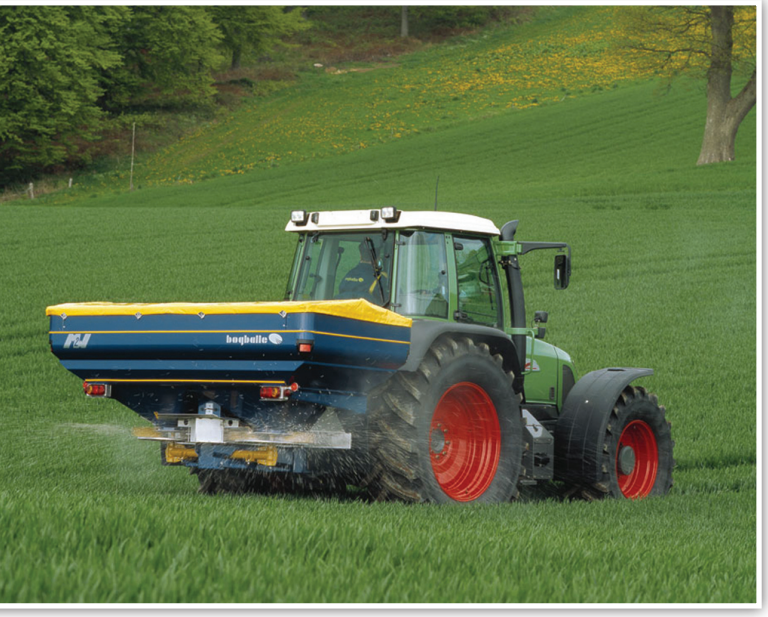
Energy Fact Sheet No: 1 – August 2016

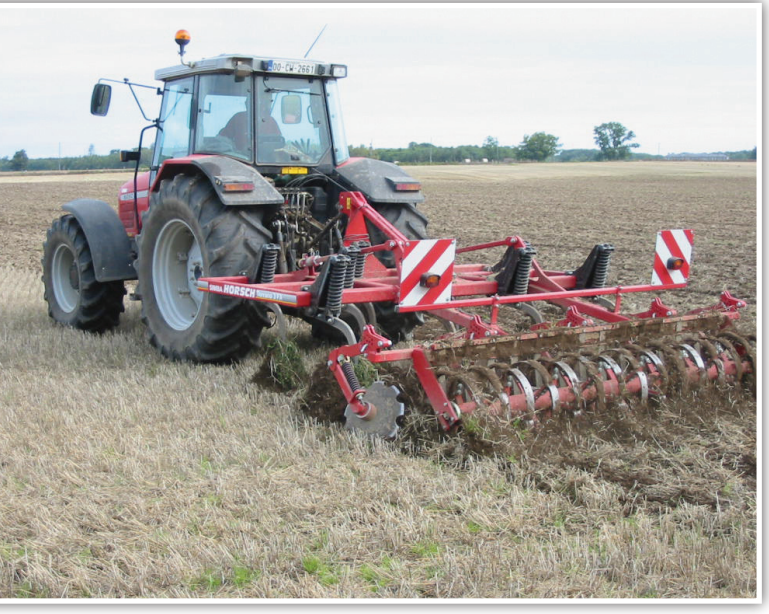
Energy Use On Tillage Farms

Grain drying and cultivations are key to improving energy efficiency on tillage farms. From grain quality assurance standards to end-user grower protocols, there is increasing pressure on tillage farmers to improve energy efficiency. While these may seem like regulatory hoops, there are considerable financial savings to be gained by being energy efficient.

Energy efficiency has always been a harder sell than renewable technology, but the returns can be just as good, with many projects paying back in two to five years. The difficulty is that energy efficiency is harder to measure and requires accurate monitoring and recording.

