Farm Energy Efficiency

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Presentation Overview

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- About JCM Solutions
- NSW Government Energy Efficiency Support
- Why bother with Energy Efficiency?
- Where to start?
- What opportunities do I have?
- Western NSW Pumping Examples
- Final Q & A

About JCM Solutions

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- JCM Solutions has been conducting energy efficiency audits in NSW since 2009.
- We are Preferred Auditors on the OEH Energy Saver panel
- We have helped more than 60 businesses, including agricultural, save significant energy and dollars in that time
- We have done specialist irrigation audits, identifying large savings
- We are experts in pump benchmarking, performance characterisation and whole of business energy modelling.
- We have recently completed several irrigation assessments in NSW and are currently working with a large water authority to characterise and optimise over 20 of their pumping systems

NSW Government Energy Efficiency Support

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Office of Environment and Heritage (OEH) manages the **"Action Matters for Business"** initiative.
http://www.environment.nsw.gov.au/business/

Program helps industry to be more energy efficient in targeted sectors
Irrigation is a "Key Technology "nominated for funding support.

What is available to farmers?

- Access to a panel of OEH recognised energy experts
- A contribution of **up to 50 per cent** towards the cost of a targeted energy audit
- **Up to $10,000** for project technical support
- **Up to $15,000** funding assistance for measurement and verification services

am
action matters for business

Energy Efficiency

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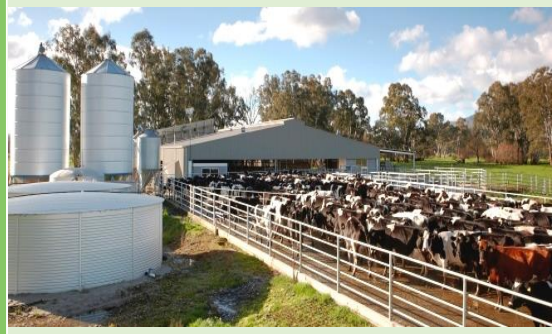
Energy Efficiency -may be overlooked day to day
- is it too hard or too expensive?
- helps make your business profitable

Big savings can be simple:
- better energy supply agreements,
- smart use of what you already have,
- simple tricks to lower costs,
- upgrading to more efficient equipment .



When it's done right it just makes good business sense!

Why Bother?

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- Energy cost savings impact the bottom line directly
- Lower Aussie $ and rising oil prices have increased diesel costs
- Electricity costs will continue to rise
- Gas costs are about to explode in NSW

Increasing your energy efficiency will lower your costs

Where do I Start – Energy/Fuel Bills

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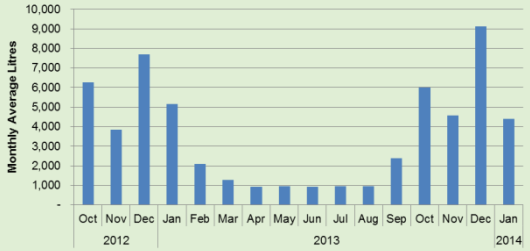
How much does energy cost my business each year, what's my baseline?

Electricity, diesel, gas and petrol total spends



- Why do we need a baseline anyway?
  - How I compare with irrigation benchmarks
  - To measure improved performance relative to the baseline.
  - To see the relative costs of energy types and decide where is the "best bang for my energy saving buck"
  - Future investment decisions can be better targeted and paybacks can be determined

What gets measured gets managed!

