Potato Store Management for Energy Efficiency

Potatoes in Practice 2009

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Programme

- Introduction
- Potato Council's *12 Steps to Energy Efficiency*
- Focus on energy use in ambient and refrigerated box stores for seed
- Future Developments
- Opportunities for renewable energy generation

12 Steps to Energy Efficiency

1. Meters and sub-meters
2. Control systems
3. Inverters
4. Calibration
5. Insulation
6. Fans and ducts
7. Doors, louvres and joints – air leakage
8. Lighting
9. Motors
10. Energy audits
11. Box Layout
12. Hygiene

Metering

- Do you know how much storage is costing?
- How much should it cost?
- PLC Benchmarks - £1 to £12 per tonne stored
- Case studies show costs of £4 - £6, with one store costing significantly more
- Pringle *et al* quotes increases of 23%, 48% and 70% when temperature dropped from 4º C – 3º C - 2º C - 1º C
- Air leakage has a large effect on energy use – 20% increase in energy at 0.6 air changes/hr cf 0.24

Control Systems

- Know how your system works!
- Check that it is working
- Consider a data logger for later analysis
- Could the storage temp. be increased?
- Is dew point temp. control used?
- How does the defrost system work?
- Can cheaper period of power be utilised?

Inverters

- Also called Variable Frequency Drives (VFDs)
- Alters the speed of the motor
- Reducing the speed of a fan by 50% can reduce power use to 15%
- BUT, the airflow produced will also be reduced and this may affect quality
- VFDs may suit some situations but care is needed

Calibration

- Control boxes can only work from feedback from their sensors
- Sensors need to be located correctly
- Maintenance of sensors will be required
- Calibration using an ice-bucket is the best way to check that the sensors are correct.

Insulation

- Insulation reduces the heat movement through the walls or roof
- Normal recommendations is to aim for a figure of 0.3- 0.4 $W/m^2/^oC$
- This should be achieved with about 80 mm of foam or boarding
- 100 mm insulation will reduce heat ingress and temperature differentials

Fans and Ducts

- Fans generally cost as much to run in one year as they cost to buy
- The efficiency of fans is greatly affected by the inlet, outlet and any ducts connected
- Make sure these are considered at installation
- Keep clean to reduce surface roughness

Doors and louvres

- Keep doors closed!
- Protect from weather
- Use plastic strip curtains?
- Ensure insulation is similar to walls
- Seal around edges
- Remember pedestrian access door
- Reduce air leakage as much as possible
- Beware CO_2 build up
- How much air leaks into your store?

Energy Audits

- The external view of the store may be useful
- A review of the energy costs and comparison with benchmarks will become increasingly important
- The store management can be appraised at the same time
- A “carbon footprint” can be calculated also

Box Layouts

- Check that there is enough airflow
- Consider reducing ventilation when not needed
- Monitor temperature differences
- Try not to overload the store
- Ensure efficient airflow around the store

Hygiene

- Cleaning ducts, fans and coils will aid airflow
- It may also reduce disease transfer
- Reducing amount of soil in boxes clearly helps airflow

Key Points for Ambient Stores

- Maximise use of cold air by using an air blending system
- Use a good control system
- Maintain temperatures using a well sealed and insulated building
- Frequent recirculation when outside air is not suitable prevents excessive temperature differentials

Key Points for Refrigerated Stores

- Keep temperatures as high as possible
- Seal and insulate
- Monitor energy use
- Ensure good airflow patterns and minimal temperature variations
- Prevent over-efficient defrosting

Future developments

- Smart metering to become more widespread
- Improving efficiency of the fridge
- Recovering waste heat
- Renewable energy generation

Small Scale Renewables

- Proposed Feed-In Tariffs will make small scale renewables more financially attractive

Wind	<1.5 kW	30.5 p/kWh
Wind	1.5 – 15 kW	23.0 p/kWh
Wind	15 – 50 kW	20.5 p/kWh
Hydro	<10 kW	17.0 p/kWh
Solar Electrical	4 – 10 kW	31.0 p/kWh
Solar Electrical	10 – 100 kW	28.0 p/kWh

•The above tariff is in addition to about 4.5 p/kWh from selling power to the grid, or replaces power purchased at around 10 p/kWh.

•Payback periods for a small – medium sized turbine supplying could be attractively short especially in an exposed location.