



Department for  
Energy Security  
& Net Zero

# Managing fuel storage and drying to best practice quality standards

*Biomass Connect  
Webinar 8*

*Speakers: Will Richardson  
Johnathan Andrew  
David Christopher*

*Date: February 15th 2024*

## Webinar starts 4:00 PM



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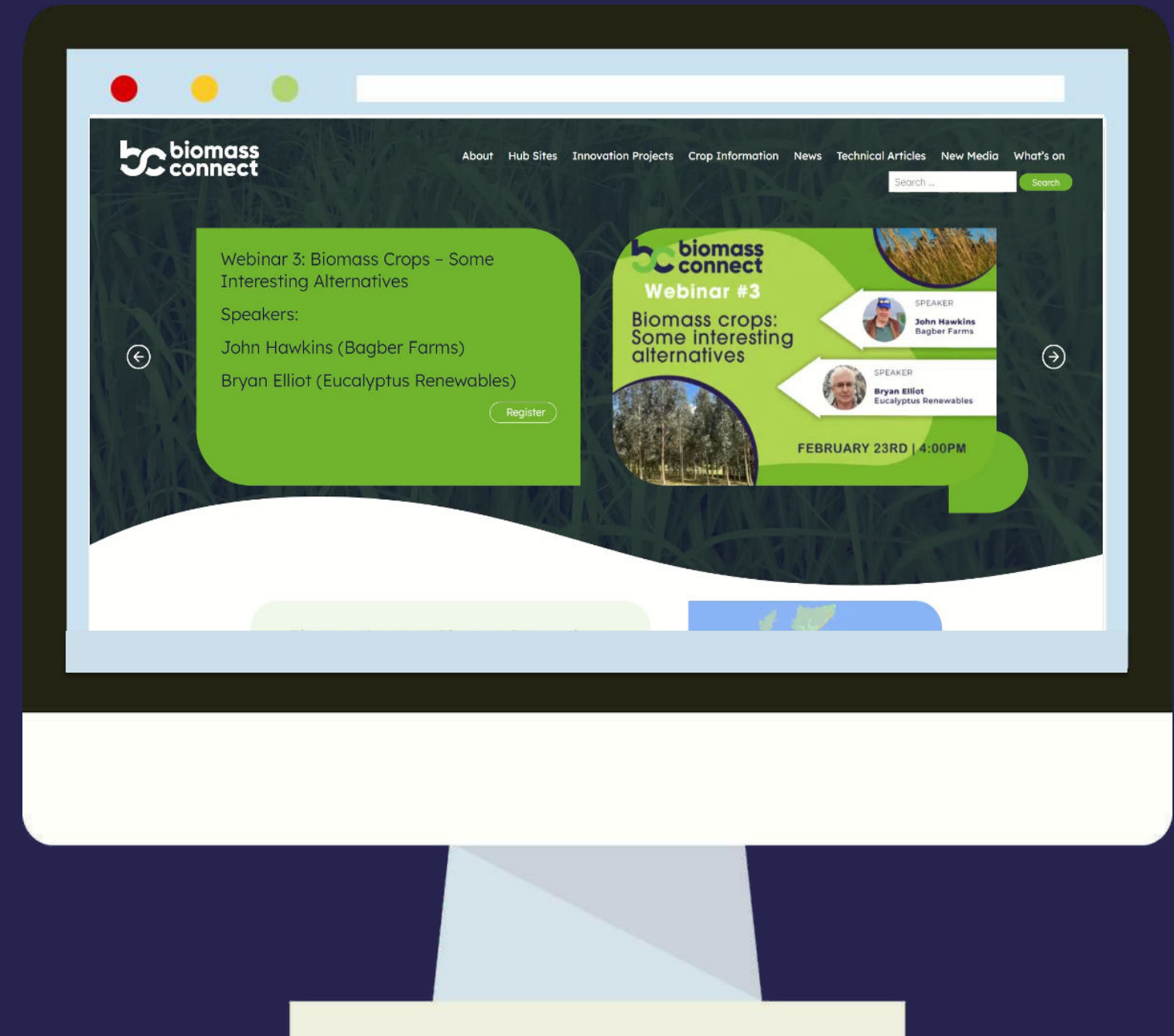
**PART 5** Q & A Session

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**PART 6** Coming Soon

# How to find us

[www.biomassconnect.org](http://www.biomassconnect.org)





# Introduction

Growing biomass crops offers quick turnaround times and high yields, but storing and drying them poses unique challenges depending on the chosen crop and its final use. This webinar tackles that complexity, guiding you through space, logistics, and cost considerations while ensuring your biomass meets market quality standards. We'll delve into different storage and drying options, covering crucial health and safety aspects, along with legal obligations you need to know.

