who found Eskom funding too complex in the past, should re-investigate energy saving opportunities as there is a good chance that they may realise now. Funding is available in many new categories like VSDs, system optimisation, scheduling etc."

“Funding is available in many new categories like VSDs, system optimisation, scheduling etc.”

Roger Stones, Senior Energy Advisor at Eskom

Lets discuss some of these categories and see what **Irri-Gator Products** can offer to assist the end user to make use of these offers.

1. Increase of System Efficiency

Eskom is currently offering incentives in the form of kilowatt buy-backs for qualifying agricultural users. The concept involves that the electricity user streamline his project as to run as energy efficiently as possible. If he can save an average minimum amount of kilowatts, without load scheduling, he might qualify for those saved kilowatts to be bought back from him. The rational is that it is cheaper to buy back these kilowatts than it is to start up gas turbine generators to generate extra energy when the grid is overloaded.

...besides the buy-back, the customer also now directly saves on electricity costs...

The benefit is that, besides the buy-back, the customer also now directly saves on electricity costs since he is using less electricity.

In the past, electricity costs were not a big factor when designing a pump or system. This led to many designers overdesigning pumps to give the end user

more flexibility. Sometimes farmers also insists on full-size impellers in order to standardise or for ease of maintenance. In itself it is not necessarily a bad practice, however farmers are now paying the price.

Piping systems on the other hand were sometimes designed very marginally to try and save initial costs. This creates unnecessary friction loss, sometimes resulting in larger motors being needed.

Another factor to consider is that many systems run at higher flow rates than required. This could be due to the fact that the pump is oversized and it therefore runs at higher pressures, resulting in higher emitter flow rates. System age and maintenance can also play a role in as much that emitters are worn or broken or pipes are leaky, resulting in higher flow requirements.

On many farms, pumps might have been designed very efficiently, but over time additional functions get allocated – functions which a lot of the time require much less pressure. Common practise is then to choke the pump’s capacity down by using a hand valve.

For existing installations, addressing these issues, could be costly. Piping systems will mostly have to be seen as a given, while new pumps can also be very costly. Addressing system maintenance could be less expensive, but might not have a big enough impact.

Where a pump has one duty point, sometimes a lot of savings can be unlocked by simply cutting the impellor, however this would not necessarily be the most effective way of addressing systems with multiple duty requirements.

Consider Variable Speed Drive (VSD) technology. A VSD replaces the existing pump’s Star-Delta



starter and basically, by modifying the pump’s rotation speed, never let the pump work any harder than it should. Rotation speed is varied by means of feedback from a pressure transducer in the mainline and a number of easily changeable set points in the electrical panel. A different pressure set point can be allocated to each irrigation block or duty point (usually we group blocks or duty points into pressure zones so as to minimize the amount of set points). These set points can then be pre-selected by

the end user, either by means of a selector switch, or automatically from an irrigation controller.

...by reducing rotation speed of a motor by 10%, we can save up to 27% on power...

According to the Laws of Affinity, by reducing rotation speed of a motor by 10%, we can save up to 27% on power requirements (see **Box 1**). Although VSD technology doesn’t necessarily improve pump efficiency, in cases where one can reduce rotation speed and still achieve the required duty point, one can save kilowatts and therefore save electricity without replacing pumps or changing piping systems. Additional savings are unlocked by means of built in power factor correction, as well as the soft-start functionality which smoothes out power spikes at start-up.

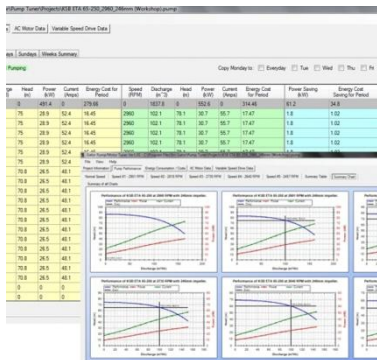
<p>Affinity Laws:</p> $\frac{Q1}{Q2} = \left(\frac{n1}{n2}\right) \left(\frac{d1}{d2}\right)$ $\frac{H1}{H2} = \left(\frac{n1}{n2}\right)^2 \left(\frac{d1}{d2}\right)^2$ $\frac{P1}{P2} = \left(\frac{n1}{n2}\right)^3 \left(\frac{d1}{d2}\right)^3$ <p>Q = Flow H = Pressure P = Power n = rotational speed (RPM) d = impeller diameter</p>	<p>If d remains constant:</p> $\frac{Q1}{Q2} = \left(\frac{n1}{n2}\right)$ $\frac{H1}{H2} = \left(\frac{n1}{n2}\right)^2$ $\frac{P1}{P2} = \left(\frac{n1}{n2}\right)^3$	<p>If n reduced by 10%:</p> $Q2 = \frac{Q1}{1.11}$ <p>∴ Q reduces by 10%</p> $H2 = \frac{H1}{1.23}$ <p>∴ H reduces by 19%</p> $P2 = \frac{P1}{1.37}$ <p>∴ P reduces by 27%</p>
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

Box 1

VSD technology can also change thinking around design norms. By initially overdesigning mainlines, a farm can possibly now be divided geographically into definite pressure areas so that blocks at the same elevation can always be opened at the same time (as opposed to the flow/pressure balancing approach commonly used at the moment). Not only might this result in electrical savings, but it also improves management since now blocks are irrigated adjacently, decreasing travel time between activation (if manually activated).