Energy Baseline

Step 1

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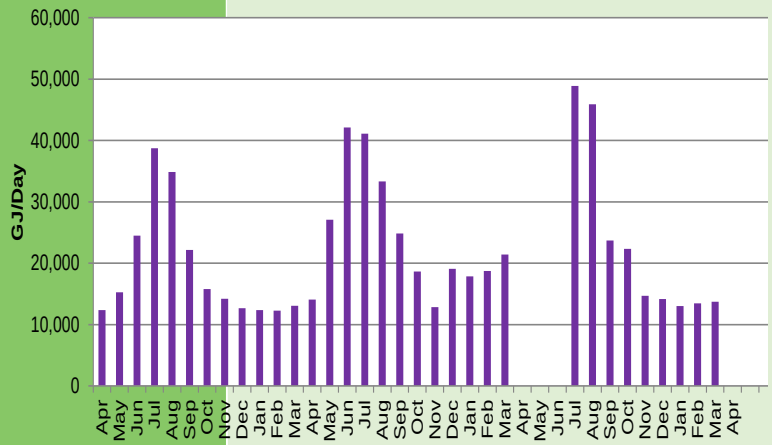
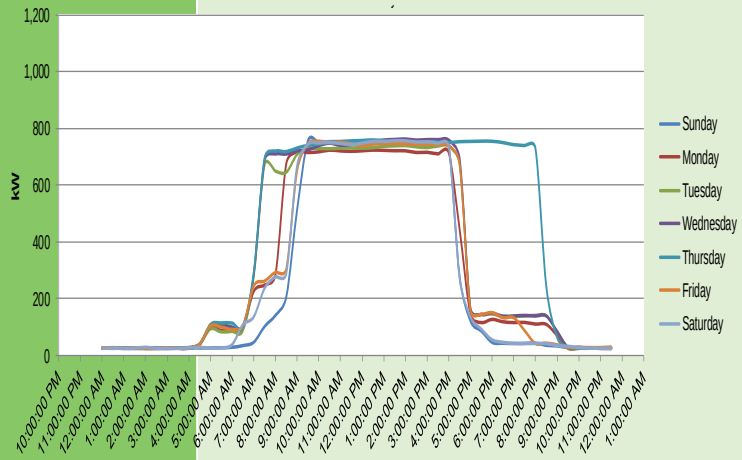
Forming an Energy Baseline:

- What energy sources do I use? Identify all!
  - Electricity
  - Diesel
  - Gas and petrol
  - Other?
- Basic number crunching
  - Annual energy cost
  - Annual kWh, kL, etc usage
  - Annual ML pumped
- Advanced number crunching looks at monthly, even daily energy use once you know what is important

Create a pumping KPI/Benchmark

- $/ML or $/ML/m head





Energy Baseline

Step 2

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Collect 12 months of bills and put into spreadsheet

Allocate costs to each pumping system

No individual bills? Allocate by motor size or volumes pumped

Collect Monthly pumping data per system

Estimate $/ML for each system

How do they compare to each other/benchmarks?

How are the costs tracking year on year?

How can I make Electricity Savings?

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Simple things to look at:

- My energy contract and charges
- Managing lighting costs – PV cells, timers, de-lamping, etc
- Efficient fittings – LED lights use less than 25% of conventional lighting
- Efficient compressors for refrigerants
- Eliminating wasteful practices, turn off what you are not using!

Know your Electricity Bill – Time of Use

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Current Transactions

Electricity Charges

Charges based on actual/estimate read

Your Plan Business Time of Use NMI [redacted]
From 19 January 2016 to 11 April 2016 (84 days)

Tariff Description	Meter Number	Previous Reading	Current Reading	Usage kWh	Rate c/kWh
Off Peak	00057241:1	54909	59755	4846	
Off Peak	361821:1	15347	17066	1719	
Off Peak	743941:1	91231	91337	106	
Total Off Peak				6671	14.650
Peak	00057242:1	76719	81128	4409	
Peak	361822:1	36100	43655	7555	
Peak	743942:1	93676	99303	5627	
Total Peak				17591	24.550
Total Shoulder	00057242:2	0	0	0	24.550
Service to Property Charge				84 days	$6.250 /day
GST					
Total Electricity Charges					

Off Peak electricity use costs 40% less than Peak and Shoulder

Know your TOU periods and use them to your advantage

Know your Electricity Bill – Contestable Supplies >100 MWh

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	Days	Quantity	Rate
Energy Charges			
Peak		7702.968 kWh	$0.069900 / kWh
Shoulder		13345.224 kWh	$0.069900 / kWh
Off Peak		29031.504 kWh	$0.028500 / kWh
Carbon Adjustment		50079.696 kWh	$0.02132 / kWh
Sub-total			
Network Charges			
Network Peak		7702.968 kWh	$0.047365/kWh
Network Shoulder		13345.224 kWh	$0.047365/kWh
Network Off Peak		29031.504 kWh	$0.028168/kWh
Peak Demand Charge		261 kVA	$14.95510/kVA
Shoulder Demand Charge		227 kVA	$14.95510/kVA
Off Peak Demand Charge		267 kVA	$3.41820/kVA
Network Access Charge		28 days	$13.61270/day
Sub-total			
Renewable Energy Charges			
E&REC - LRET		50079.696 kWh	$0.006350 / kWh
E&REC - SRES		50079.696 kWh	$0.007340 / kWh
E&REC NSW Energy Saving Scheme		50079.696 kWh	$0.001360 / kWh
Sub-total			
Other Charges			
AEMO Pool Fees		50079.696 kWh	$0.000346 / kWh
AEMO Ancillary Charge		50079.696 kWh	$0.000300 / kWh
Metering Charges		1	$2.60274/day

