Fact sheet
Energy 17

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ENERGY DATA FOR FIELD VEGETABLE PRODUCTION

Introduction

Increasing energy prices, combined with consumer demand for crops with a low carbon footprint, mean that horticultural producers are facing increasing financial and social pressure to improve energy efficiency. By monitoring and tracking consumption against production and output levels, it is possible for growers to equate energy use to specific tasks and develop realistic reduction targets. Simple energy reduction policies, such as turn it off/close it/turn it down, can help, as can regular maintenance of refrigeration equipment, checking insulation seals, and the use of simple automatic controls, such as occupancy sensors and thermostats.

The rest of this factsheet outlines steps which could help the overall energy usage efficiency on a farm, sourced with thanks from www.thecarbontrust.co.uk.

Horticultural producers are facing increasing financial and social pressure to improve energy efficiency.

Ambient storage options – potatoes, red beet, onions

The figures given below are based on the energy consumption of a reasonably economical potato store at 130-160kWh per tonne per annum. The figures are also broadly applicable to onions and red beet storage.

Increasing insulation in potato or red beet storage can give savings of up to 10%.

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Have you considered improving insulation?

☐ Yes ☐ No

Increasing insulation thickness by 25mm can reduce fan hours and heat requirement for frost protection and condensation control – *potential savings of up to 10%.*

Can you improve sealing of the store?

☐ Yes ☐ No

Improve store sealing at doors, eaves, vents, etc. – *potential savings of 5-10%.*

Do you check system efficiency and integrity?

☐ Yes ☐ No

Typical faults include undersized and restricted ducts, inlet and recirculation vents, and floors. Duct leakage gives uncontrolled warm air recirculation – *potential savings of 2-10%.*

Have you reviewed the suitability of the fan used?

☐ Yes ☐ No

A grain store specification fan could be replaced by a low-pressure fan unit. The fan should operate 10-13% of the time.

Saving: up to 60%.

Do you have automatic control for the system?

☐ Yes ☐ No

A good automatic control system compared to poor manual control could save up to 60%.

Are the temperature sensors accurate?

☐ Yes ☐ No

Inaccuracies can result from poorly positioned and/or inaccurate sensors. Poor setting of controllers can also cause problems.

Saving: up to 50%.

Onion drying and ambient storage

As previous information, but in addition:

Do you have a modulating burner with thermostat control?

☐ Yes ☐ No

A large amount of energy is used during drying.

Saving: approximately 20%.

Do you have full automatic control of stage two drying?

☐ Yes ☐ No

Control the second stage with humidity sensors and air mixing.

Saving: 20%.

A large amount of energy is used during onion drying.

Refrigerated bulk and box storage – potatoes, winter cabbage, onions

The figures given below are based on the energy consumption of a reasonably economical potato store at 130-160Kwh per tonne per annum and are broadly applicable to onion or winter cabbage storage.

Have you improved insulation?

☐ Yes ☐ No

For example, from 0.55-0.25W/m2 °C requires application of an additional 50mm of polyurethane insulation – *potential savings of up to 27%.*

Do you have sufficient store sealing?

☐ Yes ☐ No

Sealing can reduce infiltration by 50%. Improve store sealing at doors, vents, eaves, etc. Use air curtains/flexible doors.

Likely saving: 10%.

Have you checked the efficiency of air circulation fans?

☐ Yes ☐ No

Fan load, etc., on the refrigeration plant can amount to 25%. Where store is only partly loaded this can rise to 50%.

Saving: 6%.

Are temperature sensors accurate?

☐ Yes ☐ No

Wasted energy is 15% for each 1°C lower than required due to inaccuracy.

Do you have a flexible store divider?

☐ **Yes** ☐ **No**

Divide store in half with a flexible insulated divider when the store is half full.

Saving: 35%.

Do you pre-cool using ambient air ventilation? ☐ **Yes** ☐ **No**

With some crops it is possible to reduce crop temperature by storing outside overnight, or use store ambient ventilation.

Saving: 10%+.

Is evaporator defrosting used in refrigeration? ☐ **Yes** ☐ **No**

Reset time clock after 'pull-down' or install automatic defrost. Excess ice/heat to store.

Saving: 2-25%.

Is an electronic expansion valve used in refrigeration?

☐ **Yes** ☐ **No**

Improved efficiency over mechanical thermostatic expansion valve (TEV) (but TEV is low cost and simple).

