

ENERGY-EFFICIENT IRRIGATION

HOW IS ENERGY USED?

On most farms, whether they are dairy, mixed or cropping farms, irrigation is often the largest user of energy, using up to and sometimes over 75% of total energy on the farm.

The actual proportion and amount of energy used for irrigation will vary greatly between areas of Tasmania and individual farms.

HOW TO IRRIGATE ENERGY-EFFICIENTLY

As irrigation is usually the major user of energy on most farms, ensuring that you are irrigating energy-efficiently can reduce overall energy costs, and often also results in water efficiency and irrigation efficiency.

There are three possible steps to minimise the cost of energy use by irrigation:

1. Check that you are on the correct tariff. See our brochure *What's the best rate for my business? A guide to business electricity tariffs*.
2. Ensure that all your equipment is running efficiently.
3. Install new efficient equipment that will improve energy use. This step will involve greater



Pumps to operate the polyhouse and the outdoor irrigation systems.

capital outlay, but with adequate assessment and planning that can usually be paid back within a reasonable timeframe.

Correct tariff

Most irrigating farmers will be aware of Aurora's irrigation tariff 73/74. Farmers need to ensure

Tariff	Cost	Fixed Cost
Tariff 73/74* – night rate (8pm – 7am) – day rate (7am – 8pm)	6.609c per kWh 15.044c per kWh	164.568c per day

*Tariff 73/74 only applies to irrigation pumping for approved agricultural purposes classified by ANZSIC Class 01.

that they are using this tariff for irrigation energy use, and that where possible they are utilising its night rate.

Maintaining equipment efficiency

Ensuring that your current equipment is operating at appropriate efficiency can reduce (p.2)

MONITORING SOIL MOISTURE CONTENT: AN INNOVATION IN IRRIGATION



SOIL: Craig's garlic crop.

A major problem in irrigating efficiently is knowing how much water is in the soil and available for the crop plants at their root zone. This can be difficult to tell from the surface.

To overcome this problem, tulip and garlic farmer Craig Ellis has recently installed a solar-powered, electrical capacitance soil-water probe, called EnviroSCAN. This device enables him to constantly monitor exactly how much (pg 5)

W I N T E R

Energy-Efficient Dairies

HOW IS ENERGY USED?

Apart from pasture irrigation, milk harvesting equipment is what uses the most energy on a dairy farm. Here is an estimated breakdown of where energy is used on a dairy farm:

Activity	% of energy use
Pasture irrigation	0 – 50%
Heating water	10 – 40%
Milk cooling	10 – 30%
Other—including vacuum pumps etc	10 – 20%

These figures will vary from farm to farm depending on the amount of irrigation and other activities carried out on the farm. (p.4)

Halving a hot water bill

THERMAL HEAT RECOVERY SYSTEMS

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Phase Dropout Recovery System

BULBS ARE TOO VALUABLE

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ENERGY-EFFICIENT IRRIGATION cont.

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not only water loss but also energy use. Here are six easy steps to help ensure that your equipment is running efficiently:

1. Maintain the system to minimise the risk of leakage, especially if you have many connections.
2. Check that the suction setup is correct. If the pump suction lift is higher than the pump it can lose efficiency and may cause damage to the pump.
3. Ensure that the system is running within the ranges of flow rates and pressure recommended by the manufacturer. If it is operated outside these specifications, it may lose efficiency.
4. Ensure that sprinklers and emitters are not worn or blocked.

System Management

1. Ensure that you are not applying more water than can soak into the soil (that is, avoid run-off).
2. Ensure that there is correct overlap between sprinklers.

Variable speed drives

Variable speed drives can reduce

energy use by up to 50 percent. They adjust the speed at which pumps rotate so that the pressure and flow requirements of the pump will match the pressure and flow requirements of your delivery system. They also save money by reducing maintenance and repair costs.

New delivery systems

If you are setting up a new irrigation system or are considering installing a replacement system, incorporating energy efficiency into the planning of this system, although possibly increasing capital costs, could save electricity and reduce the repayment period for the equipment.

The most important consideration in deciding which system to install based on energy use is where and what you need to irrigate. In some situations a travelling gun system could prove to be more efficient than other systems, depending on circumstance and need.