Usage Charges - Retail (kWh)

Usage Charges - Network (kWh)

Demand Charges - Monthly (kVA)

Other Charges

Electricity Energy Savings

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Simple things to look at:

- Managing lighting costs – PV cells, timers, etc

Electricity Energy Savings

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Simple things to look at:

- Efficient fittings – LED lights use less than 25% of conventional lighting

Milking shed using 400W Hi bays and 72 W double fluros.

Could replace Hi bays with 120W Hi bay and fluros with 18W LEDs (saving over 2 kW)

Electricity Energy Savings

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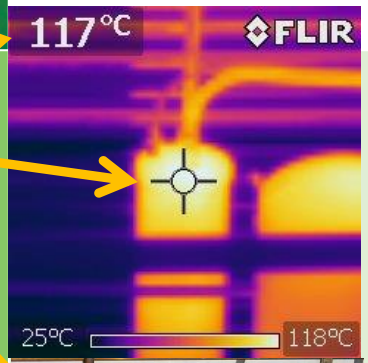
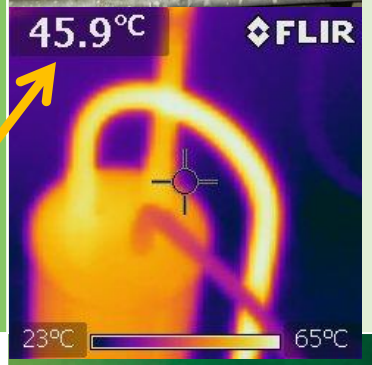
Excess heat loss

Simple things to look at:

- Efficient compressors for refrigerants – maybe need to replace aging inefficient compressors





Normal heat loss

Electricity Energy Savings

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Simple things to look at:

- Eliminating wasteful practices, turn off what you are not using!

Working out pumping costs

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Step 1 Review monthly bills electric or diesel
Step 2 Record totalisers at start and end of month
Step 3 Calculate $/kL or L/kL or kWh/kL
Step 4 Compare pumps
Compare to previous results
Step 5 do I need to make changes?

What do I do with this information?

Pump Comparison Example

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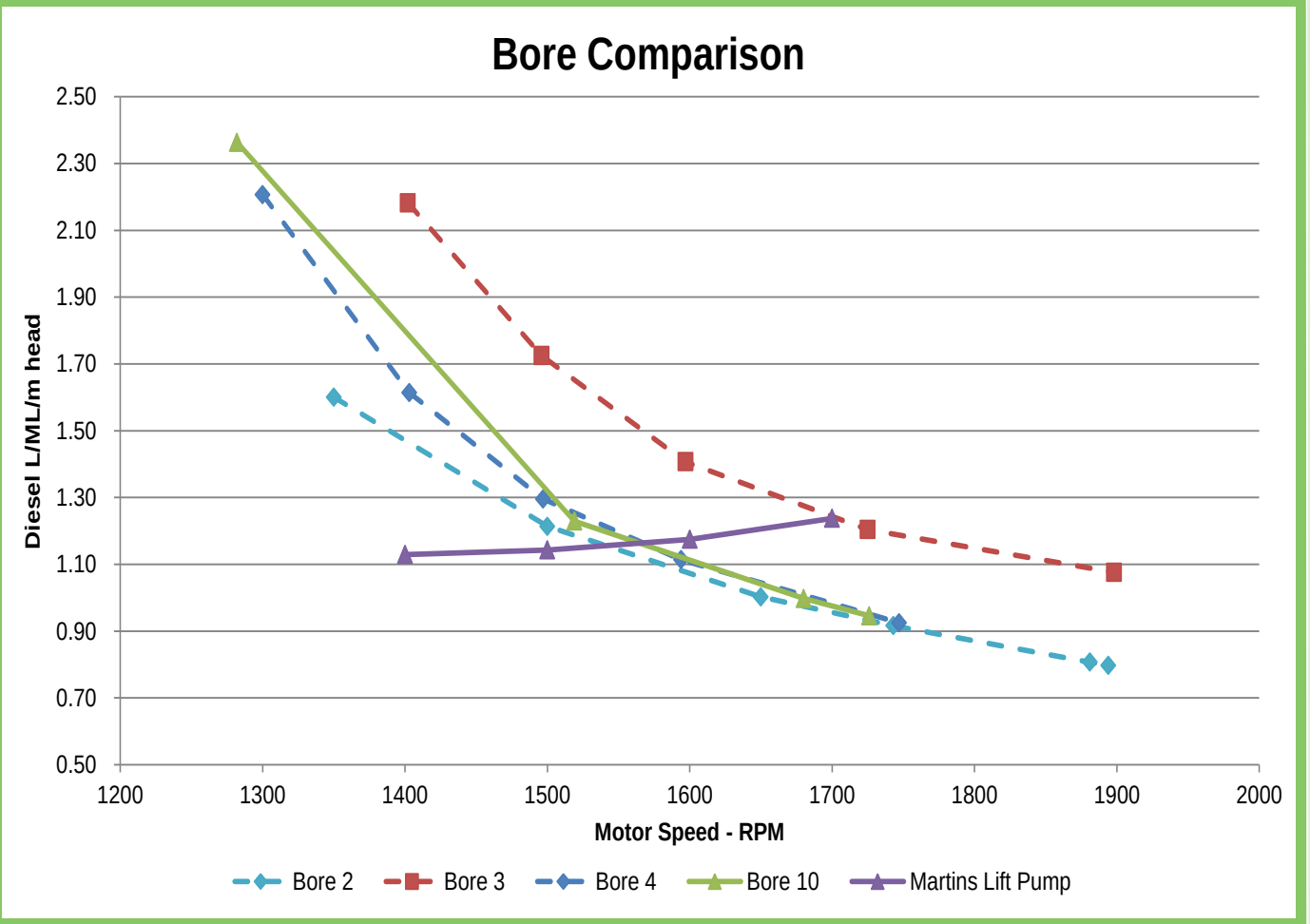

