Improving efficiency of potato store operation in Great Britain

AHDB Potato Council research project R439
and *Storage 2020* knowledge transfer campaign

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Cost-effective storage

- **Maximise return**
  - **Maintain quality**
  - **Market opportunity**
- **Control costs**
  - **Limit losses: moisture/disease**
  - **Optimise energy use: avoid unnecessary expense**

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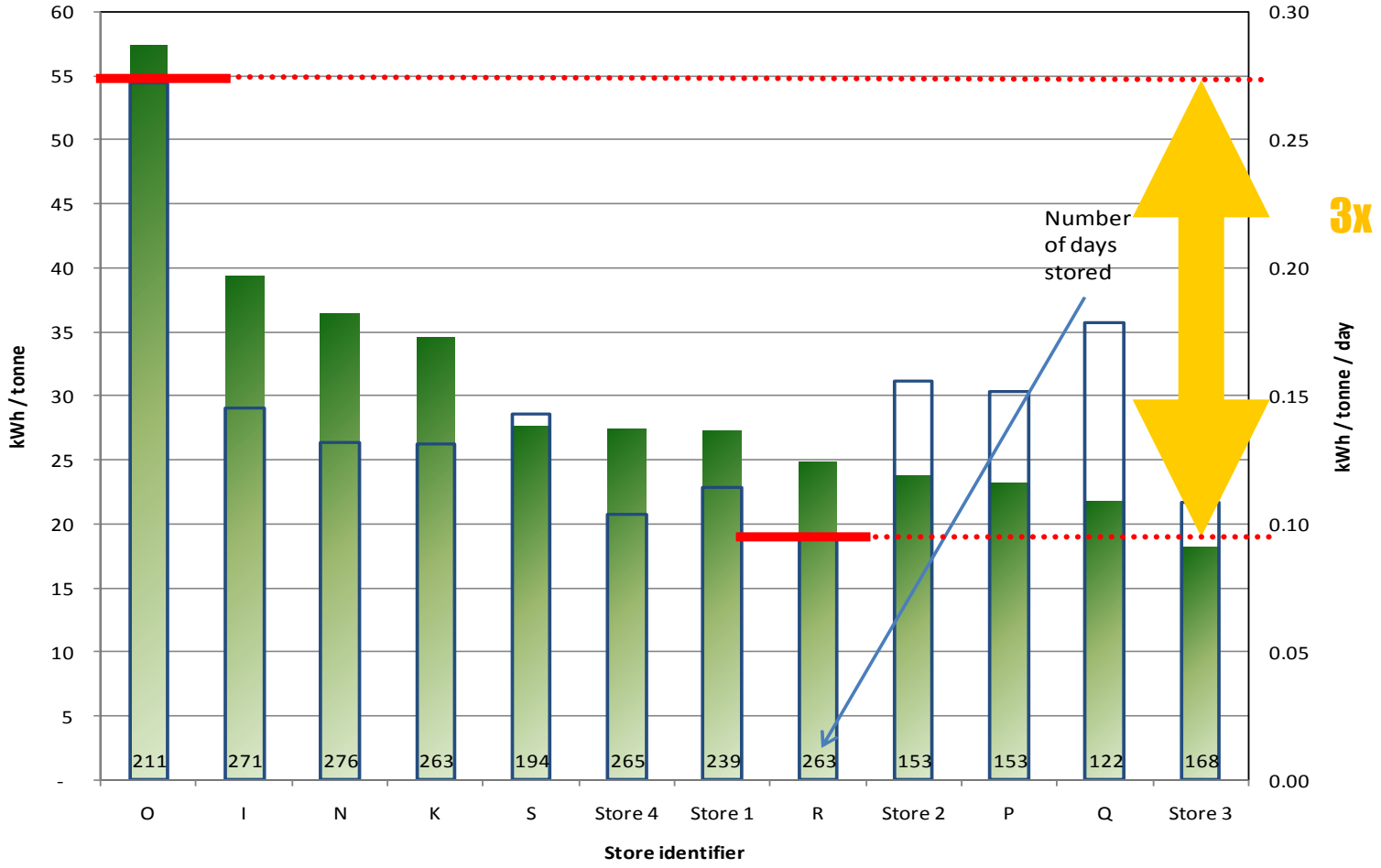
Energy use: previous survey



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Aims

- **To explore the detail behind these differences to explain them more precisely**
- **Identify areas where true savings are realistically achievable**
- **Calculate cost-benefit information**
- **Obtain data to assist the introduction of new, efficient technologies**

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Assessments

- Targeted a range of farms for each aspect
- Sampling approach or short-term logging
- Aim to quantify through direct measurement of store/crop condition or
- Make an assessment of equipment performance

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Areas of interest

- Energy use measurement
- Air leakage
- Refrigeration efficiency
- Air distribution efficiency
- Temperature uniformity
- Insulation performance
- Changes in store hardware
- Humidification
- Carbon footprint