Furthermore, gain valuable insights from two farmers who successfully utilize biomass crops in their boilers, sharing their practical experience and lessons learned.



# Speakers:



Will Richardson  
RDI Associates Ltd.



Johnathan Andrew  
Umberleigh Barton Farm



David Christopher  
Langaller Farm



# Woodfuel Quality Standards

Presented By Will Richardson



# What will we cover?

- **ISO solid biofuels standards**
- **Woodsure accreditation**
- **Requirements for self-suppliers and producer traders**
- **Producing and maintaining a quality control system and manual**
- **Record keeping**
  - **Moisture content analysis – different options**
- **Quality specific points for biomass crops**
- **Health and safety**
  - **Fuel store operations and maintenance**

# Woodfuel Quality Assurance

- **Specifications** – Usually physical properties, these can be set by anyone; a boiler manufacturer, Local Authority, your grandmother



- **Standards** – They have specifications but also include methods of testing for the specifications. These are set by a recognised Standards body, e.g. BSI, CEN, ONORM



- **Quality Assurance** – A method of ensuring and documenting that all the standards are met



- **Quality Assurance Scheme** – An independent third party, monitors and checks that quality assurance is being carried out.



# What are the standards for wood fuel? – BS EN and ISO

ISO: Prepared by Technical Committee ISO/TC 238 'Solid Biofuels' in collaboration with CEN/TC 335. A European Standard was approved in April 2014.

BS EN ISO 17225-2:2021 Fuel Specification and Classes supersedes previous BS EN and country based standards.

## *Some Definitions*

***Solid biofuel:*** Solid fuels produced directly or indirectly from biomass.

***Biomass:*** Material of biological origin excluding material embedded in geological formations and transformed to fossil.

***Woody biomass:*** Biomass from trees, bushes and shrubs.

# Virgin Wood

In the context of the Biomass Suppliers List, virgin wood is:

- Roundwood – includes harvested thin/clear fell) and windblown material
- SRC
- Sawmill residues (primary processing)
- Arboricultural arisings
- Logging residues and brash
- Utility/service/transport link management

Classifications for legality and sustainability under the BSL

Cat A – FSC/PEFC certification

Cat B – full UKFS compliant management plans

Cat C – Risk Based Regional Assessment – have one of these regardless!



# Quality Assurance

## Biomass Suppliers List



- This is not a mark of quality but of legality and sustainability. Applies to woody biomass raw materials and fuels produced from these – chip/hog, firewood, pellets, briquettes
- Allows customers with boilers receiving Renewable Heat Incentive payments to source fuel from legal and sustainable sources in line with UK government regulations.
- If you sell fuel to customers with boilers receiving RHI payments you will need to register on the BSL.
- It is now a requirement to show that your woodfuel products meet a recognised solid fuel standard such as the ISO. Most suppliers of virgin woodfuel are now signed up to Woodsure.
- Not applicable to waste wood sources.

# Quality Assurance



## Categories

- Self Suppliers – uses own wood to fuel their own boiler from a permitted location. Not able to sell fuel to any one else. Use their own BSL registration to claim RHI payments. Fuel raw materials must be sourced from within 50 mile radius of the boiler. If you buy in top up raw materials you must register as a producer trader. You can buy in top up registered fuel form a producer trader.
- Producer trader – Purchases in raw material and processes it into a finished fuel product. Can use own raw materials as well. Sells woodfuel onto a third party. Can also purchase fuel from an authorised supplier.

# Quality Assurance



Woodsure - a Quality assurance scheme for biomass based on Published Standards – ISO. Full UKAS based quality assurance scheme.