The advantages and disadvantages of each of these systems are listed below.

Soil-water monitoring

By monitoring the water



Drip irrigation system watering vegetable fennel.

CENTRE PIVOT IRRIGATION – very low energy use.

The number of centre-pivot irrigation systems installed each year in Tasmania has increased dramatically since the first three were installed in 1994. Centre-pivot irrigation is best suited to large areas, crops with high water requirements and higher value crops.

Advantages	Disadvantages
Low pressure, therefore, low energy costs	Circles create unirrigated areas (without end-gun irrigators, they irrigate only 78% of a square)
Very high uniformity of application	High instantaneous applications towards the end of the line can cause run-off on sloping sites and heavier soils
Irrigation events can be scheduled more frequently when required	Perceived (not generally actual) high capital costs

FLOOD IRRIGATION – low energy use.

Flood irrigation is low on energy use as it relies on gravity to spread water across an area. Flood irrigation is best suited to pasture and even slopes with heavier soil types.

Advantages	Disadvantages
Low pressure required to pump and no pressure required to spread water, therefore, low energy costs	Unless areas are laser planed, can result in very low irrigation efficiency due to inaccurate application and losses from run-off and seepage
	Very low uniformity of application
	Run-off and seepage losses can cause waterlogging and promote salinity issues in susceptible soil types

MICRO IRRIGATION – low energy use.

Micro irrigation includes dripper systems as well as small sprinklers. In such a system the watering pattern can increase as the plants grow. Micro irrigation is best used for permanent installations of high value perennial crops such as vines and tree crops.

Advantages	Disadvantages
Low pressure, therefore, low energy use	Generally requires sophisticated water filtration systems
High uniformity of application	Best used only on soils with good filtration
High to very high irrigation efficiency	



Pressure regulator for drip irrigation system.

LINEAR-MOVE IRRIGATION – low energy use.

Linear-move irrigation systems have a similar infrastructure to centre-pivot irrigators, the difference being that rather than pivoting on a central point the whole arm moves across the area being irrigated. As with centre-pivot irrigation, linear move is best suited to large areas, crops with high water requirements and higher value crops.

Advantages	Disadvantages
Low pressure, therefore, low energy costs (higher than centre pivot due to hose friction losses)	Less appropriate for undulating or irregular terrain as system is not “anchored”
Very high uniformity of applications can be very high irrigation efficiency	Generally higher capital costs/ha than centre pivots

FIXED AND PORTABLE SOLID SET – medium energy use.

Fixed sprinkler systems are best suited to perennial crops, especially trees. Portable sprinkler systems are best suited to high value, intensive, vegetable, herb and ornamental crops.

Advantages	Disadvantages
Medium pressure required for sprinklers, therefore, relatively low energy use	If designed with inappropriate sprinkler spacings can result in inefficient uniformity of application
If appropriately designed with adequate sprinkler spacings have good uniformity of application	
High irrigation efficiency	

LONG LATERAL – high energy use.

Long lateral systems are best suited to pasture application and less suited to crops.

Advantages	Disadvantages
Well suited to areas of irregular shape and steep or undulating terrain	Friction losses in lateral hoses result in increased pressure requirements and therefore higher energy costs
	Very low uniformity of application
	Generally low efficiency due to low uniformity of application

TRAVELLING GUN (soft and hard hose types) – high energy use.

Travelling gun irrigators are popular in Tasmania and are best suited to annual crops with low water requirements.

Advantages	Disadvantages
Very flexible and portable systems	High pressure, therefore, high energy costs. Hard hose systems can have higher costs due to friction losses in the hose if not designed properly
	Very low uniformity of application primarily from wind effects, inappropriate lane spacings and start and end-of-run issues.
	Low irrigation efficiency



Pressure-regulated dripper system.

content of the soil you can improve the efficiency of your irrigation practices by only watering when you need to. The use of water by plants is affected by many parameters, including solar radiation, humidity, wind speed, temperature, some farming practices and plant growth stage. It is important to know how much is available to the plants in the soil so that you can determine whether application of more water is required to ensure adequate growth and healthy crops.