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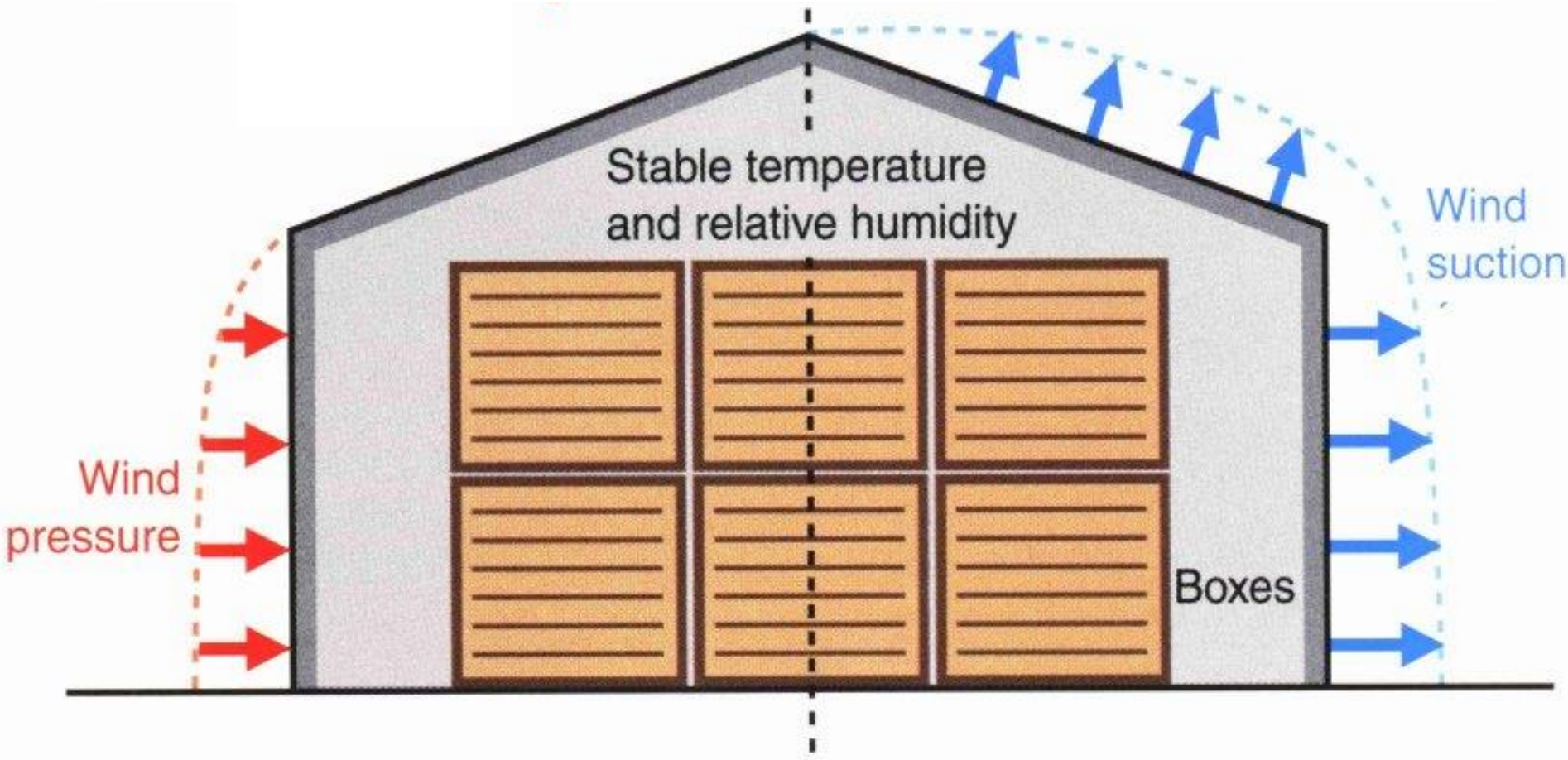
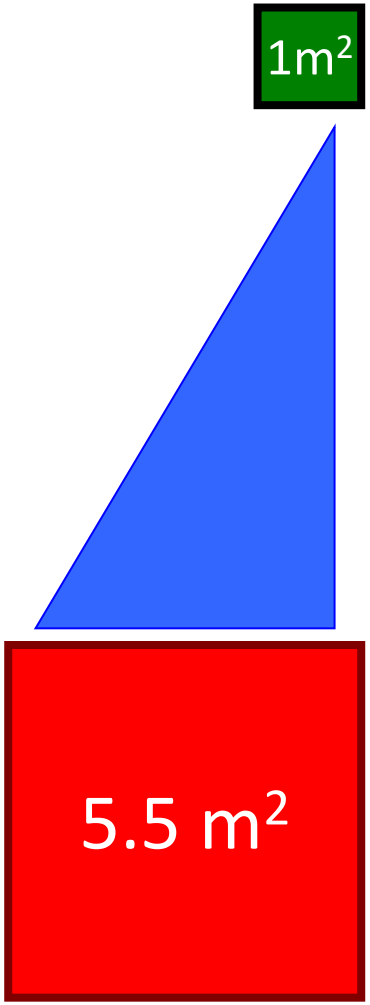
Potato store air leakage