<http://www.woodsurre.co.uk/>



Ready to Burn – third party assurance that your product is manufactured from legal sources of timber and is less than 20% mc and fit for use in wood burning appliances

<https://www.readytoburn.org/>

# Quality Assurance

Requirements:

Documented quality control processes – can use existing ISO accreditation systems and processes or can use Woodsure templates.



Key requirements:

- Quality manual – roles and responsibilities
- Process flow chart
- Site plan – segregation
- Identification of critical control points
- Sampling and testing
- Complaints process and how non-conforming product is dealt with
- Fuel quality declaration

# Sampling and testing

- Health & safety.
- Decide when & where to sample.
- Take an appropriate sampling tool - **NOMINAL TOP SIZE**.
- Assess the mass of the heap in tonnes.
- Calculate the number of increments required.
- Take samples.
- Divide sample.

Nominal Top Size:  
The aperture size of the sieve  
which 95% would pass through



# Sampling wood chip in small stockpiles

## NOMINAL TOP SIZE

The size sieve which 95% passes through

P16A it could be as high as	31.5mm
P16B it could be as high as	100mm
P45A it could be as high as	100mm
P45B, P63 and P100 it could be as high as	200-300mm

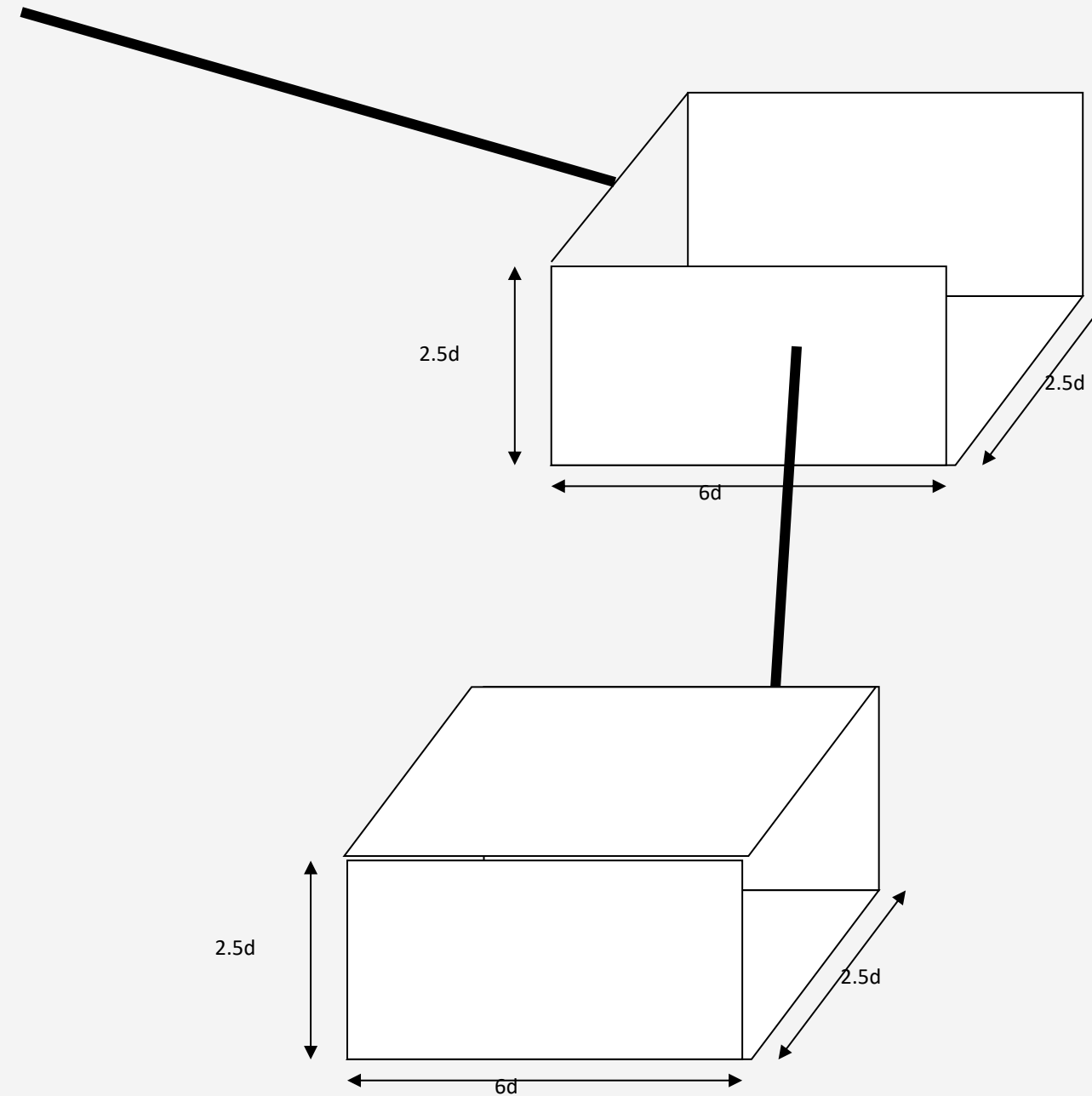


# Sampling tool capacity

$$V_{\min} = 0.05 \times d$$

$V_{\min}$  = minimum capacity of the sampling tool in litres

$d$  = nominal top size in mm



**Example of a scoop and a box**

# Sampling wood chip from stockpile

Methodology

BS EN 14778:2011 Solid biofuels – Sampling

