SAVE ENERGY ON-FARM

IT JUST MAKES SENSE

Taranaki Rural Energy

Advisor Toolkit

Helping farmers discover and act on energy savings on-farm

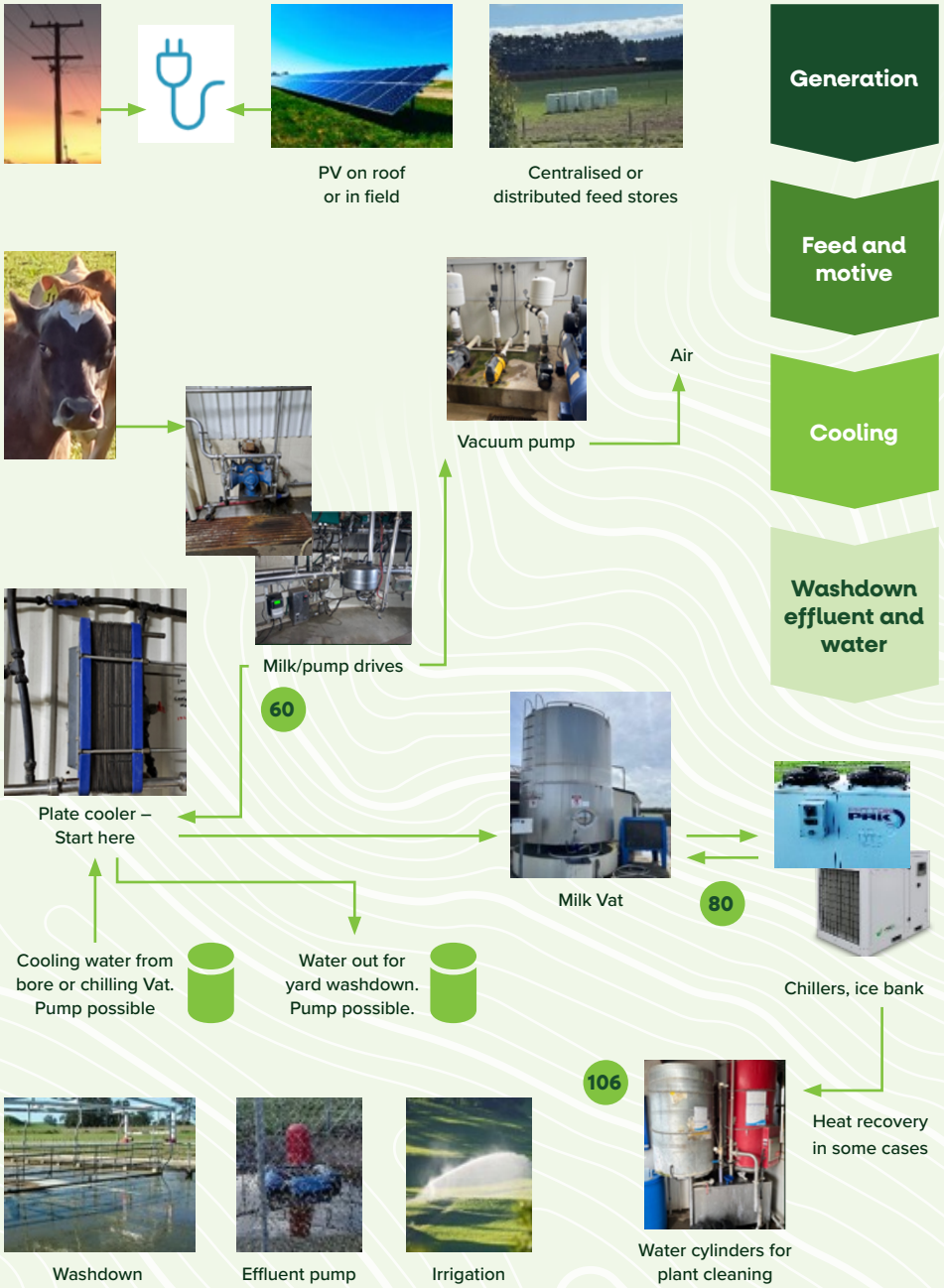
At a glance – energy outside the shed

Upon arrival, orientate yourself first.