Graphic courtesy of SRUC

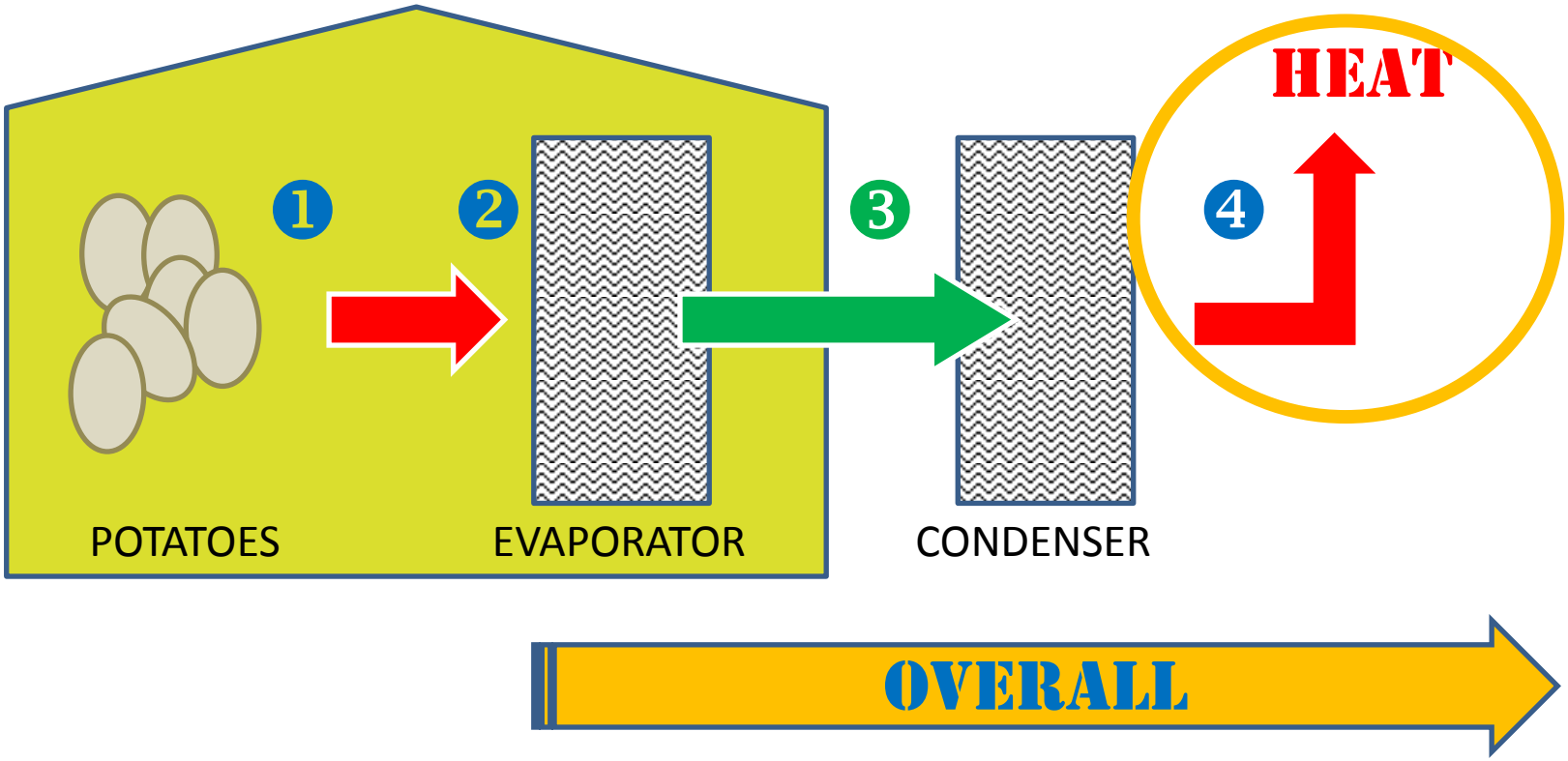
Potato store air leakage



Single hole equivalent for 1000/1500t stores >
Responsible for *c.* 5% of energy use if well-sealed.
Responsible for 35-55% of a store's energy use if not.