***Estimate size of heap in tonnes***

***Calculate number of increments***

***$n=10+(0.040 \times M_{lot})$***

***where  $M_{lot}$  = mass of the lot in tonnes***

***Take samples from the whole pile***

***Subdivide and mix – cone and quarter***

The principle of sampling is to get a representative sample from the whole lot concerned. Every particle in the lot to be represented by the sample should have an equal probability of being included in the sample. If this is not possible, then note your limitations in your sampling plan.

# Moisture Content Testing

For moisture testing you need a sample of between 3-5kg

For chip, subdivide main sample by cone-and-quartering until it is reduced to 5kg



# Moisture Content Testing

- Measuring fuel moisture accurately is vital.
- Simplest way is to use your oven at home as your “testing facility”.
- Take a known quantity (i.e. weigh it!), e.g. 2000g and place on a tray or in a steel receptacle in your oven and leave for 12 hours at 105oC (until you get 2 consistent weights) .
- Re-weigh your sample and perform the sum:

$W_s$  is weight of sample  
 $W_o$  is weight after drying

$$MC\% = \frac{(W_s - W_o)}{W_s} \times 100$$

e.g. a 2kg sample which, when dried, weighs 1kg had a moisture content of 50%.



# Moisture Content Testing

- There are faster ways to measure moisture:
- Pin-style meter in roundwood prior to chipping, e.g. Delmhorst or Protimeter
- “Bucket” moisture meter, after chipping, e.g. Messtechnik
- Probe moisture meter e.g. Humimeter
- Prices range from £25 to £1,500.

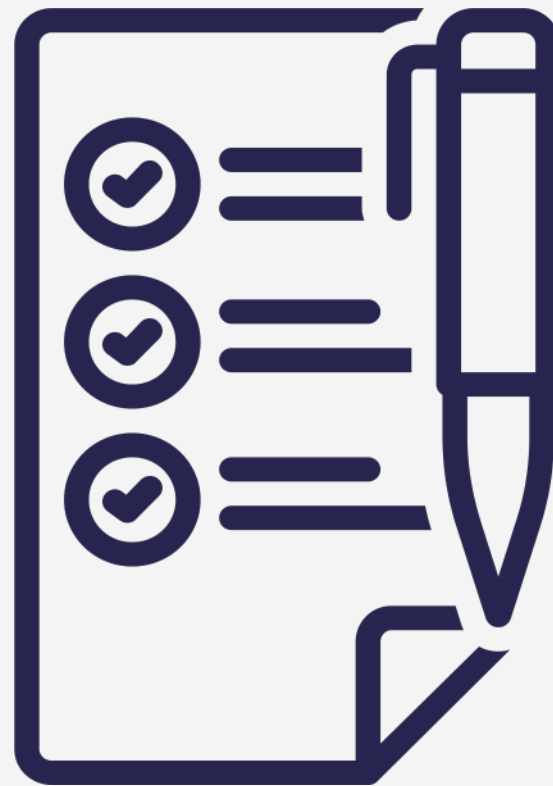


# Particle Size - sieves

- Testing procedure for Önorm M7 133 specified the use of woven wire mesh sieves with square holes, and a vibratory sieve shaker.
- Replacement standard ISO 17225 uses completely new testing equipment consisting of round hole punched plate sieves and an orbital shaker.
- Direct comparisons are not straightforward.
- Particle dimensions given in the standards relate to the aperture in the sieve, not the actual chip size.