Look around for:

- [ ] Milk cooling / storage – check for vats
- [ ] Washdown, pumping and effluent
  - look for water storage
  - check backing gate if accessible
  - identify effluent pond
- [ ] Solar PV – check for any PV on roof or in nearby yard / paddock
- [ ] Baleage or sileage stored centrally or distributed
- [ ] Other (e.g. external lighting in shed / yard, irrigation)

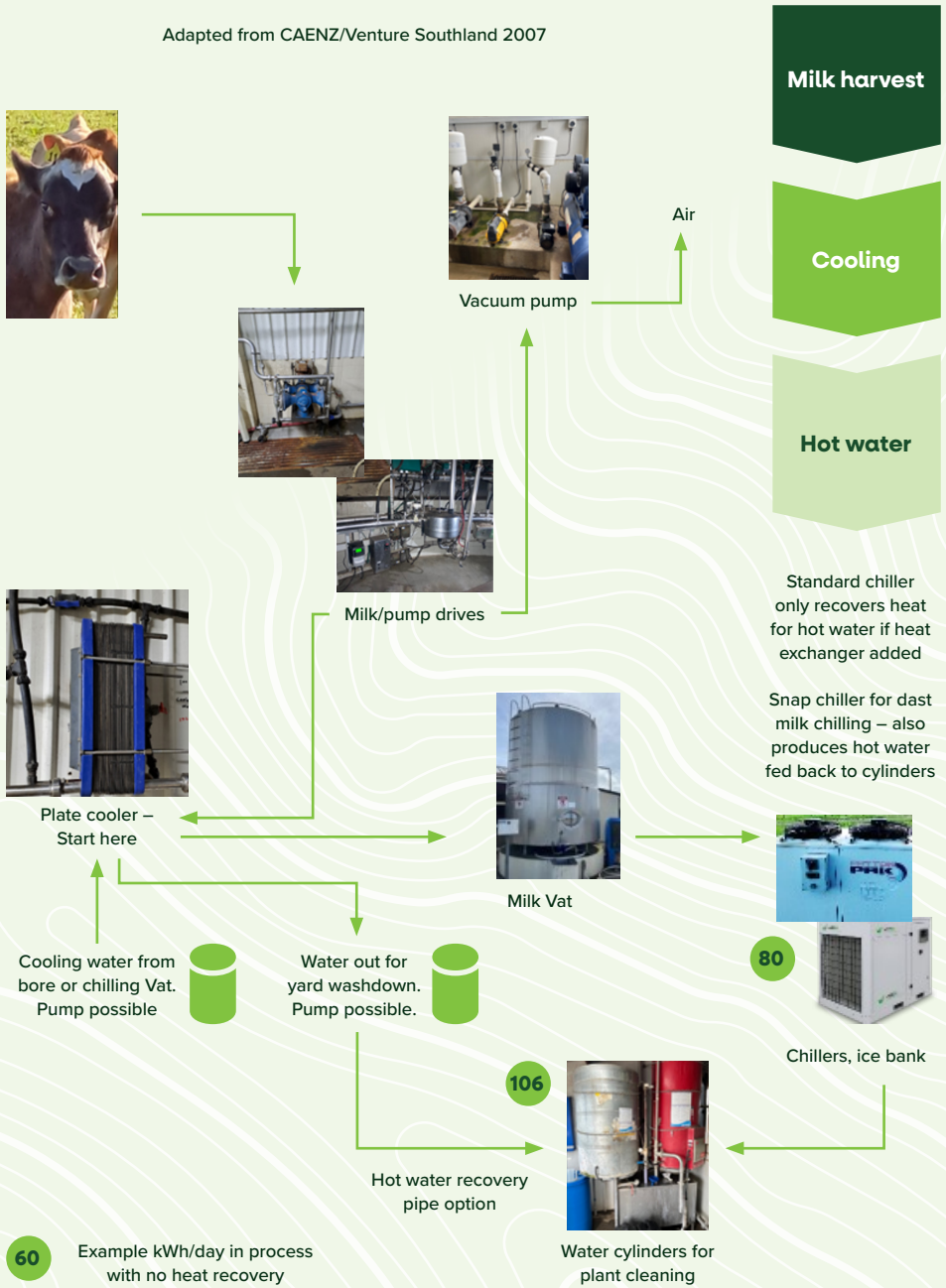
NOTES:



At a glance – entering the shed

On entering the shed

- [ ] Pause, assess layout, identify key activity areas (harvesting, cooling, heating) and consider age and condition. Sheds vary in layout, equipment, and customisations—you don't need to know them all.
- [ ] Locate the plate cooler to begin tracking water and milk flows, as well as equipment. (see plate cooler page).
- [ ] Find the hot water cylinder(s).
  - **Tip:** Usually inside the shed, they're smaller than the milk vat, with copper pipes at the top and an electrical cable at the bottom.
  - As you walk around, use the check sheets for each activity area to confirm with the farmer what's present and identify opportunities. Non-energy benefits often make actions more worthwhile, so highlight those where relevant.
  - Agree at each stop what should be added to the action plan, and write it in as you go.
  - Check sheets can be used in any order that fits the farm.
  - For more details, see the At A Glance Guides.
  - Ask if the farmer is the owner, manager, or sharemilker, as this affects decision-making.
  - Find out how investment and operational decisions are made, as it may influence the best options.

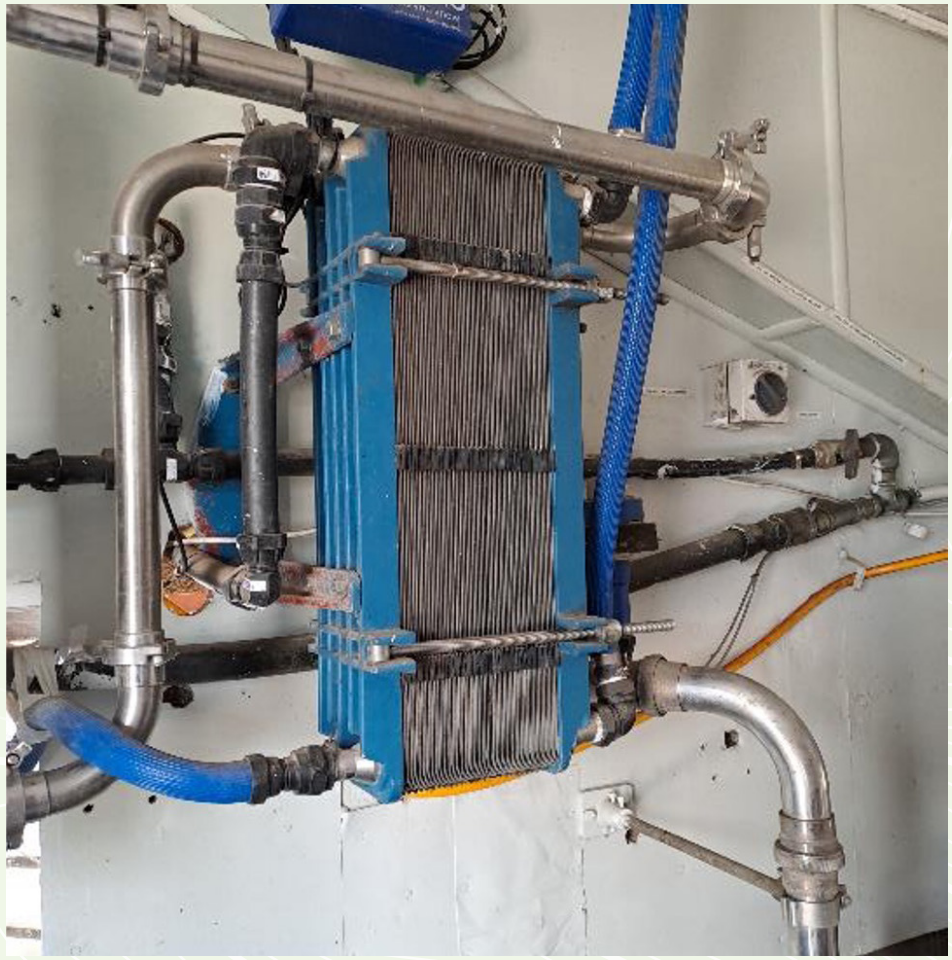


Track flows from plate cooler

Chilling energy use: 23%

Locate the plate cooler as the starting point to track water and milk flows and equipment, identifying:

- ☐ **Milk outflow pipe:** Connects to chiller and milk vat (large)
- ☐ **Milk inflow pipe:** Connects to the milk pump
- ☐ **Cold water inflow pipe:** Connects to the shed water supply (often a storage tank, pre-chilled water vat and/or pump)
- ☐ **Warm water outflow pipe:** Connects to a tank for washdown water storage. Some farms have a pipe leading back to the hot water cylinder (HWC) for heat recovery, typically featuring a manual valve to switch the water flow when the HWC is full.



Milk chilling	Tips	Done	Action	Potential opportunity notes
Is the plate cooler temperature checked to ensure that the milk leaving is less than 2°C hotter than the incoming water? SM ?	Use a PVC strip thermometer (limited accuracy; see DairyNZ), a touch thermometer, or a plant monitoring system (e.g., Levno, though it can be costly).		Y / N	Quick win for good chiller savings and improves chilling time/capacity.