Storage refrigeration efficiency

Coefficient of Performance (COP) : kW electricity > kW cooling



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Refrigeration: condenser fans

- Condensers dissipate heat from fridge systems
- Traditionally used pressure switched fans where more units come on as load increases

ON/OFF DEPENDING ON HEAT LOAD

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Upgrade: condenser fan replacement

- Removal of pressure switched units; replaced with continuously variable fan systems

ON/OFF DEPENDING ON HEAT LOAD

NEW FANS RUN CONTINUOUSLY BUT SPEED ADJUSTS ELECTRONICALLY TO LOAD

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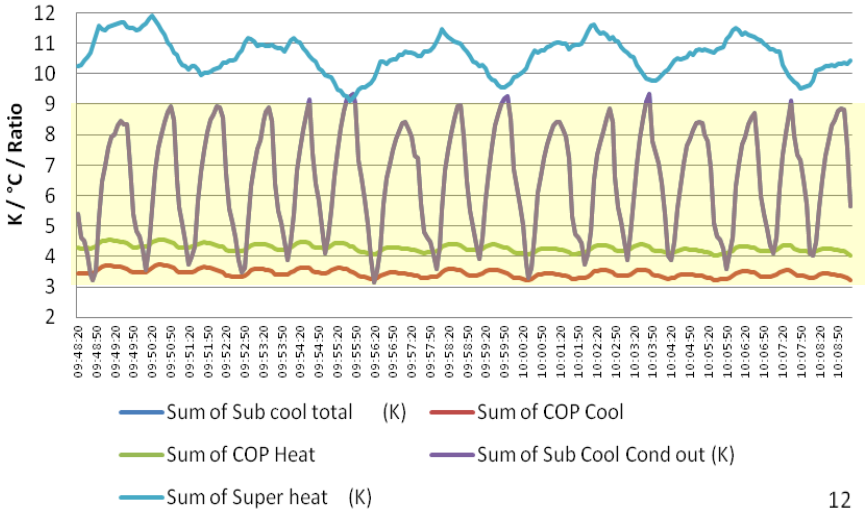
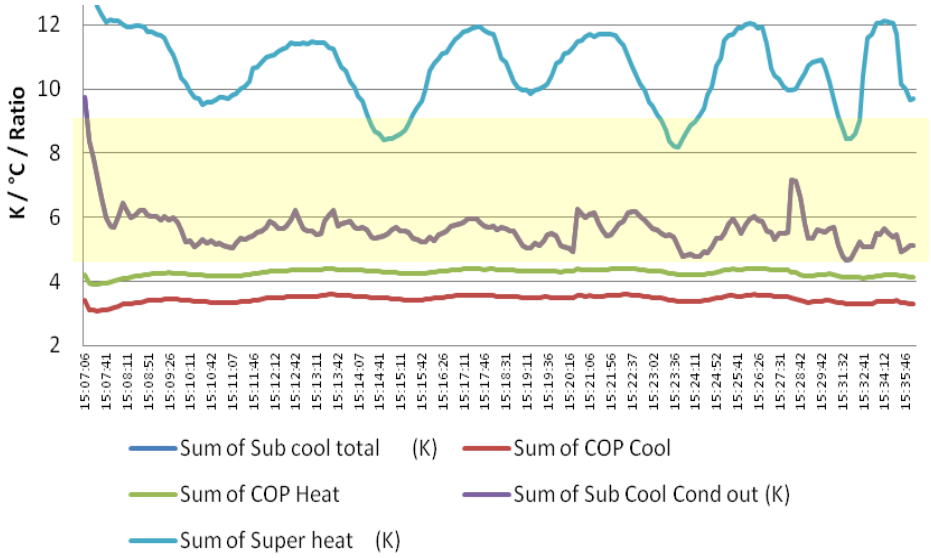
Condenser fans

◀ OLD



NEW ▼



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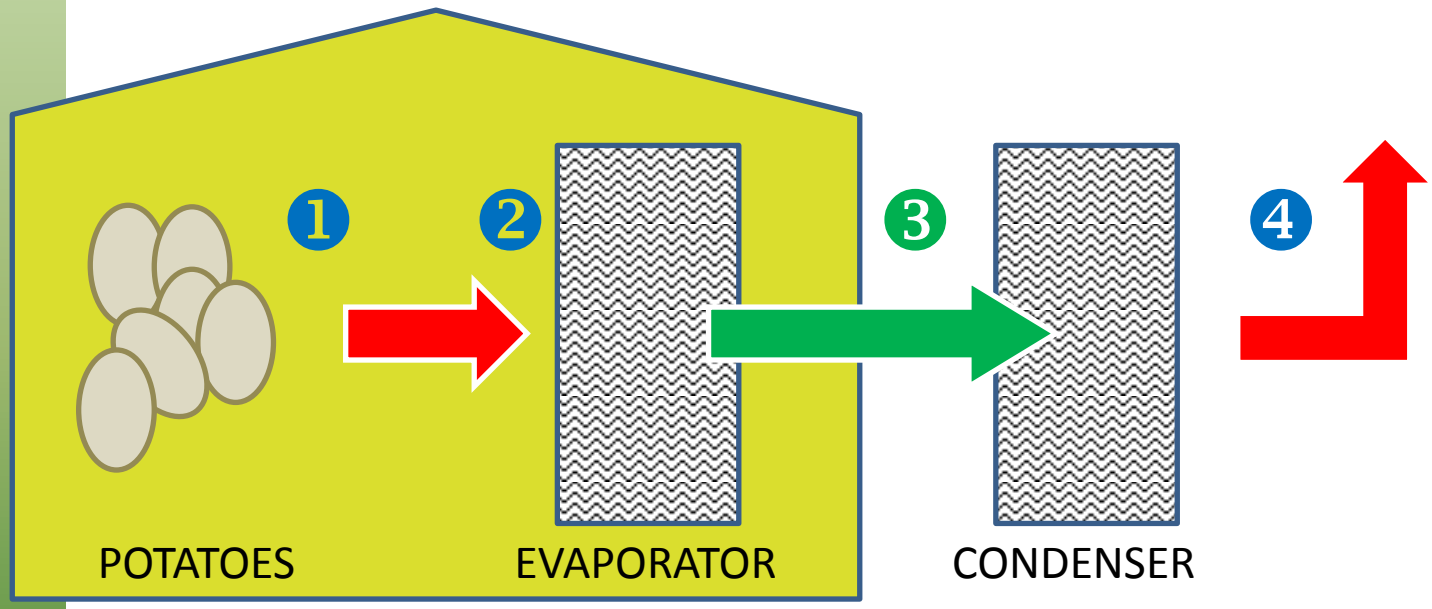
Fridge condenser fan upgrade