Saving: 2-5%.

Pre-cooling outside overnight is an option with some crops.

Is there capacity control of the compressor in refrigeration?

☐ **Yes** ☐ **No**

Important reduction in energy when operating at reduced load.

Saving: up to 47%.

Can the coefficient of performance for the refrigeration system be improved?

☐ **Yes** ☐ **No**

Compressor consumption is minimised by having the highest evaporation temperature and a large evaporation surface area to give the maximum heat transfer coefficient.

Saving: up to 15%.

Have you considered other heat recovery systems?

☐ **Yes** ☐ **No**

Can only be used in very specific situations incorporated at design stage.

The savings are not cumulative as one option may affect the potential savings of another.

Pack areas and workshops

Do you limit the space heated?

☐ **Yes** ☐ **No**

Avoid unnecessary heating of large areas that are sparsely staffed.

Localised and radiant heating can save energy and provide better working conditions in large grading and washing operations.

The use of partitioned enclosures increases staff comfort and retains heat.

Saving: up to 70%.

Do you avoid product heating?

☐ **Yes** ☐ **No**

Space and water heating should only operate during occupancy by staff.

Unnecessary warming of produce as it passes through a warm pack house should be avoided, as energy will be required to re-cool the product.

Saving: up to 10%.

Do you only heat during occupancy?

☐ **Yes** ☐ **No**

Space and water heating should be controlled to only operate during occupancy by staff (apart from frost protection). *Saving: up to 50%.*

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Is warm air recirculated?

☐ Yes ☐ No

Warm air heating systems should be ducted with point outlet diffusers. These systems should always recirculate the air within the pack house area. Ventilation of the building should be controlled independently.

Saving: up to 50%.

Do you have temperature redistribution fans?

☐ Yes ☐ No

Slow moving, open paddle type fans mounted in the roof will even out distribution of rising warm air.

Are the boilers and warm air heaters regularly serviced?

☐ Yes ☐ No

They should be serviced at regular intervals and combustion efficiency checked frequently

Saving: up to 50%.

Do you have thermostats checked against a thermometer?

☐ Yes ☐ No

Saving: up to 7% per °C excess.

Is equipment only operated when necessary?

☐ Yes ☐ No

Avoid having all the product lines operating and running empty when only part of the system is required. Fit isolator switches to all individual components.

Is process/line speed optimal?

☐ Yes ☐ No

Adjust the forward speed of grading lines to ensure that the product completely fills the line. Avoid bottlenecks in the process that result in part of the line running empty or at fractional capacity.

Saving: up to 10%.

Avoid having all the product lines operating when only part of the system is required.

Is the line switched off during breaks?

☐ Yes ☐ No

During work break periods switch off as much of the equipment as possible.

Saving: up to 12%.

Are process requirements minimised?

☐ Yes ☐ No

Analyse product requirement for any particular process. Review this regularly internally and with the customer.

Is waste production minimised?

☐ Yes ☐ No

Avoid over-processing, which increases volume and waste content of effluent. Waste treatment and disposal consumes more power.

Saving: up to 50%.

Is process water recycled?

☐ Yes ☐ No

Where heated or cooled water is used recycle this as much as possible. Allow adequate time for water to be drained from produce.

Saving: up to 50%.

Have you considered low-tech processing?

☐ Yes ☐ No

For example, simple trimming tables with produce and waste collection bins are likely to be just as effective as stations on conveyor systems.

Are your buildings insulated?

☐ Yes ☐ No

It is important to insulate to minimise heat losses, particularly roofs.

Do doors have plastic strip curtains or heated air curtains?

☐ Yes ☐ No

Saving: up to 10%.

Is process heat recycled?

☐ Yes ☐ No

For large heat-consuming and heat-rejecting processes, e.g., frying or blast freezing, consider using heat recovery or utilisation of rejected processed heat.

Saving: up to 70%.

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Further information

For further information please contact Dr Michael Gaffney, Horticulture Development Department, Teagasc Food Research Centre, Ashtown, Dublin 15 at:

+353 (0)1-805 9500

michael.gaffney@teagasc.ie

The information displayed above was sourced from:

www.thecarbontrust.co.uk

Fact sheet produced by Dr Michael Gaffney, Horticulture Development Department, Teagasc Food Research Centre and Barry Caslin, Teagasc, Rural Economy Development Programme.