This is usually recorded in the farm manual for the Fonterra biannual check requirement. Refer to DairyNZ's milk cooling resources for checks and setting options.

Hot Water **Energy use: 24%**	**Tips**	**Done**	**Action**	**Potential opportunity notes**
Hot water cylinders not wrapped SM 1	See metal. New hot water cylinders see only minimal benefits from wrapping.		Y / N	Easy, low-cost wins.
Uninsulated hot water outflow pipes (2-3 metres) SM	Look for wide pipes exiting the cylinder, typically used for plant wash. Insulating these pipes enhances safety and energy efficiency.		Y / N	
Any leaks, drips around cylinders, pipes or chillers SM	Check for stains or pooled water. Note that some farms with heat recovery systems may have intentional water overflow.		Y / N	
Ask if the farm reviews its hot wash frequency or uses cold water acid rinses SM ? SM ?	Consider a review if the farm has low milk pick up thermoduric readings, as this may suggest that a hot wash every second day is OK.		Y / N	Substantial savings: Switching to a second-day hot wash can reduce energy use by nearly 50% on those days. Farms vary in practice, from two hot washes daily to every second day.
Ask if timers are in use for night rates, solar or other needs	Using solar or night rates can be 30-50% cheaper		Y / N	Quick, low cost 30-50% saving.
Is there heat pump for hot water (this is very rare)	The cylinder won't have al cable; instead, you'll see a heat pump and an outdoor air fan unit.		Y / N	Major investment for LT plan. 25-35% saving.
Is there gas hot water? When a farm has or installs solar PV, electric hot water works well with it. Plan ahead to switch to electricity before the gas boiler fails.	If there's no hot water cylinder, look for a row of LPG bottles outside. High LPG prices make the switch to electric more cost-effective.		Y / N	Assess on design.

Finding hot water cylinder(s)

These are inside the shed, have an electricity cable entering the bottom, are smaller than the milk vat and typically have copper pipes coming out of the top. A larger shed will have larger cylinders than in the photo.

1 Unwrapped hot water cylinder on the left; wrapped cylinder on the right.

Electricity cable near bottom feeding heating element helps identify hot water cylinder.

Search DairyNZ Plant Cleaning Routines. Discuss with neighbours regarding wash frequency.