Coefficient of Performance (COP) : kW electricity > kW cooling



COP increased from 2.9 to 3.2 (10%)

❷ 83.7 >92.2kW +10%
Fan power use
up by 3%

❸ 104.2>113.4kW +9%
Power use
down by 20%

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Refrigeration efficiency measurement

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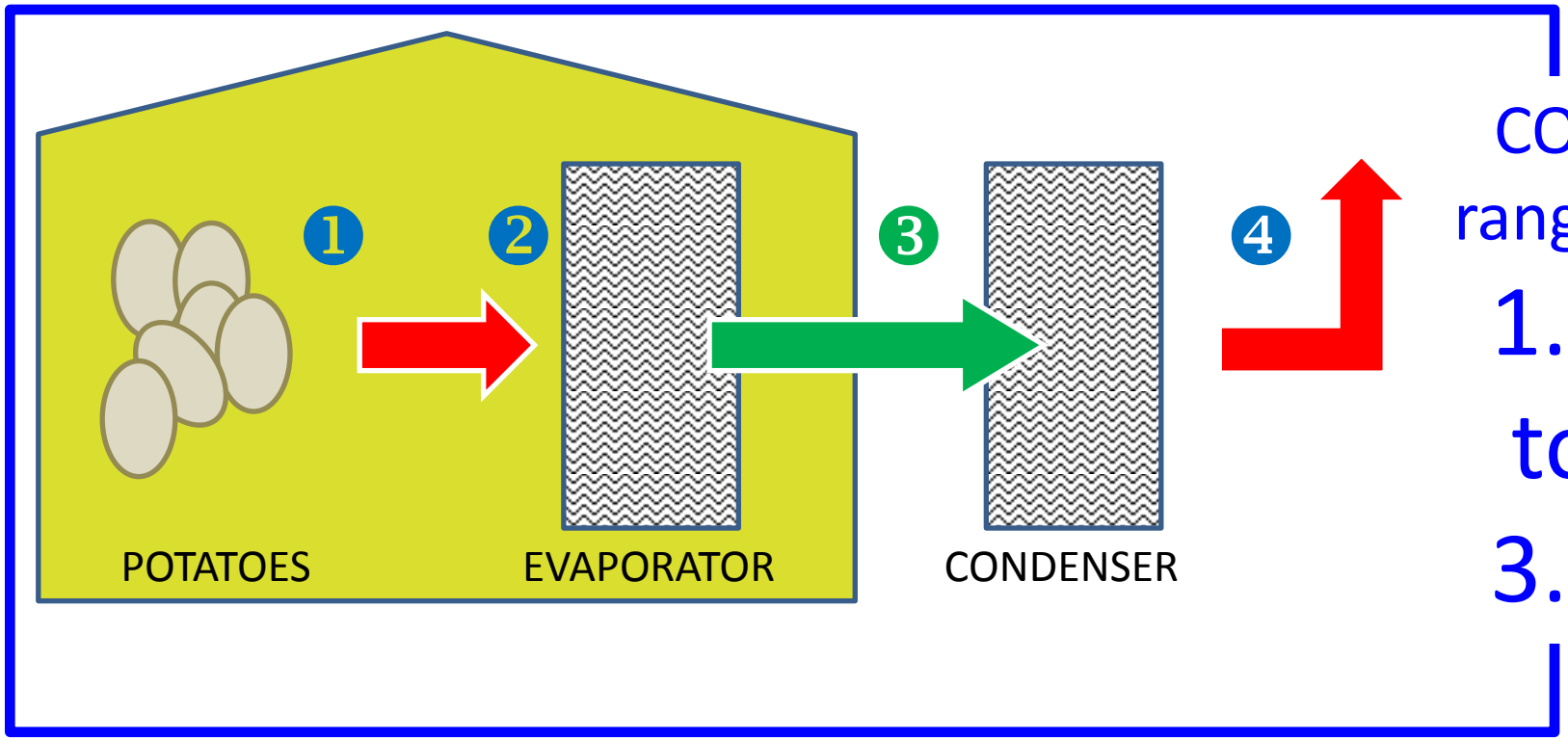
Fridge efficiency overall