# Record Keeping – BSL



## MOISTURE TEST RESULTS

Keep regular record of test results – batch, frequency or both. Date, average, weather conditions, tester name

## RAW MATERIALS

Accurate records of incoming raw materials – type, date, weight/volume, supplier, reference document [invoice, weigh bridge ticket, delivery note etc...]

## SALES

Record of all sales – customer and delivery address, date sold, date delivered, amount [weight/volume/heat] BSL number, moisture content.

# Record Keeping – Woodsure

**All of the above plus more!**

# Quality specific points for biomass crops

- Willow has more bark and that equals more ash. Can have up to 3% ash remains
- Miscanthus has a higher ash content than willow!
- Miscanthus is dusty and therefore particulates are high and often necessitate additional abatement equipment
- Does an emissions certificate that covers just wood chip also cover willow wood chip?
  - Yes – applies to woody biomass
- Willow tends to be higher in N than most roundwood chips
- Willow often is harvested with leaves which can be higher in Cl and S and can cause issues with combustion chambers – this can apply to other species too



# Quality specific points for biomass crops

- Miscanthus is higher in silica and can end up with clinkers – reduce this through controlling air flows and combustion chamber temps and removal of ash on a regular basis
- Willow has a high MC at harvest so needs to be seasoned in one way or another - active drying, passive drying - some biomass will be lost during the process
- There aren't many people using miscanthus because of emissions certificates being brought in back in 2013.
- There are no quality requirements for miscanthus or other grassy biomass types but usual moisture content and particle requirements apply in terms of boiler/feed system requirements
- Sustainability requirements needs to be adhered to through the SFR

# H&S and Fuel Storage

Main hazards relating to storage of woodfuel products are:

- Dust and spores – farmers lung
- Carbon monoxide – processed wood [chip, dust etc..] releases carbon monoxide.
- Movement of machinery – tractors, trailers, telehandlers etc...
- Keep storage areas and hoppers well ventilated.
- Follow risk assessments, site safety rules and signage