Milk harvest: Pumps & Drives, Including Motors (Energy Use: 52%)	Tips	Done	Action	Potential opportunity notes
Does the milking vacuum pump have a Variable Speed Drive (VSD)? SM 2	Look for adjacent box and electrical leads connecting to the pump e.g. Vari-Vac, smart drive.		Y / N	VSDs can reduce costs by 10-15%, with payback periods of 2-6 years and improved reliability.
Does the milk lift pump have a Variable Speed Drive (VSD)? 3	Look for adjacent box.		Y / N	
Does the platform drive (rotary shed) have a Variable Speed Drive (VSD)? 4	Look for adjacent box. Or under platform.		Y / N	

Identify Key Components

- **Vacuum pump:** Connects to the milk pump pipework, featuring a distinctive cylinder and wide diameter pipes.
- **Milk pump:** Connects the milk intake pipe to the plate cooler.
- **Rotary drive:** Located under the platform.
- **VSDs:** Look for additional cables connecting the pump/drive to a control box. If cables aren't visible, check walls for boxes and confirm with the farmer.

2 Vacuum pumps with no VSD above and left (e.g. there are no wires connecting to a control box). Distinctive vacuum cylinders (in white above) and wide pipes identify the vacuum pump.

Vacuum pump on the right has cables from pump to the VSD.

3 Example of a milk pump. There is no vacuum cylinder. It has standard diameter pipes.

4 Rotary drive in the pit with VSD (see arrow)

5 VSD/controller examples

Milk chilling – Vats **Chilling energy use: 23%**	**Tips**	**Done**	**Action**	**Potential opportunity notes**
Check the vats available and what they are used for. 6	May be in yard or shed with access to yard.		Y / N	
Is the chilled milk vat wrapped? SM 7	This can save energy.		Y / N	15-20% activity saving. Low-cost.
If a vat stores pre-chilled water, is it wrapped?			Y / N	
If there's no chilled water vat, assess size and location of any available vat. Does it add value? ?	See below for rule of thumb to test if assessing justified.		Y / N	

Find the vats

Vats may be inside or outside, but they need to be easily accessible for the tanker. The milk vat is usually larger than the hot water cylinder.

Typically, you'll find:

- A large chilled milk storage vat. Confirm it's the milk vat by tracing the pipework to the chiller/cooling system and back to the plate exchanger.
- A smaller calf milk vat, which doesn't require insulation.
- If there's another large vat, ask the farmer about its use. It often stores extra water for milk chilling or, in some cases, repurposed for washdown water.

6 Milk vat in yard (not wrapped)

Smaller calf milk vat (left). Some farms store water here for peak season chilling, if large enough. Calf vats do not need wrapping.

7 Wrapped (insulated) milk vat

Is stored chilled water worth considering?

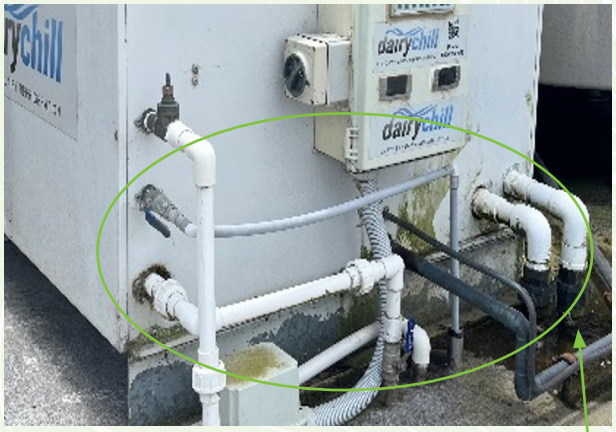
- To significantly impact chilling loads and milk vat temperatures, a farm needs chilled water stored at 2-3 times the milk volume per milking. Check DairyNZ milk cooling guidelines for more info.
- If the milk vat stores 2 milkings, the chilled water vat should be of a similar size for a noticeable effect.
- For 3 milkings, a chilled water vat at least 2/3 the size of the milk vat can be beneficial. A calf vat like in image 6 may be too small.
- Ensure a short pipe run, easy connection to pipes, and a good-sized chiller.
- For example, with 400 cows producing 5,600 litres of milk per milking (i.e. 28ltrs/milk/day/cow), you'll need at least 11,200 litres of chilled water storage (about a 2m diameter, 2.8m high vat).