Coefficient of Performance (COP) : kW electricity > kW cooling



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Air distribution in overhead ventilated stores

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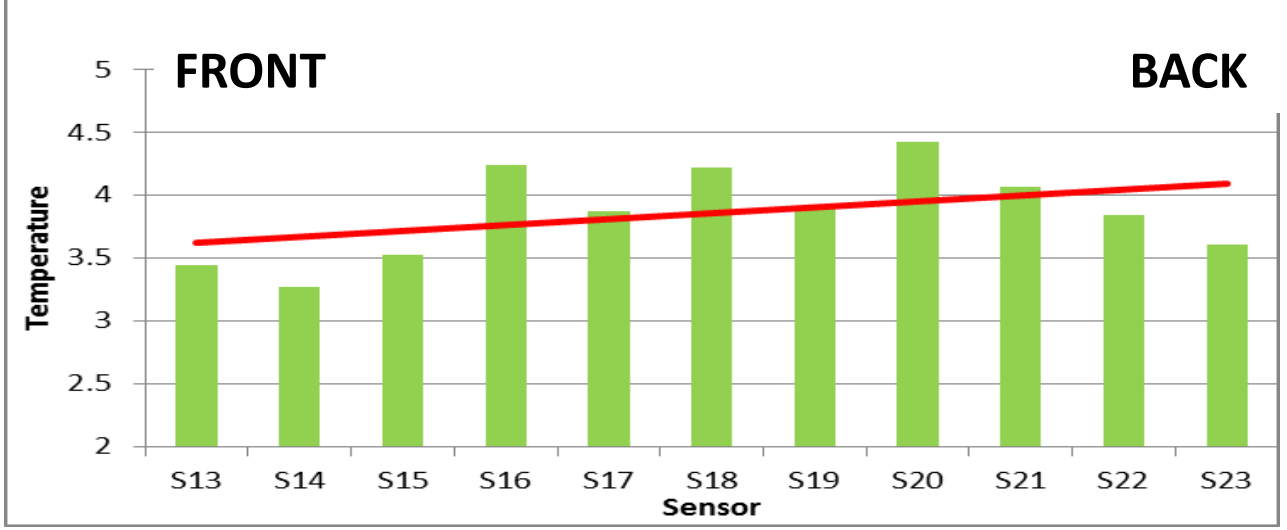
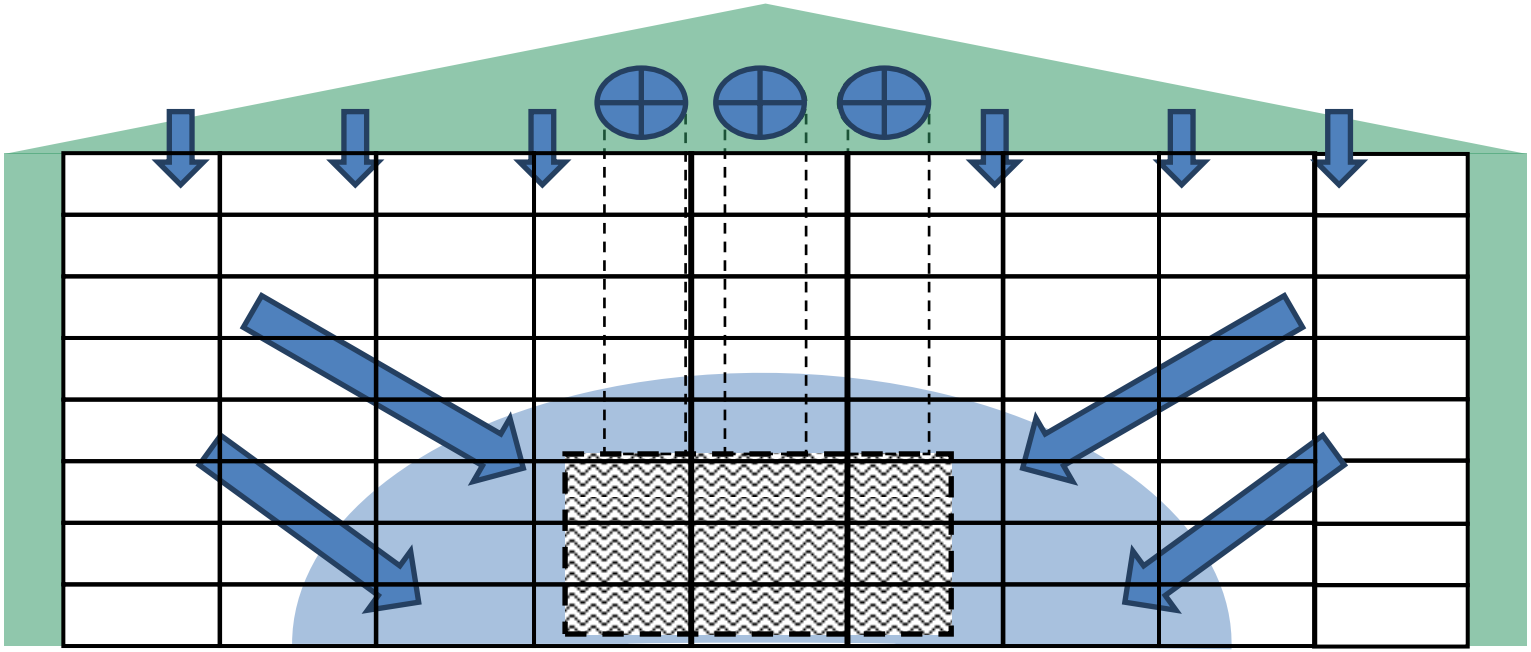
Air distribution