Home Grown Irrigation Efficiency Opportunities

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- Improving pump efficiency
  - Regularly service pumps
  - Review system design
  - Maintain pipe runs/minimise leaks
  - Eliminate sharp bends, unnecessary long runs, diameter changes
  - Use the right pump/pipe for the job
  - Use the right pump speed

Pump Operation and Maintenance

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- Even the right pump deteriorates with time
- Check total head (pressure)
- Review operating pressures , too high wastes money!
- Reduce losses in pipework (minimise bends, pipe diameter changes etc)
- Avoid system leaks
- Check for impellor wear/damage over time
- Drive motor deterioration

Efficiency losses quickly add up

Irrigation Energy Opportunities

Electricity

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- Check pump efficiencies
  - compare $/ML
  - Consider upgrade of poor performing pumps
  - Is my pump still “Fit for Purpose”
- Variable Speed Drives and Soft Starts for large pumps?
- Solar or hybrid systems
- Power Factor Correction
- Off Peak Pumping wherever possible
- Reducing unnecessary use of machinery

Technical Support Considerations

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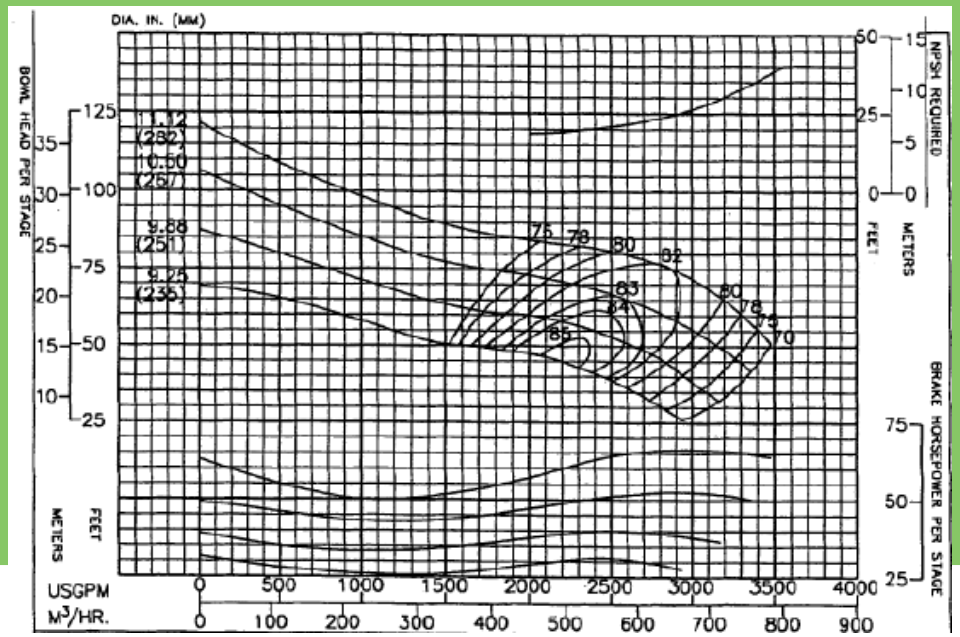
Experts can bring different perspectives
Hidden opportunities can be uncovered
Specialist measurements can refine benchmarking