Soil moisture can be measured in a variety of methods, including:

1. Gravimetric, using a digstick or drying a soil sample in an oven.
2. Volumetric, using nuclear or electrical capacitance meth-

ods.

3. Tension, as in tensiometers or gypsum blocks.

Using such a soil water monitoring device can help you develop an irrigation schedule based on the water needs of the crop and the availability of water to that crop. By operating such a schedule correctly you can

DID YOU KNOW_

that the new Aurora website has improved online services for:

- checking your account
- monitoring your power consumption
- organising connections and disconnections of meters

www.auroraenergy.com.au



Vagon variable-speed drive-control box.

ENERGY-EFFICIENT DAIRIES cont. from page 1



Milking equipment is a major consumer of energy.

HOW TO USE MILKING EQUIPMENT EFFICIENTLY

As milking equipment is often a major user of energy on a dairy farm, assessing the way this equipment uses electricity can reduce overall energy costs. There are three possible steps to be taken to minimise the cost of energy use in your dairy:

1. Check that you are on the correct tariff. See Aurora's publication *What's the best rate for my business? A guide to business electricity tariffs*.
2. Ensuring that all your current equipment is running efficiently.
3. Install new equipment that will reduce energy use. This

step involves greater capital expenditure, but with adequate assessment and planning this outlay can usually be paid back in a reasonable timeframe. Energy-saving equipment can either reduce the energy needed to heat water for cleaning, or reduce the energy needed to cool the milk.

HOW TO HEAT WATER EFFICIENTLY

As mentioned earlier, water heating accounts for up to 40% of the electricity used on dairy farms, but only about 16% of electricity cost, because farmers generally use cheaper off-peak

electricity to heat their water.

Maintaining equipment efficiency

Ensuring that your current equipment is operating at appropriate efficiencies can reduce the electricity required for heating water. Three ways in which you can reduce electricity use at a low cost are to:

1. Ensure that thermostats on water cylinders are not set too high and causing the water to boil.
2. Maintain the water heater and piping to eliminate leaks.
3. Use insulation to reduce heat loss.

The heat recovery from milk

The heat removed from the milk of 200 cows in one day is about 163 kWh or enough energy to heat over 1500 litres of water from 15°C to 95°C.

There are three ways in which heat can be recovered from milk:

1. Using warmed water from the precooler.
2. Using water-cooled condensing mechanisms on vats.
3. Installing a desuperheater or Thermal Heat Recovery System.

Precooler

If you have a precooler installed, the warm water can be

recovered from the milk pre-cooler heat-exchanger. This water temperature will be about 30°C, depending on milk and water flow rates.

Water-cooled condensing mechanisms

In the condensing mechanism on a vat the heat from the refrigerant is either "dumped" into the air, or transferred to water. If it is transferred to water this water can be heated and utilised.

Thermal Heat Recovery System

A Thermal Heat Recovery

Correct tariff

Dairy farmers need to ensure they are using the correct tariff for their hot water supply.

Tariff	Cost	Fixed Cost
Tariff 62* – Off-peak night period only	6.395c per kWh	12.171c / meter & time switch / day
Tariff 43** – Hot water supply	8.746c per kWh	5.629c / meter / day

*Tariff 62 may be supplied only in association with tariff 31, tariff 33, tariff 36 or tariff 22.

AURORA BUSINESS GUIDE

Aurora's comprehensive 48 page Business Guide to Electricity is out now. Packed full of important information and handy advice, this guide is a great reference for any business. See back page for details of how to order your copy.

MONITORING SOIL MOISTURE CONTENT cont. from page 1



The solar powered ENVIROSCAN

System is similar to a hot water unit, and can be fitted to vats that use an air-cooled condensing mechanism. Acting in a similar fashion to a water-cooled condensing system, a Thermal Heat Recovery System is connected to the refrigeration line between the compressor and the condenser and utilises the heat transferred from the compressed gaseous refrigerant to heat water.

This system improves the efficiency of milk cooling as water is more efficient than air at extracting heat from the refrigerant gas.

Water heated by the heat removed from milk can be used as feed water to the main water heater, reducing the energy needed to heat it to the required temperature for cleaning.

