AgEcon

Fact Sheet

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# Thinking solar?

## A pump audit beforehand can improve return on investment

***It's been well documented by other industry programs such as QFF Energy Savers Plus Program and BBIFMAC in the Burdekin region that pump auditing has the potential for quick payback and provides the best use of capital. When sizing up renewable energy, can a pump audit prior to engaging a supplier make solar more profitable?***

To maximise returns, most farmers should adapt production activities to influences such as changing market requirements and production costs. To answer the question 'Will I be better or worse off if I do something which I am not doing now?' the farmer needs some detailed planning and an accurate assessment of benefits and costs involved. If you want to achieve the best balance of enterprises or replace machinery or a pump, you must assess the relative merits of your proposed changes in the context of overall farm structure. One useful technique for such an evaluation is a partial budget approach - which deals explicitly with changes in returns.

Previous AgEcon analysis has found installing solar PV is most profitable on smaller pump sizes that can connect to the network and remain eligible for a feed-in-tariff. This case study of a Maryborough irrigator involves an analysis of a 26kW grid-connected bore pump drawing approximately 61,000 kWh per annum. The energy used in the existing line-shaft pump equates to 5.02 kWh per ML per m head. A pump audit found the pump was not operating to the manufacturers pump curve and sized incorrectly (which may have been for a number of reasons including change in aquifer yield, changes to irrigation methods and pump task). The recommendation was to sell the 26kW pump and replace with a 22kW submersible pump operating at a lower cost of 4.08 kWh per ML per m head. This resulted in more efficient extraction using 47,000 kWh p.a. The sale of the used 26kW pump left a net changeover cost of $4,000 in addition to the $2,500 audit cost.

Turning to the solar installation, the audit changed the size of the solar PV array required to match pump demand. Initially 39 kW, operating at a combined (solar/grid) levelized cost of energy[1] of $0.158. Following the correct pump sizing, a 30kW array of solar PV was chosen saving $13,500 of capital. Now that the physical changes have been isolated and values applied, a partial budget can be drawn up and an equation applied:

[1] LCOE, or levelized cost of energy is a term which describes the cost of the power produced by the new system over a period of time, typically the warranted system life. By purchasing solar you are essentially creating a hedge against rising utility costs by fixing the per kWh rate at a known cost. https://www.simpleray.com/resources-and-informations/how-to-calculate-simple-lcoe-for-solar

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$$\text{Return on Marginal Capital} = \frac{\text{Change in Returns (A)}}{\text{Extra Capital (B)}} \times \frac{100}{1}$$

The rational for the pump audit is to save energy in addition to that absorbed by the solar installation. Table 1 shows the calculations of each scenario.

**Table 1 a partial budget approach to the value of a pump audit prior to a solar purchase**

| | Business as usual | Solar only | Audit only | Audit and solar combined |
|---|---|---|---|---|
| **Energy cost** | $0.30 kWh | $0.158 kWh | $0.30 kWh | $0.158 |
| **Energy used (kWh/p.a)** | 61,000 | 61,000 | 47,000 | 47,000 |
| **Net energy savings (from baseline) p.a.** | | $8,662 | $4,200 | $10,874 (total net gain) |
| **Capital outlay (purchases – sales)** | | $58,000 (39kW PV) | $2,500 pump audit<br>$12,000 new 22kW pump<br>-$8,000 sale old 26kW pump<br>Net=$6,500 | $45,000 (30kW PV)<br>Plus net capital costs from audit $6500<br>Total = $51,500 |
| **Return on Marginal Capital** | | ($8,662/$58,000)*100 | ($4,200/6,500)*100 | =($10,874/$51,500)*100 |
| | | 15% | 65% | 21% |

The scenarios analysed indicate the pump audit as the investment with the highest return on marginal capital. The solar PV (with the audit) has a return on marginal capital 6 percentage points higher than the solar without the audit. This analysis shows that there can be savings accrued on lower solar capital costs if the pump is not sized correctly or matched to the task. However, this partial budget analysis does not consider grid energy price indexation, lower energy costs flowing on to higher yield from more applied water, depreciation or tax implications. Finance implications not accounted for, include annual tax deductions including interest payments on borrowed funds.

The return on marginal capital is a useful screening device. If the percentage is high compared to alternative uses of capital, then the development warrants further study by way of a cash flow budget. If it is low, it can usually be rejected.


## Acknowledgments

- Phil Szabo – Taylored Engineering Solutions & Research
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## References


- QFF Energy Savers: Information and resources: https://www.qff.org.au/projects/energy-savers/information-resources/
- Efficiency Gains for Australian Irrigators (BBIFMAC): https://eegai.usq.edu.au/eegai/