Chillers and heat recovery Chilling energy use: 23% Hot water energy use: 24%	Tips	Done	Action	Potential opportunity notes
Ask if the farm uses heat recovery for hot water. 8 If not, consider suggesting a retrofit check. ?	A chiller with only one pipe in and one out indicates no heat recovery. If there's a pipe leading to a radiator, check for easy access to connect heat recovery.		Y / N	Depending on the design, savings can reach up to 30%.
Check if there's an ice bank cooling system with heat recovery. Note that Coolsense offers a Pay As You Save (PAUS) option, allowing immediate savings. SM ? 9	These chillers have multiple pipes for coolant in/out and hot water. If no ice bank cooling system with heat recovery, see discussion points for other options.		Y / N	Up to 30% savings on chilling, in addition to hot water savings. Coolsense offers significant GHG reductions from gases used, with a Pay As You Save (PAUS) option.

Identify Key Components

- **Vacuum pump:** Connects to the milk pump pipework, featuring a distinctive cylinder and wide diameter pipes.
- **Milk pump:** Connects the milk intake pipe to the plate cooler.
- **Rotary drive:** Located under the platform.
- **VSDs:** Look for additional cables connecting the pump/drive to a control box. If cables aren't visible, check walls for boxes and confirm with the farmer.

8 Simple chiller – just two pipes shows no heat recovery. Radiator pipe accessible for a pipe to connect to a heat exchanger for recovery. If chiller is housed in a closed cabinet, access is likely to be hard so heat recovery less of an option.



9 Heat recovery – multiple pipes for coolant flow and heat recovery for water. On the bottom right, the dark water patch indicates a leak that needs to be addressed – be sure to check for additional leaks as well.

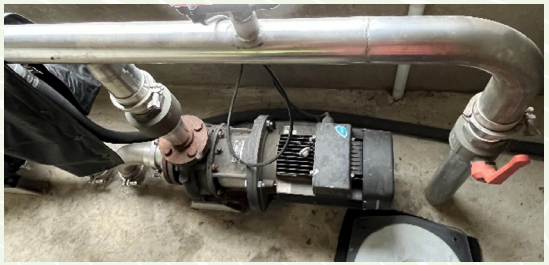
Rule of thumb for discussing ice bank cooling systems

Consider whether the farm should include upgrading to an ice bank or heat recovery system (or an equivalent solution, such as a glycol-based system) in its long-term plan. The timing for this decision depends on:

- **Age and Condition:** Assess the current system's age and condition, especially if there are ongoing milk chilling issues even after improvements to the plate exchanger temperatures or pre-chilling systems like Chillboost and chilled water vats.
- **Long-Term Contracts:** Even if the chiller isn't due for renewal, gauge the farm's interest in a long-term Pay As You Save (PAUS) contract, which allows farms to start saving immediately. Farmsource offers a package with Coolsense for new glycol chilling systems, structured so that farms can pay for the chiller over its lifespan as they save on chilling and hot water costs, while also benefiting from potential GHG savings.