The amount of water heated this way will be more than is needed for cleaning. Excess warm water can be used for udder washing, general washing, employee showering or even floor heating.

EFFICIENT MILK COOLING AND REFRIGERATION

Maintaining equipment efficiency

Ensuring that all your milk cooling equipment is working efficiently, is clean and undamaged

is the first and lowest-cost step to minimising energy use. This can include making sure that all cooling fans are clean and that refrigerant gas levels are adequate.

MILK COOLING EQUIPMENT

Precooler

A precooler is the most cost-effective way of reducing the energy used to cool milk. A pre-cooler can reduce dairy energy use by 20-40% where a supply of cool water is available and a plate cooler can be installed easily.

Maximising precooler performance

In order to maximise the performance of a precooler you need to ensure that:

- a large enough heat exchanger or “plate” is used,
- water flow rates are fine tuned, and
- the cooling water is as cool as possible.

If all these are ensured, milk should be cooled to within 2°C of the incoming water temperature when it passes through the plate cooler.

Cooling the milk before it enters the vat reduces the energy and time needed to cool the milk further to the required level. This saves not only money, but also

water is in the soil and means he can irrigate more efficiently.

“At first I was sceptical and didn’t think it would actually work, but as long as the probe is placed in a position representative of the whole paddock, it does help a lot,” Craig says.

“The EnviroSCAN enables me to check on my computer how much water is in the soil, and then I can go and start the irrigator if I need to. It can save not only energy but also time, water, labour and therefore

money.

“It also means that I know whenever the crop needs watering, and I can produce a better crop.”

Such a system starts at \$3,500 with one probe, with extra costs for each additional probe, and is supplied by Yandilla Park Services of Victoria.

For further product information visit www.yandillapark.com.au or www.enviroscan.com.au



Milk is cooled prior to entering vat.

minimises time in which microorganisms can grow.

Cold storage

Cold storage (e.g. ice banks or chilled water storage) enables the use of off-peak electricity to form ice or cold liquid, which can then be stored to use for cooling at a later time.

Cold storage is usually not the best way to reduce energy costs as the increased capital costs and energy consumption reduce the benefit of being able to use cheaper off-peak electricity.

A benefit of cold storage systems is that the ice, or chilled water, can continue to cool the milk in the event of an electricity outage.

MINIMISING THE RISK POSED BY OUTAGES IN YOUR DAIRY

Aurora is working continuously to upgrade its service and improve the supply to our customers, but

sometimes, due to circumstances beyond our control, interruptions in the supply do occur.

Installing a diesel or petrol back-up generator for use in such emergencies is likely to be your best option for keeping milk cool in the event of an electricity interruption.

For further product information visit www.genesisauto.com.au

Correct tariff

Depending on the equipment you are using in your dairy to cool and refrigerate milk, you have several tariff options. These are listed in the table below.

You should ensure that you are using the appropriate tariff for your equipment.

Tariff	Cost	Fixed Cost
Tariff 62 – Off-peak night period only	6.395c per kWh	12.171c / meter & time switch/day
Tariff 22 – General or Tariff 36 – Commercial/Residential, Educational and Farm buildings	17.516c per kWh for first 500 kWh per quarter; 12.980c per kWh for remainder, per quarter.	62.782c/day

DID YOU KNOW...

Aurora now have a new guide to helping you save money. Turn to the back page to order your copy.



THERMAL HEAT RECOVERY SYSTEMS

– halving a hot water bill



The Therma Heat Recovery System.

Six years ago Hamilton farmer John Jones visited Agfest looking for a replacement milk-cooling unit for his 300-cow dairy.

The unit John chose came with an added bonus.

“I wasn’t really looking for energy efficiency, but the vat I chose came with a built-in Thermal Heat Recovery System, which uses the heat from the milk to heat my water, effectively halving my hot water bill.”

ENERGY USE IN THE DAIRY

John uses the off-peak, night only tariff (tariff 62) to heat water. He pays about \$1,800 for hot water. The rest of the electricity bill for the dairy would be about \$8,500 and includes everything else like the water pumps, lights, milking machinery and vats. Of these, the vats would use about 75% of the electricity.

