

Presentation to SMASH meetings

a) Energy efficiency in the dairy shed

b) Some strategies to meet new milk cooling standards while saving energy

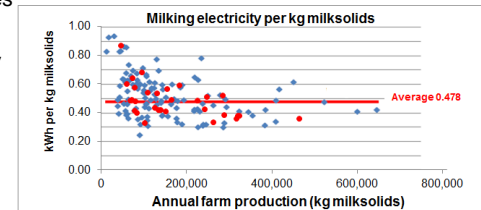
Jim Miller, April 2015

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On-farm electricity

- Latest MPI Farm Monitoring Report puts typical electricity costs at \$0.13 c/kg milksolids
- A 100,000 kg milksolids farm will use around 48,000 kWh/y and spend about \$10,500
- Efficiency varies considerably
- More variability in the smaller farms but they can be just as efficient as the larger farms



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Working out your own KPI

- Need to do over a 12 month period but can be any 12 months as long as you have milksolids data for the same 12 months
- Get electricity data off your invoices or the supplier's website
- Correct for varying reading dates and any estimated vs actual reads
- Include any electricity supply to remote pump houses, implement sheds, and effluent pumps which support the milking operation. Don't include house supply
- Could also use the tool on EECA's website <http://www.eecabusiness.govt.nz/tools/dairy-tool>

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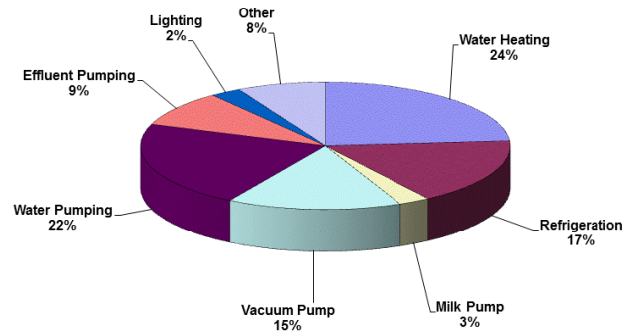
Tariffs

- Which lines company area you are in has as much impact on cost as which retailer you are with.
- Minimise connections – each ICP (connection point) will cost you \$1 - \$5/day even if on the same account
- Shop around – but do compare tariffs over the full year
- A controlled water heating tariff, where available, will almost always make sense and save you money
- Benefit of day/night tariffs depend on the prices offered and your usage split.
- If you do have a day/night tariff, think about how to push use into the night time (11pm to 7am) tariff, e.g. put hotwater heating on a timer, irrigate effluent at night

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Typical split of electricity use

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Water heating opportunities

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- First minimise the use of hotwater
- Fit timer control on heating elements
- Many farms will have options to recover heat from the refrigeration plant to preheat water with 3-5 year paybacks.
 - Which option is best depends on tariffs, how much hot water you use, and how much you are prepared to spend :
 - simple refrigerant desuperheater
 - recirculating desuperheater
 - heat pump (e.g Mahana Blue, Dairy Boost)
- Solar hot water, ground- or air-source heat pumps, and even bottled LPG are also cost effective in some situations



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Refrigeration

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- Keep condensers clean and allow free air movement around them
- Maximise pre-cooler performance, should cool to within 1.5 – 2 C of water temp
 - use coldest water you can
 - avoid recirculating water
 - ensure water side of plates kept clean
 - concrete tanks preferable to plastic ones
- Vat insulation of outside vats:
 - cost \$2,000-\$3,500 fitted
 - commonly give paybacks of 3 – 5 years
- Snap chillers and chilled water systems are good for milk quality but don't expect them to save electricity



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Milking plant

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- The vacuum pump is generally the main load in the milking plant itself
- Biggest savings is in minimising the milking and wash-up time as much as possible
- VSDs give good savings by matching the speed of the pump motor to the actual vacuum requirement
- Greatest savings are with liquid-ring pumps and as a general rule, the larger the vacuum pump and the longer the milking time, the quicker the payback

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Effluent Systems

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- Becoming an increasingly large component of the milking shed electricity
- If you reduce water use you will reduce electricity used in pumping water to and effluent away from the shed
- Look at ways to minimise hosing-down time - concrete in good order, pre-wetting, scrappers,



Evaluating energy efficiency investments

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- Some efficiency options are either/or – e.g. recovering heat from the refrigeration plant reduces the case for solar heating
- Don't get sucked in by salesmen's sweeping payback claims – every situation is different. For example paybacks on systems recovering heat from the refrigeration plant depend on:
 - how much hot water you use
 - your actual electricity cost for water heating
 - expectations of future increases in electricity prices
 - size of your refrigeration plant
 - type of refrigerant
 - adequacy of the refrigeration condenser
- You must take the time to work out your best options
- Beware the snake-oil offers – e.g. power factor correction units

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Changes to milk cooling requirements

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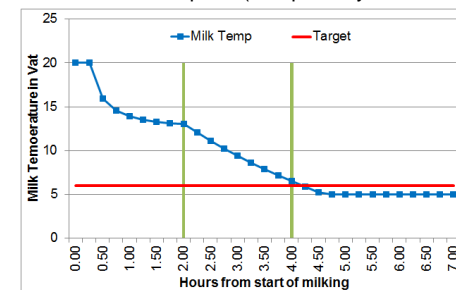
- From January 2018 regulations (NZCP1) will require:
 - Milk cooled to 10 °C within 4 hours of start of milking
 - Milk cooled to 6 °C within 6 hours of the start of milking or 2 hours of the end of milking
 - Milk in vat must not exceed 10 °C when second milking added
- In most cases it is the 6 °C within 2 hours of end of milking that sets the peak refrigeration demand
- Approximate 40% increase in peak refrigeration load over current regulations
- But about half of farms will have enough refrigeration capacity already, some others will need only small increases

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Knowing where you are at now

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- First step is to figure out what if anything you need to do. This can be done in a number of ways with varying degrees of accuracy
- You can do your own monitoring but need to adjust for milk volumes vs those at peak (and possibly ambient temperatures)



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What do you need to do?

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- Consider energy efficiency options which free up cooling capacity while saving you money:
 - improve precooling (1°C colder reduces the load by 8-10%)
 - insulate outside vats (similar reduction)
- Efficiency measures which probably help but harder to predict:
 - desuperheaters & other refrigeration heat recovery systems
 - electronic expansion valves
- If you still need extra refrigeration, consider the options: larger unit, glycol/chilled-water prechiller, or icebank prechiller.
- The state of your cheque account, condition of the present refrigeration unit, the vat pad capacity, and any peak power constraints all need to be taken into account.

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In conclusion

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- Benchmarking is a good starting point to see how you are going
- Some simple housekeeping things will save electricity.
- Greater savings requires greater capital expenditure but generally plenty of opportunities giving 2-5 year paybacks
- Don't accept savings claims at face-value – do the sums for your own circumstances, challenge all assumptions
- Get independent advice, use the information and case studies on the EECA and DairyNZ websites
- Look at efficiency measures before upgrading the refrigeration plant for tougher milk cooling standards
- Tariff options can be complex – shop around but do your sums before changing retailers

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Affordable Energy Audit

Independent Advice – Which of the many energy saving options are best for your farm

Individualised Benchmark Report – Comparing your electricity usage to others

Indicative Paybacks – For a range of technologies and recommendations for changes to farm practices or investments

Quick and Easy – Just 20 minutes of your time to answer some questions and send some electricity account details

Affordable Advice – Fixed fee basis that includes tel/e-mail advice for the following 12 month period

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