General Pumping/motor energy use: 52%	Tips	Done	Action	Potential opportunity notes
Consider pump/flow controllers on water pipes (incl. farm water tank). Benefits include reduced breakdowns and burnout, extended pump life, more consistent flow, and decreased power usage. 10	Look for adjacent box/ leads. Devices like the F60 can enhance pump longevity. Check regularly for leaks		Y / N	Primary benefits beyond energy savings, such as reduced breakdowns, extended pump life, and more consistent flow.
Are LED lights installed?	Replace any broken lights; many farms upgrade to LEDs in areas where the farmer operates most, as they provide better light.		Y / N	There is approximately a 5-year payback period, with improved lighting being the main driver for the investment.
Use timers to shift loads to off-peak night rates or during optimal sunlight hours if you have or are getting solar PV. SM [?]	This applies to water cooling, water heating, and some pumping (e.g. effluent, irrigation).		Y / N	Potential savings of 30-50% on activity costs depend on retailer rates.
Engage with the farmer about their views on alternative (non-timer) control systems. [?]	Consider harvest monitoring for water use, effluent management, and vat temperatures, as well as smart solutions like Chillboost for milk vats and Flex-Able for more efficient hot water management.		Y / N	Assess the value of each opportunity specific to the farm's needs.

10 Water pump controllers



Finding pump controllers

They vary in design, typically appearing as control boxes mounted on or near the pipework close to a pump.

Other control and monitoring systems can take various forms, so it's best to ask the farmer for details. The image here shows an antenna near the effluent pond, which indicates the presence of a monitoring system.

You may notice additional small motors around the sheds. Controllers might not be feasible if usage rates are dictated by other factors, such as feed requirements.

Keep an eye out for pooled water around pumps and pipe joints, as this can indicate leaks. The only acceptable pooling in the shed should be from the hot water cylinder overflow and the manual heat recovery valve.

Effluent pond **Pumping/motor energy use: 52%**	**Tips**	**Done**	**Action**	**Potential opportunity notes**
VSD/flow controller on effluent pump	Look for adjacent box/leads. Using a VSD can reduce pump wear and extend its lifespan.		Y / N	
Is it a positive displacement pump? If not, add to the farm plan for renewal. 11	Most efficient pump type for various applications.		Y / N	
Discuss effluent pump management e.g. float, timer and other automation to run based on pond levels. ?	Fixed timers can be inefficient, leading to unnecessary runs and potential risks. If solar power is available, aim to operate during peak sunlight hours. Additionally, consider investing in a larger pond for extended storage capacity.		Y / N	
If there's no electric pump, discuss why. ?	Cabling costs or the presence of a large pond that only requires annual emptying can influence the decision to use alternative methods.		Y / N	
Ask if pond has a stirrer, and if so, is it managed to run when the pump runs? ?	Helps nutrient spreading, reducing other input costs.		Y / N	
Pond bacteria management and additives offer multiple farm benefits. SM ?	Reduces the energy required for pumping and minimises wear and tear on the pump.		Y / N	

Other long term plan items (for next upgrade)

Piping type: on renewal move to low loss, high diameter PVC. ?	Reduces friction, lowers pump energy consumption, minimises wear and tear		Y / N	
Pond sizing: a larger pond provides flexibility regarding when to pump.	If planning an upgrade, consider the size of the pond.		Y / N	
Pond shape: more surface area increases evaporation.	Reduces energy used for pumping and minimises pump wear and tear.		Y / N	

Orientation

The effluent pond is normally downhill from the yard pad.

11 Below is a positive displacement effluent pump. The long tube shape identifies it as a displacement pump. These pumps are always equipped with controls (see box).

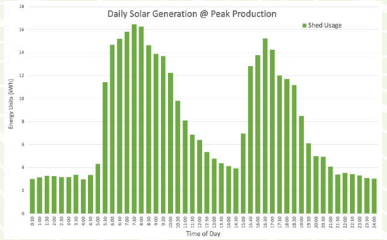
Centrifugal pumps are boxier for a rotating impeller and maybe submerged. A VSD adds efficiency.

- A float-based trigger for the pumping system is normally optimal to avoid unnecessary pumping and optimise savings on fertilisers and fuel to spread it.
- Where you have solar power, night rates or other cheap power times, complementing this with a timer or other management to target use of cheaper power can reduce energy costs and carbon.