HEAT RECOVERY FROM MILK

The heat removed from the milk of 200 cows in one day is about 163 kWh, or enough energy to heat over 1500 litres of water from 15°C to 95°C. In most milk-cooling systems this heat is lost to the air, but the Boumatic Therma-Stor Heat Recovery System installed in John’s dairy utilises this heat to heat water so that less electricity is needed to produce hot water for cleaning.

THERMAL HEAT RECOVERY SYSTEM

The water runs through the plate cooler to precool the milk and then goes to a 1000-litre storage tank. This water is already warm to touch and must be about 37°C. Some of the warm water from this tank is used for hand washing, but most of it fills the Heat Recovery Hot Water System. Hot refrigerant gas from the vat’s cooling system enters an immersion coil in the Heat Recovery System and the heat from this gas is transferred to the water, heating it even more. From this Heat Recovery Hot Water System no more than 50% of the water is used to wash the vats, and the rest goes to the electric hot water system which heats the water to be used for washing the milking machinery.

IMPROVING EFFICIENCY

The Thermal Heat Recovery System was originally designed to improve cooling efficiency of refrigeration vats, and therefore a vat with such a system is also more energy-efficient, as well as having the extra bonus of heating water.

“It’s definitely saving me energy because since installing the Heat Recovery System I have been able to take away an extra 110-litre hot water system I used to need. The 550-litre hot water

service I use now only runs at night. Before this system my hot water electricity bills used to be double what they are now.”

ESTIMATED COST AND REPAYMENT PERIOD

Since John bought his system six years ago, technology has advanced somewhat and the cost of such equipment has changed, as have the possible savings. The capital cost of such a system retrofitted into an existing refrigeration system is estimated at \$4–5,000. Alterations to existing systems may affect warranties. You need to check this before commencing any upgrade. Advertised savings due to adding such a system are up to 65% on water heating costs, depending on the amount of milk cooled, the run time of the compressor on the vat, and water usage. Therefore the repayment period of such a system in a 300-cow dairy with an average hot water bill of \$3,000 would be approximately 3–6 years. This will vary depending on individual circumstances.

SOME QUICK STEPS TO INCREASING THE EFFICIENCY OF YOUR CURRENT DAIRY EQUIPMENT

Maintenance of any dairy equipment you have is important to ensure that it remains

energy-efficient, as well as prolonging its life.

There are several ways you can increase and maintain the energy efficiency of your current dairy equipment, whether it is brand new or many years old.

1. You need to ensure that you are on the correct tariff. See our brochure *What’s the best rate for my business? A guide to business electricity tariffs*.
2. Ensure that all your equipment is running efficiently. This can include:
 - a. Ensuring that thermostats on water cylinders are not set too high and causing the water to boil.
 - b. Maintaining the water heating and piping are eliminate leaks.
 - c. Ensuring that hot water cylinders and piping are insulated to reduce heat loss.
 - d. Ensuring that all refrigeration equipment is clean and undamaged (eg cooling fans etc) and that gas levels are adequate.
 - e. Ensuring that the water flow rate through your plate cooler is efficient.
 - f. Ensuring that the water flowing through your plate cooler is as cold as possible.

If you do not feel confident in these maintenance activities, talk to your dairy equipment provider or Aurora Energy about hiring someone to do it for you.

For further information visit www.boumatic.com

The Tasmanian distributor for Boumatic Therma-Star Heat Recovery Systems is D&W Dairy Services. Email



Plate cooler and vat in dairy.

PRIVATE POLES: your responsibilities as an Aurora Energy customer



Aurora Energy does not own and maintain all powerlines. Low-voltage power lines supplying installations on private property belong to, and are to be maintained by, the customer.

Where does a private powerline begin?

When a low-voltage powerline enters private property to supply an installation (be it a house, a pump or a dairy), it becomes a private powerline and your responsibility. The private line begins where the Aurora powerline connects with the first pole on your property. This is called the “customer’s terminal” or “point of supply”. This first pole, and all the poles, lines, fittings and attachments beyond it, are your responsibility.

Aurora has begun to fix a yellow “private pole” sign to at least the first pole on all private properties, to help you, and Aurora employees, to determine where private lines begin.

