



CASE STUDY

Low and no-cost energy opportunities combine to deliver over \$20,000 in cost savings for irrigated cotton and dryland farming property near Rowena

Some farms rely on seasonal workers to operate their tractors and harvesters to achieve considerable labour savings, but hidden costs can arise from inefficient operation. The farm’s plan involves introducing energy efficiency alongside existing safety inductions for new staff, to avoid cost blowouts by as much as 20-30% from additional fuel usage.



Pilot site: “Windella” - Rowena, NSW 2387
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“I had a good look at our fuel use after sowing and I could see that one of our new operators was using 20 litres per hectare when I would have used 15 litres. I realised that training our staff on fuel efficiency was required.”

Ken Stump, Farm Owner

Ken and Judy Stump are the owners of Windella, a mixed cropping/grazing farm operation located between Walgett and Moree. The farm grows a mix of chickpeas, dryland cereal crops, fava beans, and dryland as well as irrigated cotton. Most of the property is dedicated to dryland cropping, but around 15 per cent of the nearly 10,000ha supports irrigated cotton. The Stumps also have a herd of beef cattle which graze on the land and fluctuate between 100-500 head. They have a few full time farm hands, including their son John who is the manager and lives on site. The Stumps also employ seasonal workers who live on site and assist with farming operations.

Windella’s energy use

The Windella farming operation requires around 450,000 litres p.a. of diesel fuel for sowing, harvesting, trucking/transport and pumping. The farm owns five tractors, and operates four pumps (three diesel and one electric). Water for irrigation and on-farm use is taken either from a nearby river or pumped out of a bore. Bore water is about five times more expensive than river water, which is a major factor when deciding which of the pumps to use.

The property has four homesteads (the main homestead, the farm manager’s house and two additional houses for workers) and uses electricity for general lighting, heating/cooling, and other activities in the farm sheds.

Blackouts, brownouts and energy availability

Living on a floodplain, at the fringe of the electricity networks in Eastern Australia, power reliability is a major concern at Windella. The property is well over an hour’s drive from the nearest large town, and during floods many of the roads in the area become treacherous and impassable. Interruption in power supply can be a major inconvenience for the farm’s daily operations.

Table 1: Windella energy breakdown

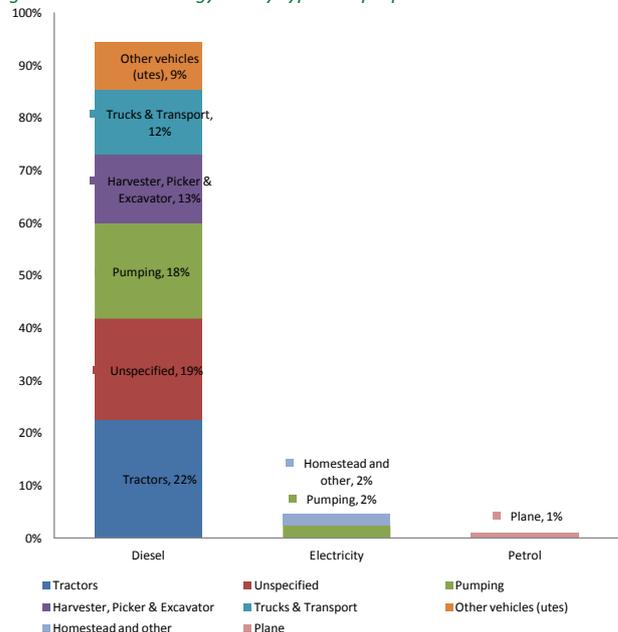
Fuel Type	Consumption (p.a.)	Units	Conversion to GJ factor	GJ	Cost	Cost /Unit	Cost /GJ
Diesel	450,000	litres	0.0386	17,370	504,000	\$1.12	\$29.02
Electricity	231,208	kWh	0.0036	832	59,728	\$0.26	\$71.76
Petrol	6,000	litres	0.0342	202	9,000	\$1.50	\$43.86
Totals/Averages				Total:	Total:	Average:	Average:
				18,408	\$572,728	\$0.96	\$48.21

The farm’s largest energy expense is split between running tractors, pumps to lift and distribute water, and the operation of other farm vehicles for transporting grain. While Windella is a dryland farming operation as well as an irrigated cotton operation, where tractors rather than pumps dominate diesel use, finding savings in pumping can still provide significant cost reductions.