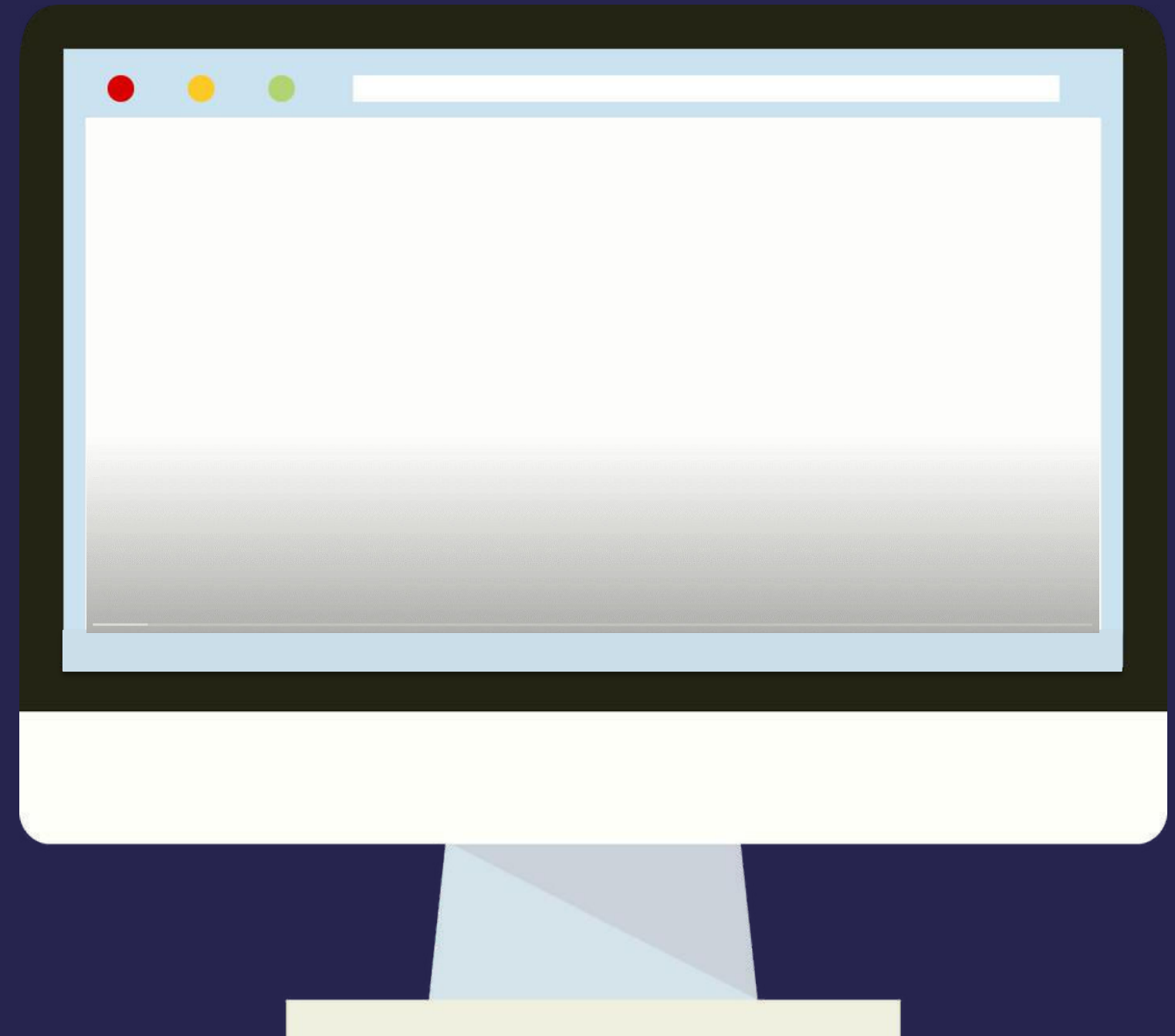




**ANY  
QUESTIONS?**

# Find us on YouTube

Want more content from us? Discover our channel's short films highlighting birds thriving in willow & miscanthus fields, along with our previous webinar featuring Langaller & Umberleigh Farms.



Note: these schemes ended in 2012

**RURAL FOCUS**  
Securing rural futures

# R4F

## Opportunities for farmers

**Prioritise actions for the future**

**Identify opportunities for immediate cost savings**

**Save money and run a more efficient business with the RURAL FOCUS R4F project**

As a farmer in the South West you can access one day's FREE consultancy advice for an on-farm resource review on how best to manage resources such as energy, water, air and non-organic wastes more efficiently. To find out more or take part in the Resource Efficiency for Farmers (R4F) scheme contact RURAL FOCUS on:

**T: 08456 047 047**  
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# R4F

## Technical Advice Days

Keep your renewables plans moving with up to two full days of in-depth technical advice on topics that have been highlighted in your R4F action plan.

So far, this advice has helped farmers to gather essential information on hydro electricity generation, anaerobic digestion, wind and solar energy.

Technical Days are 70% funded through the R4F project. In practice this means that for one day of advice R4F will pay £350+VAT and you only need to find £150+VAT.

Contact RURAL FOCUS now to find out more about R4F Technical Advice Days and how they can support your business.

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**Technical Advice Days can cover:**

- Site location
- Technology selection
- Feasibility
- Incentive payments
- Grid connection
- Planning applications\*
- Environmental permits
- Finance