Keeping a record of fuel use over time allows growers to identify where most fuel is used and see how consumption can be cut just by doing things more efficiently. Electricity use on most combinable crop farms is generally fairly minimal, so the greatest scope for saving energy (disregarding "embedded" energy in fertiliser) lies in the fuel needed during crop drying, storage and for field cultivations. Energy used in each operation varies widely depending on the business. 90% of energy use might be in the field, whereas if you are drying grain it may be closer to a 50:50 split.





ENERGY SAVING OPPORTUNITIES

CULTIVATIONS AND CROP HUSBANDRY

Typical fuel costs for field cultivations on a 50 hectare tillage enterprise are €2,500 based on a fuel price of €0.60 per litre. Recording fuel and equipment use can provide accurate information on the relative fuel used by each operation and focus on energy used. In terms of cultivations, the biggest step for cutting energy use is to switch to a minimum or no-tillage system to reduce the amount of soil moved. This will not suit every farm and there are some agronomic reasons for sticking with more fuel-intensive systems. With all systems there is an opportunity to reduce energy by reducing working depth and tillage intensity where conditions allow.

KEY STEPS TO CONSIDER

Combining Machine Operations

Using equipment that allows multiple jobs to be done with each pass, such as ploughing and seed-bed preparation and drilling can cut energy use by 25-40%. It may require compromises in set-up and speed, but generally saves time and fuel.

Matching Tractors and Implements

Using smaller engine tractors where possible can save up to 50% of fuel, depending on the job. Also consider more efficient models when buying, or use a contractor instead of buying a bigger tractor.

Match Gear and Engine Speed

Operate tractor engines at the lowest speed for the power requirement but do not overload the engine. One European Efficient Energy 20 study found that reducing engine speed from 1,800 - 2,200 rpm to 1,600-1,000rpm gave the following fuel savings:

- Spring tine cultivator -7%
- Disc Harrow -12.5%
- Fertiliser Spreading – 25.9%
- Plough – 6.4%
- Roller – 16.9%
- Drilling – 15.8%
- Transport – 17.6%

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MAINTAIN MACHINES

KEY TASKS INCLUDE:

- Tyre pressure: reduce to minimum for load and speed being used.
- Replace air and fuel filters according to service schedule.
- Keep cooling system clean to avoid overheating.
- Ensure all machines are lubricated correctly with the correct specification lubricants.
- Sharpen blades on items like balers – 10% power losses have been found on balers with blunt blades.

Optimising Tyre Sizes and Pressures

Reducing rolling resistance and avoiding wheel slip will save energy in the field. Rolling resistance is reduced by increasing the tyre size and reducing tyre pressure to minimise tyre sinkage. Wheel slip is reduced by careful ballasting and fitting large enough tyres to avoid sinkage. Ploughing trials showed that a reduction in tyre pressures from 1.6 bar to 1.0 bar saved 5% in fuel.

SELF ASSESSMENT QUESTIONS

Can minimal cultivation techniques be used? Yes ☐ No ☐

Consider type of seedbeds required for the crops grown, depth of cultivation, trash burial and the effectiveness of herbicides. Potential savings up to 90%.

Have you considered changing to lower input crops? Yes ☐ No ☐

Review profitability of each crop in the light of energy and other input costs.

Is each cultivation operation really necessary? Yes ☐ No ☐

Examine the soil and avoid 'recreational cultivation'
Potential saving of up to 50%.

Do you avoid cultivating in adverse conditions? Yes ☐ No ☐

Cultivate in best possible soil conditions, reducing soil damage and the need for additional cultivation. Potential savings up to 40%.

Have you reviewed equipment efficiency? Yes ☐ No ☐

Optimise efficiency by reviewing all machines used including powered vs non-powered cultivators, tramline/fertilizer/spray width, tractor size,
potential savings up to 50%.