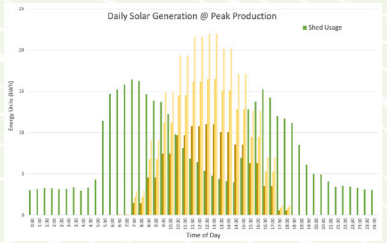
Lights, Solar PV	Tips	Done	Action	Potential opportunity notes
Any LED yard lights?	Switch to LED for lights used for long periods.		Y / N	
Check the shed roof and adjacent paddocks for solar panels. 12			Y / N	
If no solar, is there interest? Farms with high daytime use benefit the most, while those focused on night rates gain the least. Check the daily usage graph for daytime consumption. Farms can shift more load to daytime if interested. 13 ?	Our solar guide gives more talking points.		Y / N	Solar paybacks range from 4-12 years (on 30 year asset) in study examples.
If interested in solar, would the farm consider significant mechanical work, such as piling, trenching or framing? ?	See bottom section of picture 13 for a substantially farmer installed system.		Y / N	This helps target a fast payback e.g. 4-6 years.
Farm has or is planning solar. Discuss when plant runs and if storage capacity is good to run more plant in the solar window. Check daily usage graph to see current pattern. ?	Save money timing these for sunny periods: Hot water Chilling Some water/effluent pumping		Y / N	Potential to save 30-50% over using grid power and exporting solar at other times.
Farm has solar. Ask if the installer discussed solar supporting all three phases and/or load that can use solar being on the phase that solar supplies. ?	Some farms can import high-priced power on one phase and export solar on another at the same time.		Y / N	Save 30-50% per unit over using grid power and exporting solar on other phase.
Are there multiple billed connections (ICPs) for farm pumps, fences etc.? ?	Farm paying multiple fixed line fees. Small solar fence or pump units can eliminate these.		Y / N	Save daily charge (rising to $730 p.a.) per connection.

12 Solar panels on roof or ground mounted in paddock.

13 Solar and timing of energy use. This farm benefits more from solar with good daytime energy use (green).



This farm has lower daytime energy use. Lots of solar (yellow) is not used.



Dairy shed		Action
Plant renewal plans	Plan in place for what to buy when you have plant failure	Y / N
	Energy efficiency included in decision-making	Y / N
Plant service schedules	Your refrigerant plant is checked annually	Y / N
	Your milk plant is checked annually, e.g. vacuum regulation, airflow, leaks, drive belt	Y / N
	Water leaks are spotted quickly (e.g. excess pumping)	Y / N
Set point temperatures	Your hot water cylinder temperature is optimal at 55°C at the end of the wash	Y / N
	You have considered a hot water wash every second day (efficient plant set ups)	Y / N
	Regular temperature check of your milk cooler water and milk outlets	Y / N
Switch off unused plant	Unused hot water cylinders	Y / N
	Lights off after milking	Y / N
	Your pumps	Y / N

NOTES:

Diesel and time savings		Action
Feeding practices	Feed stored in more than one location to save time and reduce tractor miles	Y / N
Frequency, choice and care of vehicle (also helps with H&S)	Plan for multi-purpose trips with standard tools to save time and fuel	Y / N
	Use the smallest appropriate vehicle for the job at hand (tractor size, ute, quad, motorbike)	Y / N
	Check tractor servicing, tyre pressures and choose settings for the job/load (check visor/ manual quick guide)	Y / N
	Electric options include Ubco or e-bike, Tuatara electric quad, electric ute and tractor (light duties only, high cost) assessed	Y / N
Using contractors	Using contractors more often as they tend to have right-sized and most modern vehicles, reducing fuel and carbon	Y / N
Herd wearables	Assess energy efficiency gains when assessing wearables	Y / N
	If using them, reducing the frequency of trips (miles) as wearables allow	Y / N

NOTES:

Making A Plan

Refer back to each schedule for identified opportunities if not already completed. Discuss farmer's priorities and next steps.

Simple improvements (or other near term actions)

Action	Benefits (e.g. better light and savings)	Next step (e.g. contract electrician, barriers to overcome)	Plan (date)	Done (date)

Updates for farm plan (longer-term items)

Action	Benefits	Done

Operational changes

Action	Benefits	Done