Solar Pumping – NSW Example

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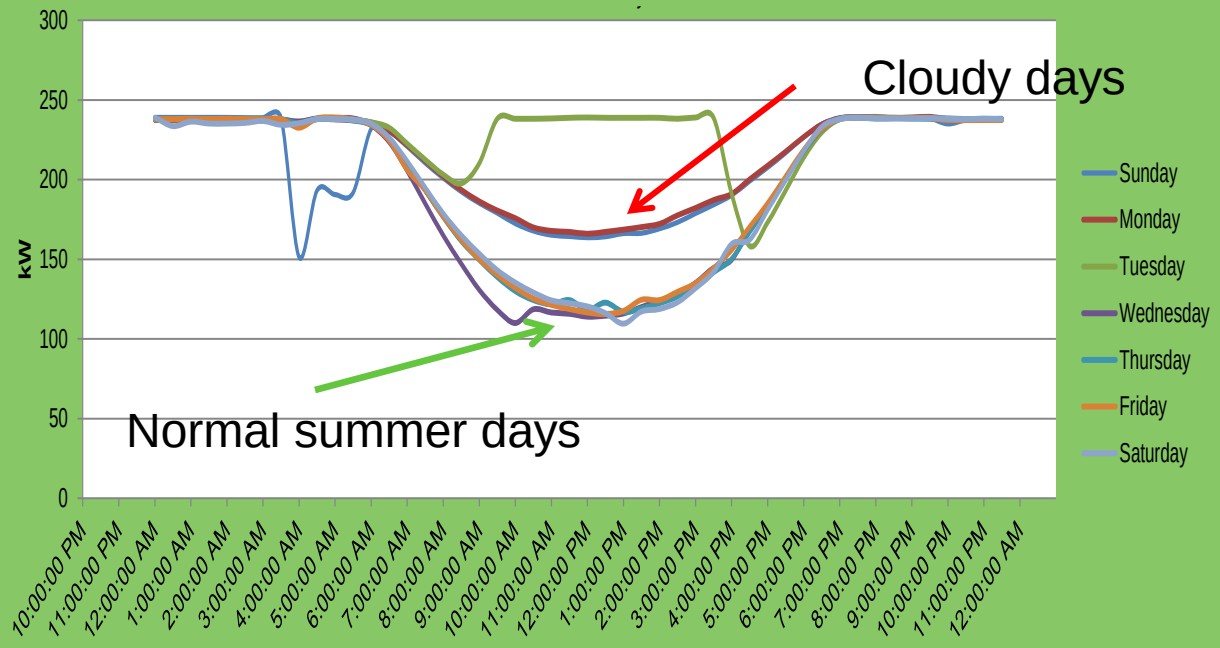

Solar can offset electricity charges but system application needs careful consideration. This system offsets about 50% of the TOU charges but cannot help with Peak kVA charges

Electric Pump Characterisation NSW Example

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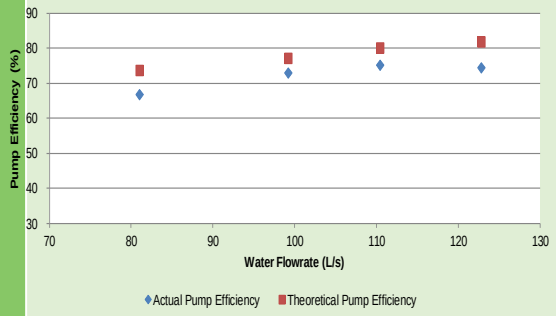

Optimum Cost for this VSD controlled bore was at around 85% of full speed, but was set to run at 100%