Your responsibilities

As a customer with a private powerline, it is actually your responsibility to make regular inspections of this line. This is to ensure a reliable and safe

supply of power to you and your neighbours.

If safety standards are not maintained, Aurora has the statutory authority to disconnect the supply. You may be held legally responsible if your powerline causes damage to persons and/or property.

Potential problems

The reliability and safety of private poles may be undermined by:

- Decay of the pole.
- Weathered and worn insulators.
- Connections and wire.
- Scrub and grass around the base of the wooden pole, increasing fire risk and encouraging fungal growth.
- Trees growing too close to the line.

In order to prevent these problems you should undertake or organise regular inspections of any private powerlines on your property.

Aurora can help you

To help customers maintain their private powerlines, Aurora provides a free service by inspecting and testing private poles up to the customer meter position when they conduct testing of Aurora-owned poles.

It is the customer’s responsibil-

ity to arrange for the testing of poles past the metering position.

If the Aurora powerline inspector finds any defects in the poles or pole tops, the customer is advised in writing of the defect and the action required to rectify it. You are then required to fix the identified problems within the time frame specified.

Your options

If you are issued with a letter, contact an accredited Aurora powerline contractor:

- Midlands Contracting and Pole Renewals 1800 551 592
- KD Ewington P/L 0408 143 331
- Power Comm Tas P/L 6427 3990
- Agility P/L 642023083. Contacta

Contact Us

Business Line 1300 132 045

(7am to 7pm Monday to Friday)

Call this number for all business enquiries, account enquiries, if you are moving premises, for heating and cooling advice, information on hot water and lighting, payment options, easements, energy cost management, private powerlines, pole queries and new supply.

Faults 13 2004

(24 hours a day 7 days a week)

Call this number to report power failures, streetlight faults, electrical theft, damage to Aurora property, electricity shocks or for safety awareness, service difficulties, vegetation enquiries, planned interruptions and cable locations.

Email

business@auroraenergy.com.au

Web address

www.auroraenergy.com.au

Correspondence

GPO Box 191, Hobart Tas 7001

Payments by mail

Locked Bag 4, Hobart Tas 7001

PHASE DROPOUT RECOVERY SYSTEM

"The dry climate in southern Tassie means that we produce very robust and therefore very valuable bulbs."

Craig Ellis is one of four farmers in Tasmania exporting tulip bulbs to the Netherlands. The area in which Craig's 2,500 hectare farm is located, near Bothwell, occasionally experiences phase dropout, which can cause strain on the motors, reducing their life, and on occasion has even caused motor burnout.

THE PROBLEM

"I have 60 three-phase motors sustaining temperatures and the air changes. If a phase drops out and my motors burn out, it could jeopardise the quality of my stock, and cost me a lot to replace the motor"

THE SOLUTION

Due to the valuable nature of his stock and the cooling system, Craig is installing a phase dropout recovery system to ensure that

Estimated benefit of installing such a system:

Cost of phase dropout recovery system	\$ 5,000
Cost of motor replacement	\$ 7,000
Cost of stock spoilage	\$ 0, but could have been up to \$1.2 million
Net benefit	\$ 2,000 - \$1.2 million

when there is a phase dropout, all equipment will be switched off to prevent motors from being burnt out.

This system is supplied by the Heat Pump Shop* and will cost about \$5000 to install. Craig says that it will be worth this cost due to the risk otherwise posed to his

* The Heat Pump Shop has been an Aurora Preferred Supplier since 1998.

THE SITUATION

- Electricity bill is usually over \$20,000 in the winter quarter
- Other quarters, it is around \$15,000
- 90% of bill is accounted for by "warm/cool" rooms
- Constant temperatures all year round

After harvesting and sorting there is over \$1 million worth of stock in the "warm rooms" that requires:

- A constant air temperature of 20°C
- 5 air changes every hour.

When new bulbs are imported from Holland, they need:

- A constant 2°C temperature over winter so that they can acclimatise to our seasons.



"Warm rooms" containing Craig's valuable stock.

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This is our first edition of Electric Farm - a publication specifically designed to help agricultural businesses manage their energy requirements.

We would welcome your feedback so we can continuously improve future editions. Phone 1300 13 2045 or email business@auroraenergy.com.au

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