Table 2: Windella energy inventory

Fuel Type	Purpose	Energy Used (GJ)
Diesel	Various	3,557
Diesel	Tractors	4,130
Diesel	Pumping	3,358
Diesel	Other vehicles (utes)	1,650
Diesel	Harvester, Picker & Excavator	2,393
Diesel	Trucks & Transport	2,281
Electricity	Pumping	432
Electricity	Homestead and other	400
Petrol	Plane	205
Totals		Total: 18,408

Figure 1: Windella energy use by type and purpose





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Cost reduction opportunities

At Windella the NSWFarmers Energy Innovation Team found the following energy efficiency and cost saving opportunities.

Table 3: Full list of opportunities with priority opportunities highlighted.

Opportunity	Cost	Savings (p.a.)	Payback
Solar/diesel hybrid for workshop & cottages or grid connected system for Windella	Under investigation (possibly \$9000 for initial grid-connected system at Windella)	Under investigation (\$1,500, 6,000 kWh for first grid connected system option)	Under investigation (possibly 6 years for small grid connected system)
Voltage Optimisation	\$10,000	Up to 5%	4-5 years
Energy efficiency induction checklist and operator training on: <ul style="list-style-type: none"> • adaptive driving • fuel monitoring • Correct ballasting • Tyre pressures 	No capital	\$11,000/10,000 litres of diesel	Immediate
Pumping (electric): Load shifting (off peak) on bore pump capacity	\$1,200 for switch + installation by electrician	\$1,500	1 year
Domestic storage tank sufficient height to gravity feed homestead from bore	Under investigation	Under investigation	Under investigation
install low load Tailwater pump at Creek station	\$70,000	\$10,000	7 years
Creek pump configuration – pump type, pipe bends, etc.	Under investigation	\$5,500, 5,000litres	Under investigation
Savings from group buying discount (17%) through Origin	No capital	\$8,500	Immediate
Solar Hot Water system	\$8,000	\$400	20 years
Replace halogen lamps with LEDs	\$1,000	\$1,000, 3,800 kWh	<1 year
Hot Water System – turn setpoints down to 65°C or switch off when not in use	No capital	\$200	< 1year
Totals:	\$97,000	\$42,000 (solar will reduce this total)	Average: 4 yrs (rounded)

Focus on more efficient use of tractors

The Stumps decided the priorities were in more efficient tractor set ups and adaptive driving to save fuel costs: a potential saving of 5-10% in diesel usage.

As part of the general induction process, the Stumps are emphasizing the importance of recognising energy use on a daily basis with new farm workers taken through an “energy efficiency checklist”. In addition, the NSW Farmers Energy Team is working on a matrix of correct tyre pressures and ballast weights for each of the farm’s tractors. This matrix will be used to ensure that tractors are running as efficiently as possible, and will provide guidance to vehicle operators who will also have training in adaptive driving.

Research suggested that optimising tractor ballasting and using correct tyre pressures, in combination with efficient adaptive driving techniques, could deliver as much as 20% of savings in diesel use. With this information in mind, the Stumps decided to develop a tractor efficiency program.

“We will set up better fuel monitoring and communicate the program to our seasonal operators at their induction session.”

Judy Stump

Load shifting and Electricity monitoring delivers quick wins

The Stumps have evaluated their existing irrigation and pumping layout and switched their electric pumping to off-peak rates (at a cost of \$1,200 for a switch including installation by an electrician). They are now considering using electricity generated from solar to further cut energy costs.

In addition, the Stumps have now installed individual electricity meters on each of the cottages (which house farm hands and manager, John). Each house is now responsible to pay for their metered consumption. Ken has already noticed that this has resulted in a substantial reduction in their electricity use (by about 20%).

Solar PV for the homestead

In order to improve energy reliability, and reduce existing electricity costs on the farm, the Stumps have been investigating solar PV, including battery storage, as either a back up (for blackouts) or as a way of replacing electricity from the grid. At this point, the financial case for purchasing sufficient battery storage to go “off-grid” is still a difficult one. However the increased confidence that comes with knowing and controlling your own energy supply is making this option more and more attractive.

The Stumps are considering the installation of an 8kW solar system with batteries and a 35kVa diesel genset backup. This is currently being investigated and compared with a small grid-connected system in the range of 3-4kW (this sizing is based on the quarterly billing values from which daily usage can be inferred¹).

This opportunity can be firmed up with additional onsite energy monitoring to determine optimal sizing and the costs involved in installing an appropriate system.

¹ Initial sizing based on a general rule of thumb of 30% of daily usage



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Did you know?

Modifications as simple as ensuring temperature settings are correct can lead to significant savings over time, with one degree Celsius of temperature adding about five percent to the energy use. More advanced control systems can provide more accurate control of temperature, lighting and fans, leading to savings throughout the system. Setpoints are subject to Food safety standards. For more information refer to some of the following resources:

- [Food Authority: Home fridge temperatures](#)
- [Food Authority: Keeping food safe. Key tips](#)
- [Choice.com.au – Fridge temperatures](#)

More information on cool room setpoints is also available in NSW Farmers’ Case study for Birrah.