\* although we cannot fill out applications

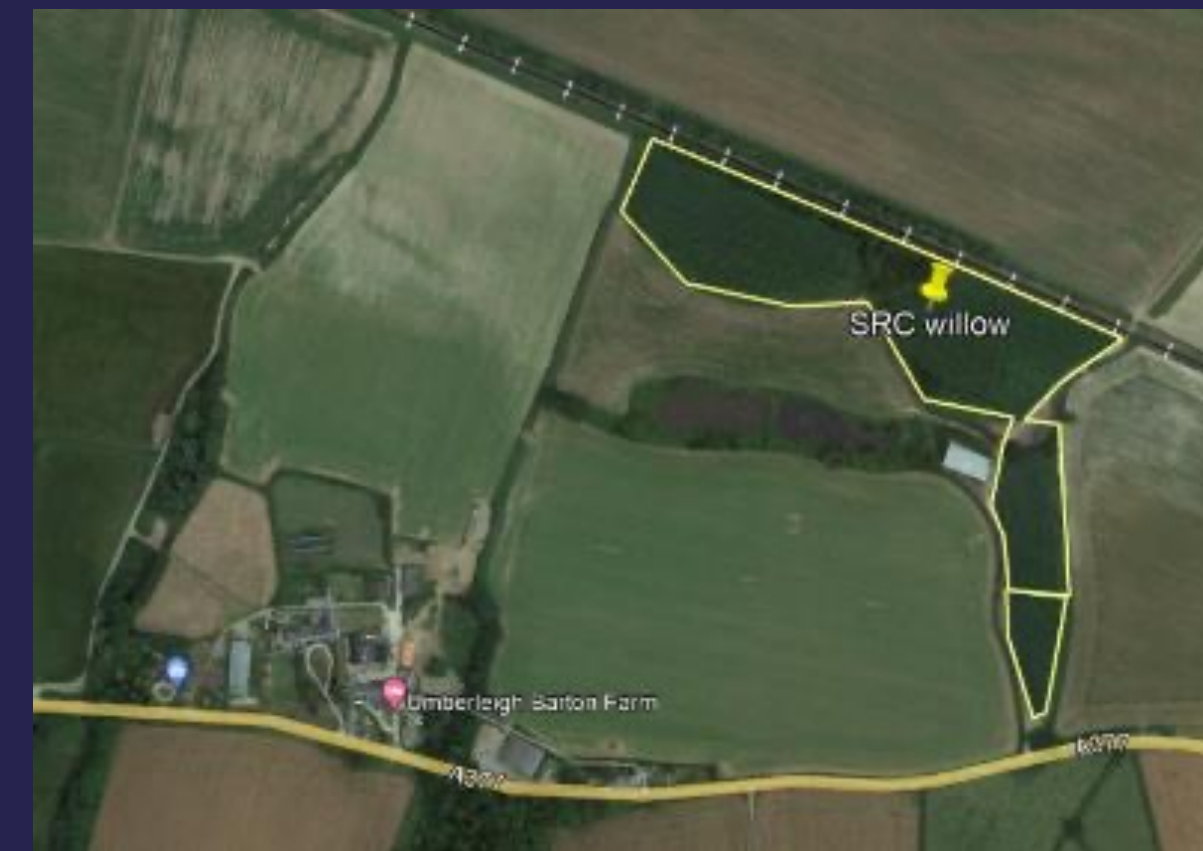


# Umberleigh Barton Farm

Presented By Johnathan Andrew

# Umberleigh Barton Farm

- Mixed farm located in Taw Valley, North Devon
- Predominantly arable farm with diversified activities
- Annual rainfall – 950mm
- Elevation – 23m ASL
- Soil type – Clay (Heavy in places)
- Topography – Largely flat in the wide valley bottom





# Short Rotation Coppice (SRC) willow crop

- 3.95 ha
- Planted 2015
- First harvest 2019
- 12-15% harvested per year
- Avg yield 14.4t/ha @30% MC
- Harvested each year in Jan/Feb



# Biomass Heating System



- ETA 130 kW
- Installed 2013
- 200m underground ring main
- 5 residential properties
- 4 rented out to tenants
- Requires 60 tonnes/chip per year
- Oil boiler back up

# The process

- Harvest in Jan/Feb
- Done by farm worker with chainsaw
- Exploring using a feller buncher
- Move to hard core pad using telehandler





# The process

- Willow is chipped direct from hardcore pad (subject to weather)
- In periods of wet weather willow moved using telehandler to barn and then chipped
- Chipped using tractor PTO driven machine
- Chipped direct into trailer

# The process

- Trailer (c.20m<sup>3</sup>) tipped in barn
- Moved into fuel bunker using telehandler