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Summary of project outcomes

- **Air distribution efficiency:**
  - Fans should be sized for worst case conditions and energy savings are then possible from inverters
- **Temperature uniformity:**
  - Air divider curtains can help to even out air flow in ‘overhead throw’ stores but not a complete solution. Other affordable upgrades being evaluated.

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Summary of project outcomes

- **Leaky buildings:**
  - Between 30% and 50% energy savings possible
- **Refrigeration systems:**
  - Best to worst systems 2.5 times different
  - Condenser fan change can pay back in 5 years
- **Insulation:**
  - Upgrades offer energy savings of up to 10%

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Summary of project outcomes

- **Energy monitoring:**
  - continues to highlight the difference between stores with over twice as much energy still used in some than others

Market	2011 (kWh/tonne/day)		2012 (kWh/tonne/day)	
	Highest	Lowest	Highest	Lowest
Fresh	0.21	0.43	0.35	0.51
Processing	0.10	0.20	0.11	0.34

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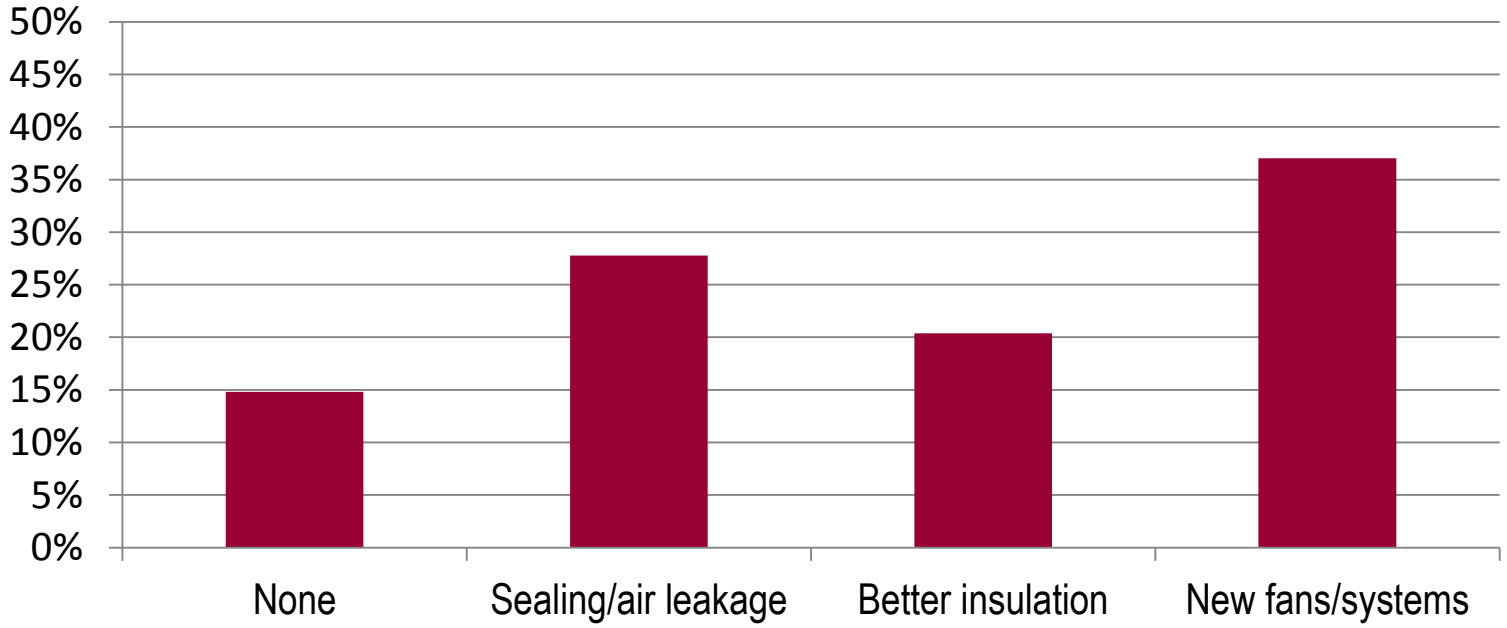
Summary of project outcomes