Good insulation and or cool rooms inside a building such as at Windella can save 1-6% on their energy use if away from direct sunlight and exposed to cooler air when opened. For more information on cool room efficiency see NSW Farmer’s information paper [Energy efficient cool rooms and refrigeration](#).



Outcomes

A number of efficiency and energy cost management opportunities have already been implemented:

- Hot water tank set point has been turned down to 65 °C
- Halogen lights throughout various cottages have been replaced with LEDs
- A group buying discount of 17% off their electricity has been secured from Origin Energy
- A switch has been installed on their domestic bore so that it runs during off-peak hours

Additional opportunities such as monitoring fuel use, setting KPIs, communicating with, and in some cases, training operators will require time and effort but further fuel savings can be substantial, ranging from 5- 20% (as much as \$9,000 a year). Another benefit is improved fuel security, as some farms experience misappropriation of fuel for personal use.

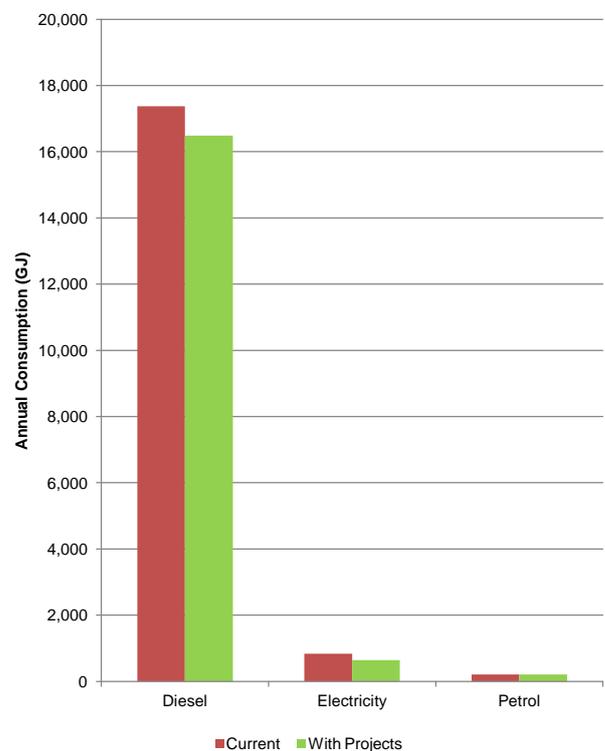
Next season Ken and Judy can expect to save \$9,000 in fuel thanks to their efforts to build a consistent approach and commitment to efficiency across their team of operators.

The Stumps upgraded their lights in their homestead from 50 watt halogen downlights to 10 watt LEDs saving up to 80 % of their lighting costs. This equates to perhaps as much as \$1000 in savings year after year! The savings are good but the message can be even more powerful, especially when chasing diesel savings of more than \$9000 a year.

Quantifying quick wins has inspired the Stumps to progress other more difficult savings initiatives and provides a symbolic story or message for others, including seasonal operators, who will be relied on for those diesel savings. The spiel at induction will now include this symbolic example of action and savings.

Beyond technology upgrades time of use provides big savings. Changing the times of operation on the bore pump to off peak electricity generates savings for Windella of around \$1000 a year.

Figure 4: Expected energy savings from continuing implementation of projects



Savings per year (GJ) 1,000+
 Savings per year (%) 6%
 Savings per year (\$) \$42,000



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Future productivity gains at Windella

With the assistance of the NSW Farmers’ Energy Innovation Program, Ken will continue to explore energy saving opportunities that deliver real savings and productivity outcomes for Windella.

In the **short term**, in addition to installing new fuel measurement equipment, diesel fuel savings will be achieved by communicating efficiency goals to operators and ensuring that tractor set up (including adjusting tyres and ballasting points) is optimal for major tasks and critical operations.

Over the **medium term**, solar PV will be investigated further and may begin saving the Windella farm money after 4-8 years (depending on the size of the system).

Long term opportunities include drawing on localised solar PV to power pumps, and examining the potential to power pumps and engines using biogas or biofuel, sourced from local on-farm waste or nearby agricultural operations. Such opportunities require a higher level of investment and may not be cost effective currently. However their development should be monitored as technologies improve and become more commercially viable.

The stumps are also evaluating options for changing to different diameter pumps and potentially implementing VSD motors (Variable Speed Drives), which would allow pumps to operate at a number of different “best efficiency points” and maximise fuel efficiency.

For help to identify ways to reduce your energy costs, contact the energy team at NSW Farmers:

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