Estimated annual saving $

Diesel Bore Pump Savings NSW Example

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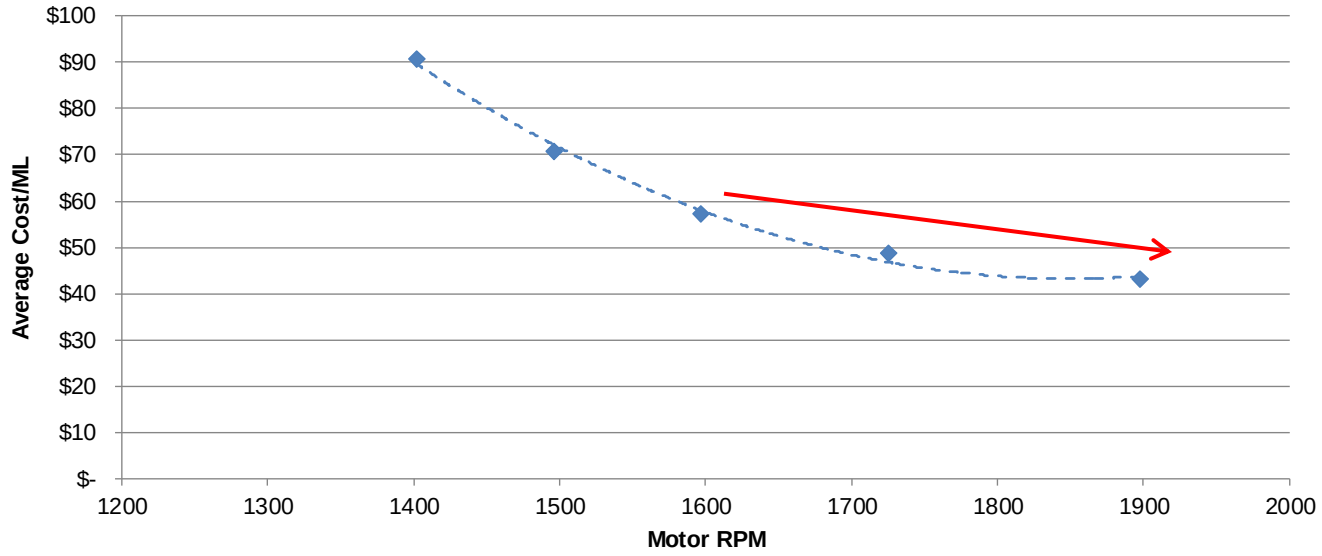
Original Installation set pump speed at 1600 rpm
Characterisation showed higher speeds were more cost effective – annual saving moving to 1725 rpm was $8.60 per ML (15% cheaper)



Electric Off-Peak Pumping

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- Energy cost usually varies with time of use
- Off Peak tariffs apply 55% of the time,93 hours per week.
- Costs can be ⅓ of peak costs
- kVA charges can also be ⅓ of peak
- Major savings can be achieved with some creative thinking

Case Study: Load shifting for two 400HP electric bores saved $80,000 pa (35% of electricity costs)

Avoid Peak Tariff periods!

Soft Start / VSDs

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- VSD controllers allow very flexible control of pumping systems.
- Start-up power demand can be greatly reduced (soft start)
- Pump speeds can be fine tuned, pre-set or dynamically controlled.
- Savings can be made in
  - Peak kVA charges (demand costs)
  - Energy used per ML pumped

Pump Curves

Operational optimisation with VSD

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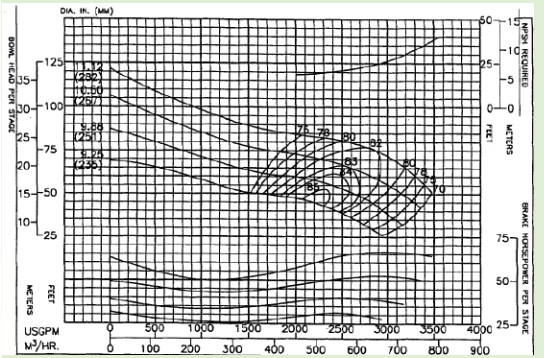
- Incorrect VSD settings can actually use more energy per ML
- Having the right pump and conditions are critical
- Pump curves define the expected performance/efficiency
- Field measurements can verify actual vs theoretical operation and can identify savings
- Raising pump efficiency is critical to energy savings and minimising $/ML



Summary

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Energy Efficiency makes your business more profitable
Create a baseline and set benchmarks
Understand where you are spending money on energy and focus there
Can you use electricity at low tariff periods
Optimise what you already have- correct pumps, optimal speeds, VSD controls etc
Know how your system is performing
Consider expert advice

Q&A

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Do you have any questions or discussion points?