

Energy Use On Pig Farms



For most pig units the three biggest energy consumers are heating, lighting, and ventilation, so it is these areas that offer greatest scope for efficiency savings. Measuring, recording and benchmarking energy use across the business is the first step

to improving energy efficiency, which is often expressed in kilo Watt hours (kWh) per pig or per kg live-weight basis. A lot of the savings are greatly influenced by management which is the most important aspect of energy efficiency.

TEAGASC RESEARCH

A Teagasc survey carried out on eight Irish pig farms with a total of 4701 sows (approximately 3% of the National Pig Herd) showed an average usage of 27kWh per pig produced (with a range of 17 to 37 kWh/pig produced).

More recent audits done on 23 pig farms show a huge variation in the energy usage ranging from 18 up to 45kWh/pig produced with an average figure of 28kWh/pig produced. These audits for 23 farms included over 20,000 sows. The high variation from one farm to another suggests that a greater emphasis needs to be put on energy efficiency.

Another source of data available is from 59 pig farms recording on the Teagasc ePM records (2015). The energy cost (heat, power and light) is €3.49 per pig produced (or €87/sow /year based upon 24.8 pig's produced/sow/year).

KEY ENERGY USES ON PIG FARMS

Energy on pig farms is mainly used for:

- Heating the farrowing and first stage weaner houses,
- Ventilation systems and fans,
- Insulation of pig buildings,
- Feed delivery and mixing, power-washing and
- Manure pumps to mix and agitate slurry tanks.

HEATING THE FARROWING AND FIRST STAGE WEANER HOUSES

Heat must be provided to the younger pigs on a pig unit. The temperature in the farrowing rooms is critical for the survival of newly born piglets. The ideal is to have a farrowing room temperature of 24°C once the first piglet is born in the room. This should be reduced to no more than 20°C when the youngest piglet in the room is over 2 days old. It is vital to minimise uncontrolled heat loss to save money and improve output.

Pig producers may use paper to supplement the heat source at farrowing rather than an infra-red bulb. If the average gestation period is 115 days, it is not necessary to heat up the creep area on Day 113 of gestation. Poor temperature control can lead to unnecessary overheating of pads resulting in wasted heat production and wasted ventilation energy. This applies

particularly in the first two weeks after farrowing. First stage weaners (i.e. 7kg to 17kg live weight approx.) also require a source of heat. The aim is to have newly weaned pigs kept at 28°C to 29°C initially, with a reduction of approximately 2°C in room temperature each week thereafter.

Accurately controlling heat pads and lamps is another key area along with enclosing creeps to accurately control temperature, prevent heat loss and reduce heating requirements. A portable USB temperature/relative humidity sensor and data logger is a cheap effective way of recording variations within the building, while a thermal imaging survey gives a more accurate indication of heat losses. Care needs to be taken when interpreting results as sows/finishing pigs can easily 0.5kW of heat that will reflect off surfaces. Thermal imaging also will not show air temperature gradients or air movement, so should be ideally used in conjunction with smoke tests.

HEAT PUMPS

A number of units have installed heat to air pumps to heat the heat pads in the farrowing units. These systems extract the heat from ambient air and use it to heat water via heat exchange systems. This can be ideal to heat water to temperatures of 55°C.

The capital costs of these systems can be high but they are effective in reducing fuel costs. A **hybrid** system also exists where the heat pumps operate to certain parameters but if the ambient temperature drops too low a boiler backup steps in to provide the heat supply. This system links to computerised controls which can adjust to changing costs of electricity prices, fuel costs etc. as programmed.

Case Study:

On an 800 sow pig unit the usage of kerosene was 900 litres per week to heat 144 farrowing crates and four rooms of first stage weaners (270 weaners per room). This was an annual cost of €46,800 per year. The cost of inserting "air to heat" pumps for this farm was €50,000 plus an installation cost of €8,000. The annual cost of electricity to run the pumps is approx. €12,800 per annum. This is an annual saving of €34,000 which gives a payback time of one year and 8 months – excluding cost of borrowing the capital. This is a significant return on investment.

VENTILATION SYSTEMS AND FANS:

Heating and ventilation efficiency are closely related. Pig houses are ventilated to control the levels of gas (i.e. carbon dioxide, ammonia, methane and hydrogen sulphide are the main ones) and airborne pathogens in the pigs environment. This is done to achieve good growth performance in terms of growth rates and feed conversion efficiencies. It's imperative that airflow can be properly controlled without influence from draughts or leaks.

Some pig houses are controlled without the use of mechanical fans to pull fresh air through the house. This system relies on the "stack" effect which relies on warm air rising and being replaced by cooler fresh air from outside the building and is referred to as natural ventilation.

