Peter Young

Waterford piggery fired up by straw fuel

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TEAGASC

Jimmy Foran and his son Jim run a 1,100 sow unit outside Carrick-on-Suir, Co Waterford. Looking to reduce heating costs, Jimmy, together with his plumber Bill Coady, travelled to Denmark to source a boiler that would reduce his piggery operational costs.

He returned to pilot trial a Skelhoje straw boiler on his own farm and has now become the official agent for this boiler in Ireland. The overall investment gave a payback in less than three years.

SKELHOJE STRAW BOILER

The boiler was sized at 300kW output, oversized for the buildings it has to heat. The boiler is heating the sow units together with Jimmy's own dwelling house.

However, the boiler is not running continuously. It is lit in the morning and runs for approximately four hours until the water is heated.

This process heats the buffer tanks filled with 32,000 litres of water up to 95ºC where the water is stored until required.

The frequency of lighting depends entirely on the heat demand. If they required hot water for a 500 sow system, they would only have to heat it every second day. In really cold weather, it may have to be lit three times every two days.

The heated water passes through highly insulated piping called district heating (DH) piping which delivers the warm water to the sow unit and dwelling house.

The DH piping is extremely well insulated and contains a flow and return. The heat losses are very low at 1ºC per 100m of travelled water. They ensure that the flow of water temperature does not go below 65ºC, otherwise the temperature of tail end of the heat pads under the sows would drop too much.

A manifold was installed which added to the cost. The manifold splits the hot water up between the piggery and the dwelling house.

The dwelling house is supplied with hot water for the radiators at 70ºC which is fed from a separate 1,500 litre buffer tank. This supplies hot water for the radiators and hot water for showers etc.

JIMMY FORAN

➲1,100 sow unit
➲Oil €59,000 excl VAT

FARM
➲Installed Skelhoje straw boiler payback <3 yrs

The central heating system works off a thermostat which draws the heat as required from the buffer tank to maintain the dwelling house temperature at 20-22ºC.

OPERATION AND MAINTENANCE

It takes about 10 minutes to light up the boiler every morning and the combustion chamber is cleaned out every four days. The ashes are cleaned out using a purpose-made shovel bucket in front of a teleporter. The ash is piled in a heap and later spread on land to supply fertilizer potash and magnesium to the land.

The complete unit, including the heat exchanger, is cleaned out once every month. This job is completed by a farm worker and takes about two to three hours to complete.

They use a wire brush to loosen the material around the heat exchanger which is then blown out using a compressor and this process is completed twice.

UNIT COST

Cost of straw: Last year Jimmy purchased the straw for €12 per bale loose in the field and €10 per bale to get it baled afterwards. It was baled into 8x4x4 bales which each weighs about 500kg. It also costs about another €10 per bale to get the bales back to the piggery from Clonmel. Each bales costs €32 delivered to the piggery. There are approximately 380 bales burned per year at a cost of €12,160

The Skelhoje boiler, installed on Jimmy Foran's farm, being cleaned out by a specially-designed bucket.

ENERGY IN STRAW

The energy content of the straw will depend mainly on its moisture content. There is very little difference in the calorific value or energy content of different straw types. Wheaten straw at 15% moisture content contains about 16.6 giga-joules of energy per tonne which is just over 4,600 kilowatt hours (kWh) per tonne. A 500kg Heston bale will contain 2,300 kWh of energy.

The straw is stored in two nearby hay sheds. One tonne of straw has the same energy value as 438 litres of kerosene heating oil. Therefore, a 4x4 round bale weighing 150kg will have an energy heating value the same as 66 litres of oil.

If we were to put a value on this bale of straw and equate it to oil at 95 cent per litre, it's worth over €63 per bale.

This boiler could be used to burn straw, hay or miscanthus. Jimmy has burned miscanthus which he was very happy with. The miscanthus has a much lower ash content than straw and burns much cleaner.

However, with straw available on his doorstep at €64 per tonne by bale delivered, he is happy to burn the cheapest fuel available to maximise his profits from the piggery.

Jimmy is also looking to incorporate a specialised drying system for grain to integrate with his heat output at certain times of the year. He plans to take the heat from the boiler into a dryer

HEATING VALUE OF OIL

Based on a heat output of 2,300 kWh per bale and the total delivered cost of the bale at €32 per bale, the cost of procuring this form of heat energy is 1.4 cent per kWh. If you compare this to oil at 95c/l, this is costing 9c per kWh.

A heat meter was fitted to determine the exact heat output in kWh.

OVERALL SAVINGS

The boiler cost €96,000 plus 23% VAT which brought the overall cost to €118,080.

The annual cost of procuring the straw is approximately €12,160. Prior to the installation, Jimmy was using 70,000 litres of oil between his piggery and dwelling house at a cost of 95c/l or €66,500. This would give a simple direct annual saving of €54,340.

Jimmy has the manpower available to insert the bale and light the boiler on a daily basis, and while he does not factor this cost in, it should be considered in most investment appraisals.

While Jimmy is able to do any required servicing of his boiler, such costs need to be considered where technical knowledge may be lacking.

Based on an overall investment cost of €141,000 and an annual fuel saving of €54,340 using straw versus kerosene oil the straw boiler system has given Jimmy a payback under three years.

BACK-UP AND ISSUES

The system still has kerosene oil as a back-up. Jimmy has not used any kerosene since installing the boiler. The only problem Jimmy has so far encountered is that if the electricity goes down, you will lose some of the settings within the computer. According to the plumber Bill Coady you could install a battery pack to ensure this does not occur.

The system allows the flexibility of installing a chip to monitor the boiler's performance from your mobile phone if you are away from home. There is the possibility that a fan could go but it will still operate on two fans, probably at a lower efficiency until the third fan is repaired.

There were some problems earlier with a relay switch which turned out to be a loose connection. There are ceramic firebricks in the combustion zone which improve the efficiency by deflecting the heat. Some of these had been damaged by the driver inserting the bale.

Table 3: Value of bale compared to oil

Bale Type	Bale Weight	Kilo watt hours (kWh) per bale	Oil equivalent (litres)	Oil Value equivalent
4 x 4 Round	150kg	690	66	€63
5 x 4 Round	250kg	1,150	110	€105
8 x 4 x 4 Square	500kg	2,300	219	€208

Table 4: Breakdown of installed cost of boiler

Cost of unit	€80,000
Transport costs from Denmark	€16,000
Plumbing, DH piping, Digging	€45,000
Total Installed Cost	€141,000

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