- **Store management survey**
  - showed industry is moving to better storage systems but more change is still required



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Actions

- Increase use of metering on potato stores
- Promote the uptake of modified and positively-ventilated box storage
- Encourage adoption of energy-saving technologies, eg inverters, adiabatic cooling
- Run Potato Council *Storage 2020* campaign to raise awareness of the need for better uniformity in stores across GB

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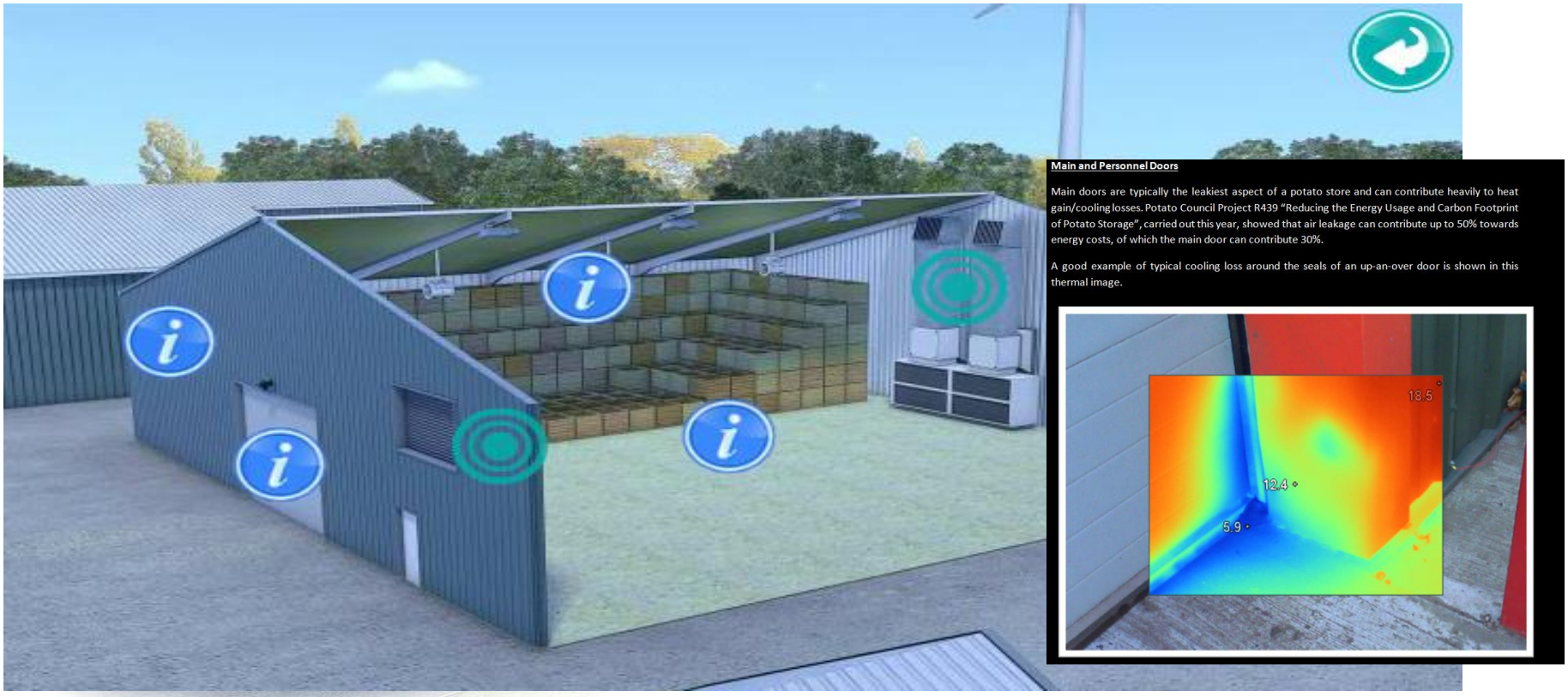
Storage 2020 campaign

STORAGE 2020
an AHDB Potato Council initiative for sustainable potato storage



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Storage 2020 campaign

STORAGE 2020
an AHDB Potato Council initiative for sustainable potato storage

- Major international storage conference:
  13 February 2014
  at Peterborough
- *StoreCheck* nationwide audit service from 2014
- Open day:
  50 years of storage research at Sutton Bridge
  3 July 2014
- Much more to do!

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Acknowledgements

- AHDB Potato Council
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