



## FACT SHEET

### ENERGY MEASUREMENT EQUIPMENT

Energy use can be measured on-site by installing and reading meters or off-site from the energy supplier's data. Measuring on-site enables the energy use components to be individually analysed. Sources of energy include; electricity, gas diesel and petrol. Each of these sources are measured differently. Electricity (kWh) is measured by either electromechanical induction or solid state type meters. Gas is measured through inline flow meters (L or m<sup>3</sup>). Diesel and petrol fuel is often measured in litres with inline flow meters at the storage tank.

To compare the various energy sources, raw data will need to be converted into a standard unit for energy measurement, the megajoule (MJ). This allows for direct comparisons between various activity areas using different energy sources, as well as the calculation of a total energy usage across the piggery.

#### Supplier Data

Energy usage from the various energy sources for the whole site can be sourced from supplier's data. These include electrical energy from your relevant power authority, fuel supply from a fuel company, and gas from your gas supply company. There may be other point source supply such as solid fuel usage which can be obtained. This information is usually contained on suppliers' invoices.

#### Direct Electrical Energy Metering

Electrical energy is measured in kilowatt hours (kWh). However, extra costs may be introduced depending on time-of-use tariffs, in the form of kilovolt amps (kVa) or power factor electricity tariffs. Piggeries need to be aware of tariff rates, power factor and the associated costs.

It is important that the reading in kWh is recorded not the voltage (V) or current (A) or any other parameter.

Each overhead supply line will have a power authority meter on-site (Figure 1). The power will be supplied through either one, two or three phases. The meter may be electromechanical or solid state type meter. These meters have a high level of accuracy (0.01%).

#### Power Authority Meter

The electromechanical induction meter operates by counting the revolutions of an aluminum disc which is made to rotate at a speed proportional to the power. Hence, they are sometimes referred to as rotating disc meters. Typically these power meters are installed on older residences. There is one meter per phase.

More recent electricity meters are solid state and display the power used digitally, which can be read automatically (Figure 2). These meters can monitor all three phases individually and together, and can be read remotely by the power authority. In addition to measuring electricity used, solid state meters can also record other parameters of the load and supply such as maximum demand, power factor, and reactive power used etc.



**Figure 1:**  
Electromechanical  
Induction Meter



**Figure 2: Solid State  
Meter**

#### Proprietary Power Monitors

Proprietary power monitors are available from specialist sensing and instrumentation suppliers (Figure 3 and 4). These can be installed within smaller capacity electrical networks to allow metering of processes or equipment. These monitors will need to be installed by a licensed electrical contractor.



Monitors are available to monitor single-phase (50–290v) or three-phase (80–500v) networks. Three-phase network monitors can measure voltage (phase and linked), current (phase and neutral), power (phase and three-phase active), power factor, frequency and working hours and minutes. The quantities are displayed digitally.

Power monitors have a relatively small physical size compared with power authority meters, approximately a third of the size.

Proprietary power monitors are available with varying levels of accuracy. In general, the more accurate the meter, the more expensive. The IME Conto (Figure 3) and Nemo (Figure 4) have a reading accuracy for power of  $\pm 1.0\%$  and  $\pm 0.5\%$  respectively.



**Figure 3: IME Conto D4-S Power Monitor**



**Figure 4: IME Nemo 72-L Power Monitor**

Multi-function monitors are available with programmable pulse outputs and RS485 communication for control and logging capabilities.

The cost of supply and installation of proprietary monitors will vary according to capabilities and functionality required. For electrical supply networks with large currents (most piggeries), power monitors will also require dedicated current transformation (CT) devices and associated switchgear.

## Current Transformation (CT)

A current transformer (CT) is used where there are large currents, there is usually a limitation in the power meter taking large currents. To facilitate the safe measurement of currents, a CT can be installed on each phase circuit of the selected power meter (Figure 5). The circuit is largely unaffected by the insertion of the CT. In piggeries, the range of line currents is varies significantly, therefore the correctly sized CT should be installed. Consultation and installation by a licenced electrician will ensure the CT's measure the current accurately.

A CT is a type of instrument transformer designed to provide a current in its secondary winding proportional to the alternating current flowing in its primary. The CT safely isolates the measurement circuitry from the high voltages typically present in each circuit measured. The secondary winding for all CT used in this work was 5 amperes. For example, a 100/5 CT provides an output current of 5 amperes when the primary winding was passing 100 amperes.



**CT's installed on the three-phase power supply**

**Figure 5: Typical Current Transformer Installation**

## Power Factor

The power factor is a measure of how effectively electrical power is being used by a system. A perfect power factor is 1, however the accepted range for a good power factor is 0.85 to 0.95. A good power factor indicates effective electricity and asset utilisation, while a poor power factor indicates ineffective utilisation of electricity. An easy way to improve power factor is to use correctly sized motors.



The rules and costs governing the power factor varies within different states, charges often apply for power factors of less than 0.85. It is important that enterprises understand the implications of their power factor and power factor correction.

## Run Hour Meter

For equipment that has a constant load and draws about the same amount of power all the time you may be able to use this method to estimate energy usage. This is usually a lower cost than installing power monitors. The current/power per unit of time needs to be measured for the equipment. The total power can then be calculated by multiplying run time and power.

Run hour meters are available from specialist sensing and instrumentation suppliers. Your local electrical contractor will need to install these devices, and should also be able to source them.

The hour meters provide a continuous display of total run hours. Hour meters are available with analogue or digital display. The analogue display has a sequence of white on black and/or red on black numbers.



**Figure 6: Run Hour Meter**

## Fuel Metering

Some enterprises have a metered bowser pump associated with their diesel fuel storage facility. If there is no bowser a simple inline mechanical flow meter can be installed to measure the transfer of diesel or petrol.

Inline mechanical fuel flow meters are available from fuel suppliers. An example of an Alemite inline flow meter is shown in Figure 7.

This meter is a low cost (\$500) mechanical fuel meter which can meter fuel accurately between 15 and 120 LPM.



**Figure 7: Alemite Mechanical Flow Meter**

## Gas Metering

Gas measurement is usually an inline flow meter (Figure 8) installed between the gas storage tank and the boiler. Gas meters usually report in cubic meters or in litres.

Gas flow meters come in many different shapes and forms and directly measure the mass flow of gas. Gas meters are expensive and need to be installed by a licensed gasfitter.



**Figure 8: Inline Gas Flow Meter**



## Key Points

- **Consider the accuracy, future needs (logging, control etc) and cost when selecting electrical power monitors.**
- **Electrical power monitors can be supplied and must be installed by a licensed electrical contractor.**
- **Mechanical flow meters are relatively inexpensive. Check the liquid flow rate range when selecting meter.**
- **Gas meters can be supplied and must be installed by a licensed gasfitter.**

## Other Fact Sheets in this Series

- Identifying Energy Use Activities
- Reading and Collecting Energy Data
- Piggery Total Energy Usage
- Improvements to Energy Efficiency.

Disclaimer: The opinions, advice and information contained in this publication have not been provided at the request of any person but are offered by Australian Pork Limited (APL) solely for informational purposes. While APL has no reason to believe that the information contained in this publication is inaccurate, APL is unable to guarantee the accuracy of the information and, subject to any terms implied by law which cannot be excluded, accepts no responsibility for loss suffered as a result of any party's reliance on the accuracy or currency of the content of this publication. The information contained in this publication should not be relied upon for any purpose, including as a substitute for professional advice. Nothing within the publication constitutes an express or implied warranty, or representation, with respect to the accuracy or currency of the publication, any future matter or as to the value of or demand for any good.