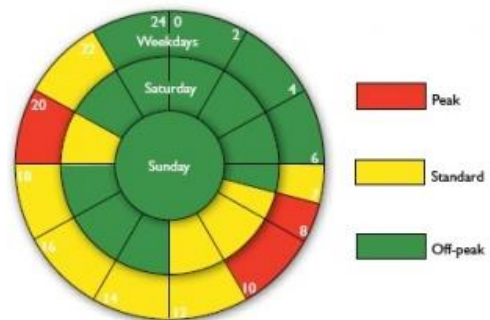
VSD technology can also change thinking around design norms.

Irri-Gator Products are leaders in the supply of [VSDs](#) to the irrigation sector in South Africa. With years of design experience added to our understanding of [VSDs](#), we offer a holistic approach to implementation of [VSDs](#). We will assist the end user or designer to assess his pump's duties and with the help of a in-house designed [software package](#), we can determine how cost-effective a [VSD](#) will be for the specific application - this in approximate R/c saving terms, not only based on theory!



2. Load Management / Scheduling

The other approach promoted by Eskom is load management which unlocks savings when pumping electrically during off peak periods. Unfortunately these periods usually coincide with night-time or weekends when labour is not readily available. This makes manual activation of irrigation blocks or centre pivots very difficult.

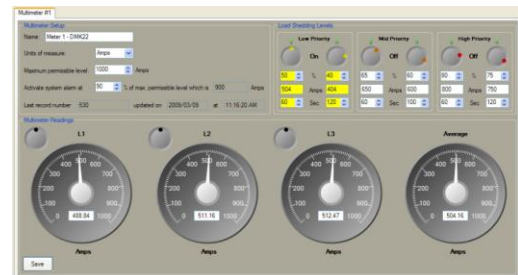


In certain areas where the topography is favourable, a possible approach can be to build a dam at a higher elevation. Water is then pumped to this dam during off-peak periods and irrigation pressure is supplied by means of gravitation from this dam. This means that irrigation can still take place during the peak periods, but without using electricity. Unfortunately this is not always practical, so let's look at other scheduling tools and options offered by **Irri-Gator Products**:

- Our [Gator 2000](#) Wired/Wireless Controller and [Gator 5000](#) PC Based Controller centralises control and allow for automatic start times at any time of day. Automation prevents over-watering due to human error and thereby saves electricity since the pump run only when needed. It also enables the user to irrigate in off-peak periods using cheaper electricity. Wireless technology can be easily integrated into any existing systems and averts the problem of lightning / power surges and cable theft.



- The **Cellulink II** GSM Controller provides an answer for remote pump and/or centre pivot activation and deactivation in order to make use of off-peak electricity periods. The user can by simply sending an SMS or missed call from his mobile phone, activate or deactivate his system from anywhere. The user can also be notified of failures and system condition changes. For example if his centre pivot stops due to failure, the **Cellulink II** GSM Controller can remotely stop the pump and notify the user, all by SMS, so that action can be taken. The **Cellulink II** can also be used to notify the user of cable theft.
- The **Ruraflex Timer** developed by Irri-Gator can be installed on any pump which needs to be stopped during peak periods (red and yellow) and restarted during more economical hours. The timer provides three switches (red, yellow and green) for simplified selection of operation and stop periods.
- [Gator Stand-Alone Telemetry Systems](#) allow for remote switching of various components and can be interfaced with dam level indicators, PLRs and PLCs etc. in order to cut out human error and schedule tasks into more cost effective periods.
- [The Gator Utilities Control and Load Management System](#) utilises wireless technology to remotely activate and deactivate geysers, air conditioners or any electrical circuit that at times draw current even though not being in use.



Irri-Gator Products offers quality products utilising the latest technology to improve system management and thereby unlocking savings. [Contact](#) us for more information and start saving today!

For more information on Eskom's offers, please visit www.eskomidm.co.za.

Cape Town
 Tel 021 982 7561
 Fax 021 981 4473
 sales_wp@irrigator.co.za



Pretoria
 Tel 012 804 7360
 Fax 012 804 4338
 sales_gp@irrigator.co.za