Are tractor tyres the correct size and operating pressure? Yes ☐ No ☐

Incorrect tyre choice and pressure will increase fuel consumption.
Potential savings up to 50%

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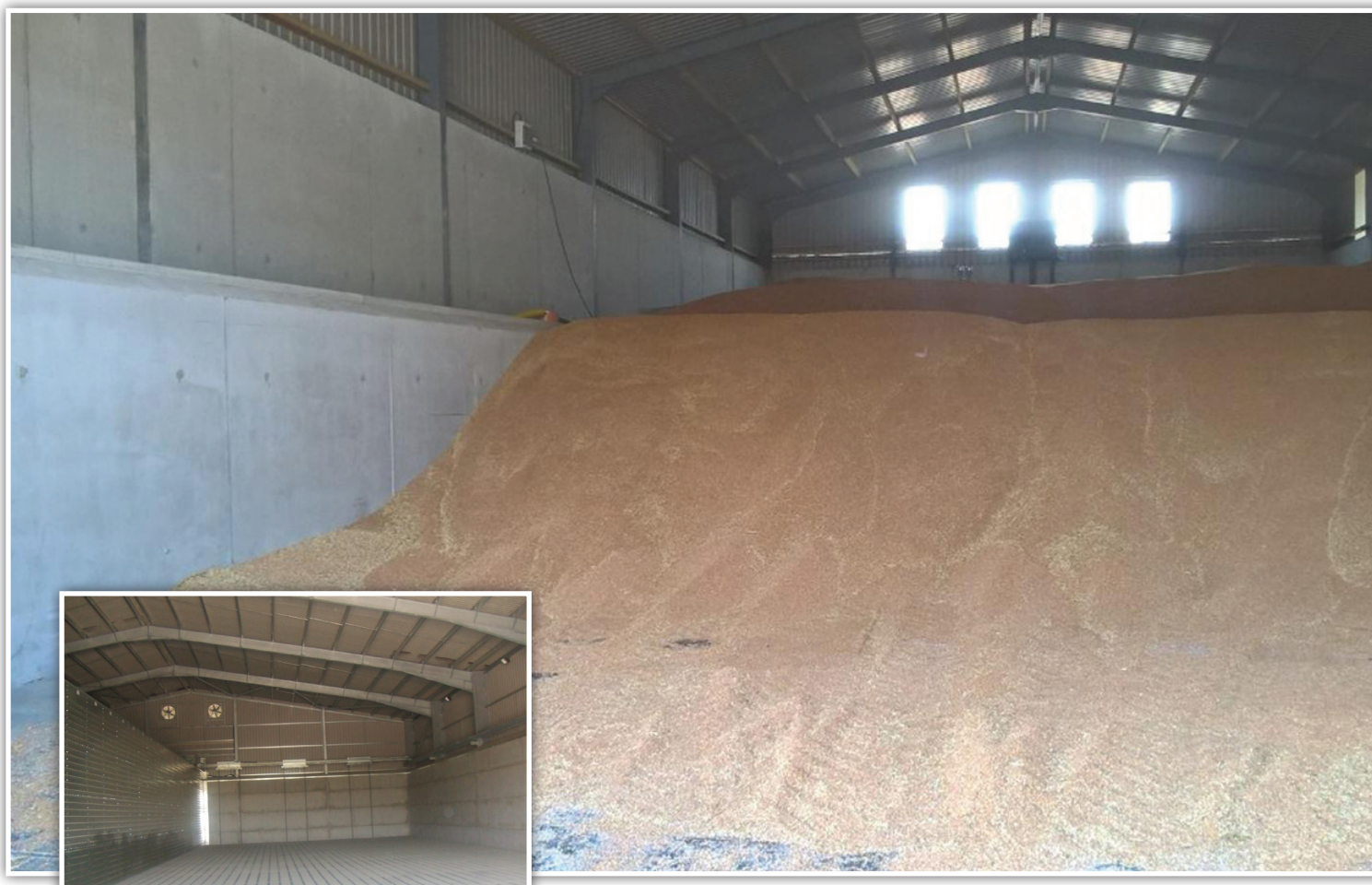

DRYING AND STORAGE

Crop drying and storage is the largest single item of direct fuel usage in cereal production. A high temperature drier will consume 55 litres of fuel oil for each hectare of crop that is harvested/ dried. To bring moisture from 20% to 15% typically takes about six litres of fuel (diesel) for each tonne of grain to be dried.