The only energy used in this system is to control the air inlet and outlets in the building. This system has very low running costs but may be a difficult system to manage particularly in very changeable weather or on very exposed sites. If ventilation is not working at 100%, just a short interval where things are wrong can be a detriment to pig behaviour. It is vital to service fans regularly and keep louvers and other vents clean and free from obstruction. Outlet fans can be made up to 10-15% more efficient by adding cones. Replacing old fans with energy efficient models pays back relatively quickly and is likely to improve odour dispersal. It may also be worth considering misting systems to help cool buildings. These systems do not have much water and provided they are set up correctly, can let you reduce ventilation rates as you're not trying to remove a lot of hot air.

Ventilation and feeding systems are the main users of energy in the weaner and finisher section of a pig farm. If the ventilation system chosen is Automatically Controlled Natural Ventilation (ACNV) and the feeding system is a liquid one the power usage is greater for the feeding system. Where

the ventilation system is fan powered with restricted inlets and the feeding system is an augered wet/dry system, the consumption pattern may be reversed.

INSULATION

The provision of heat in buildings is very wasteful if there is a poor level of insulation in the building. The walls and ceilings should be insulated to achieve suitable U values.

If the insulation has been damaged by pests it can have huge cost implications. The temperature fluctuation in the pig house should also be checked by using maximum-minimum thermometers to monitor if house temperatures vary considerably between day and night-time. Improving the insulation in some pig houses could greatly improve feed production costs by reducing the feed conversion efficiencies on certain pig farms.

LIGHTING

Good lighting should be a priority on any unit and LED's are a particular benefit. Many Danish producers are installing LED's and the technology is increasing throughout Europe. The capital costs are high, but energy savings of 80-90% over conventional lighting as well as potential health and productivity benefits. Together with LED's high efficiency they also have the ability to produce a range of light wavelengths. Research has shown that blue wavelengths are particularly effective at influencing biological rhythms in pigs and spectral control of light has great potential to improve welfare and productivity.

FEED

A further area to consider is fitting variable speed pumps to wet feed and waste equipment. This can cut costs by 30-50%.



CHECKLIST TO ASSESS YOUR FARM

Do your creeps have heating control?

Yes No

A carefully designed enclosed creep with an automatically control heater lamp could save up to 45%.

Are your creeps enclosed to reduce air leakage?

Yes No

As well as saving energy, enclosed creeps improve piglet comfort and help reduce the heating effect of lamps on the sow. Cooler sows have higher feed intakes and this helps milk production.

Are you creeps insulated?

Yes No

Insulation around the creep could save a further 13% if it is well sealed.

Do your creeps heater lamps have dimmer switches?

Yes No

Simple manual 50% dimmer switches are a very cost effective way of significantly reducing heating costs. With switches fitted the heater lamps can be operated at 50% for 2/3 of the creep period. Savings up to 30%.

Have you considered alternative heating for creeps?

Yes No

Heated pads and under floor heating can significantly cut energy costs. Where hot water heating is used cheaper alternative fuels can be considered. Significant savings may be achieved with Air to Heat Pumps- have you considered these?

Do your flat deck fans and heaters have controls?

Yes No

Most heat loss is through ventilation. Heaters should be interlocked with the fans so that heating is switched on only when the ventilation system is running at minimum. Modulated heater output is more efficient than simple on/off switching. Savings up to 50-65%.

Are you using the correct number of fans for your flat deck?

Yes No

Economies in consumption, particularly in cold weather, can be achieved by using 2 or more smaller fans per room instead of one larger fan so that only one fan on speed control can operate for minimum ventilation rates. Savings up to 50%.

Do your flat Decks have lying area panels?

Yes No

The use of lying area panels over the open mesh floors allows better retention of piglet body heat and maintains piglet comfort at a lower air temperature, reducing heating requirement. Savings up to 10%.

Have you reviewed your fan and ventilation design?

Yes No

Modern fans and motors can be more efficient. Improvements in efficiency arise from correct installation and use of fans. Air inlets, outlets, fan chimneys and other fittings must be sized to match the output of the fans.

Do you check that openings for the fans are clear?

Yes No

obstruction to airflow close to the fan on the delivery side will reduce performance. Ideally there should be no obstructions within a distance equivalent to 2 fan diameters from the fan. Fan output can even be reduced by back draught shutters. Savings up to 20%.

Are you thinking of replacing/improving insulation?

Yes No

The replacement of existing insulation with that of a higher thermal resistance can seldom be justified on energy saving costs alone. However, during new builds or when carrying out extensive refurbishment higher grades of insulation should be installed. Savings up to 5%.

Do you make sure insulation is kept dry?

Yes No

Insulation material loses its insulation properties when wet so the vapour barrier must be kept intact and repaired/replaced as necessary. Savings 5-10%.

Is low energy lighting used?

Yes No

Fluorescent lighting and lower energy lamps can significantly reduce energy costs. Up to 80%.

Are temperature sensors correctly sited and accurate?

Yes No

Ensure that sensors are located for representative livestock temperatures and check that the indicated temperatures on the controller read out/dials are accurate with a thermometer. Savings up to 20%.

Savings may not be cumulative, as alteration of one item may affect another.



Links

Sustainable Energy Authority Ireland www.seai.ie

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