# The process

- De-ashing
- $\frac{3}{4}$  of a wheel barrowful of ash every 2 weeks in winter (approx. 1800kg of woodchip burnt)
- Ash added to farmyard manure and spread

# Costings

- Mechanised establishment considered essential
- Manual harvesting is labour intensive
- On-farm production provides sufficient fuel security and mitigates impact of third party price increases

Costs	p/kWh
Growing costs	0.86
Harvesting and chipping	3.08
Handling in/out store	
Boiler running & repairs	0.34
<b>TOTAL</b>	<b>4.28</b>



# Lessons learnt

- Essential to have adequate space to handle cut material
- Covered storage is a huge advantage particularly where chip drying is not possible
- Access tracks located around the willow are extremely valuable at harvest
- Repairs and maintenance of boiler can be expensive





# Langaller Farm

Presented By David Christopher

# Langaller Farm

- Poultry & sheep farm located on southern edge of Exmoor
- Largely permanent pasture
- Annual rainfall - 1400mm
- Elevation - 180m ASL
- Soil type - Shallow brashy loam
- Topography - varies, but steep in places



# Miscanthus crop

- 15 ha
- Planted 2007
- 50% used for heating
- Avg yield 7.5tDM/ha
- Harvested each year in April



# Biomass Heating System



- ETA 130 kW
- Installed 2012
- 200m underground ring main
- 2 domestic houses
- 3 poultry sheds
- Requires 50 tonnes/chip per year
- Log boiler back up

# The process

- Harvest in April
- Done by contactors
- Forage harvester producing chips
- Haul to barn where its stored up to 5m deep





# The process

- Handling and storage
- 3m<sup>3</sup> loader bucket with grapple
- Used to load into & out of store



# The process

- Drying
- Pedestal fans @5m centres
- Dry crop from
- 30% MC to 15% MC for long term storage





# The process

- Filling the bunker
- Use a telehandler bucket to transfer to boiler bunker
- 30mins/week



# The process

- De-ashing
- 30m<sup>3</sup> of chip produces a barrowful of ash
- Ash mixed with waste silage & manure
- Spread back on miscanthus ground every few years



# Costings

- It pays but without RHI you need to look carefully
- Scale is important because a big proportion of costs are overheads [mainly boiler repairs]

Costs	pence/kWh
Growing	2.5
Drying	0.16
Handling into store	0.17
Handling out of store	0.74
Boiler running & repairs	2.5
<b>TOTAL</b>	<b>6.07</b>

# Lessons learnt



- Consistent 20mm chop length important for trouble free auger feed
- Hammer mill is no good - low density
- Swathing doesn't work- inconsistent chop length
- Forget trying to chip at 15%- get it in when weather / contractor allows and dry it down
- 38% MC possible
- Transporting chip is messy unless compacted- hence grapple on bucket
- Boiler repair costs easily underestimated
- Bigger boiler required due to de-ashing cycle
- On-floor drying shed for storage would be nice!

**ANY  
QUESTIONS?**



# Upcoming Events:

[www.biomassconnect.org/whats-on/](http://www.biomassconnect.org/whats-on/)

JOIN  
**bc biomass connect**  
and the BFI Innovation Projects  
at  
**Low Carbon Agriculture 2024**  
6-7 March 2024 | NAEC, Stoneleigh

The poster features a solid blue background. At the top, the word 'JOIN' is in white. Below it is the 'bc biomass connect' logo, with 'bc' in a stylized green and blue font. The text 'and the BFI Innovation Projects at' is in white, followed by 'Low Carbon Agriculture 2024' in a large white font. At the bottom, the dates and location '6-7 March 2024 | NAEC, Stoneleigh' are written in white.

**bc biomass connect**  
**SHOWCASE EVENT**  
**Biomass Connect**  
*Save the Date*  
7th & 8th November 2024  
*watch this space*  
Updates Coming Soon

The poster has a background image of a field with young trees. The 'bc biomass connect' logo is in the top right. The words 'SHOWCASE EVENT' are in large, bold, white letters. Below that, 'Biomass Connect' is in a green font. To the right, there is a white vertical line, and to its right, the text 'Save the Date 7th & 8th November 2024' and 'watch this space Updates Coming Soon' is written in a white, italicized font.

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