The improvements in management and equipment necessary to reduce the use of energy during drying and storage of crops, will lead to significant savings in cost and improved quality and value to the produce stored. Measures leading to reduction in energy may not always be cost effective because of the substantial capital investment required but often they can be justified due to the additional benefit of improved produce quality and reduced weight loss. Simple measures such as ensuring all controls (especially humidity) are set correctly can cut energy use by a quarter.

- Grain can be efficiently stored by using on-floor or bin drying systems which use ambient air to remove the intial moisture and only then adding heat to further extract moisture below 18% MC.
- Ensure equipment is well maintained, ventilation fans are the appropriate size and moisture measurements are accurate.
- Adding recirculation to existing cross-flow driers can save up to 30% of energy usage.
- Ensure the drier is operating at the right capacity and avoid a second pass through.
- Increase harvesting capacity to allow grain to be harvested at lower moisture.

There have been big advances in grain drying technology over recent years and energy efficiency is a key driver. It takes about six litres of diesel to reduce grain moisture from 20% to 15%. Modern dryers include features such as precise control of grain flow and temperature, insulated walls to retain heat, air recycling and efficient burner technology.

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Savings noted in the following table are based on cost of fuel for 3% moisture content reduction.

Is harvesting managed to minimise additional drying? Yes ☐ No ☐
Harvest management can ensure that the crop is combined at optimum moisture content, though crops prone to shedding can suffer economic loss if harvesting is delayed too long. Potential savings of up to 75%.

Is grain dried in bulk with high volumes of air? Yes ☐ No ☐
This is the most energy efficient method of grain drying. Management is critical to effectiveness and efficiency. There is no substitute for air volume (0.05 m^3 per second per tonne being dried). Additional heat applied to grain above 18% moisture content is a waste. Typical faults include undersized and restricted ducts, inlet vents, drying floors, duct air leakage & humid air recirculation. Savings 2-10% If faults corrected.

Is steady progressive operation maintained in your high temperature drying system? Yes ☐ No ☐
Steady progressive operation is important. Dryers must be neither too lightly, nor too heavily loaded. Efficiency is reduced if grain has to pass through the drier a second time.

Do you keep a record of your energy use? Yes ☐ No ☐
Close monitoring of fuel use, identifies areas where potential savings can be made. It provides an early warning of potential/actual equipment or system failure. Potential savings of up to 50%.

Is your drier fitted with cross-flow recirculation? Yes ☐ No ☐
Saving up to 30% compared to a basic cross-flow drier.

Do you have a mixed flow drier? Yes ☐ No ☐
Saving up to 50% compared to a basic cross-flow drier.

Do you use dry aeration? Yes ☐ No ☐
Saving could be 12-17%. Conversion of existing round bin system could be considered.

Are you sure moistures are measured accurately? Yes ☐ No ☐
Over drying by as little as 1% consumes an extra 3.5 litres of fuel per tonne. More important from a financial point of view is the loss of saleable weight. Potential savings of up to 35% – Depends on accuracy of moisture meter.

Are controls set accurately? Yes ☐ No ☐
For air volume/ recirculation/ temperature . Potential savings of between 5-25%.

Is burner maintenance carried out? Yes ☐ No ☐
Jet condition. Air to fuel setting. Potential savings of up to 5%.

Has ventilation fan specification and design been assessed? Yes ☐ No ☐
Insufficient fan capacity slows drying. Potential savings of up to 5%.

Has humidity control been checked and improved if necessary? Yes ☐ No ☐
Potential savings 13-44%. Energy reduction based on electric staged heaters on high heat level.

Is low rate aeration (crop cooling during storage) used? Yes ☐ No ☐
Low volume fan units for cooling grain rather than large drying fan. Potential savings of up to 10%.

Links
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www.seai.ie

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