Agricultural biomass frontier

Industry insights & Opportunities

Agricultural biomass

Crop residues

- Wheat straw, corn stover
- Rice husks
- Sugar cane bagasse
- Soybean hull

Animal waste

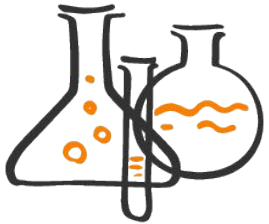
- Manure, slurry
- Bedding material

Biomass crops

Conventional energy crops

Why grow biomass crops?
What about food?
Is this environmentally friendly?

- **45% of EU maize is grown for Ethanol.**
- **50% of US soybeans are converted to biodiesel.**
- **55% of sugarcane in Brazil is cultivated for Ethanol.**



Grown on prime food land
Requiring substantial amounts of fertiliser & irrigation

Renewable biomass crops

No pesticides, no herbicides
No fertiliser, no irrigation

Short rotation trees

- Willow, Poplar
- Eucalyptus
- Paulownia

Grasses

- Switchgrass
- Napier grass
- Miscanthus

Renewable biomass crops

No pesticides, no herbicides
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Short rotation trees

- Willow, Poplar
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Grasses

- **Switchgrass**
- **Napier grass**
- **Miscanthus**

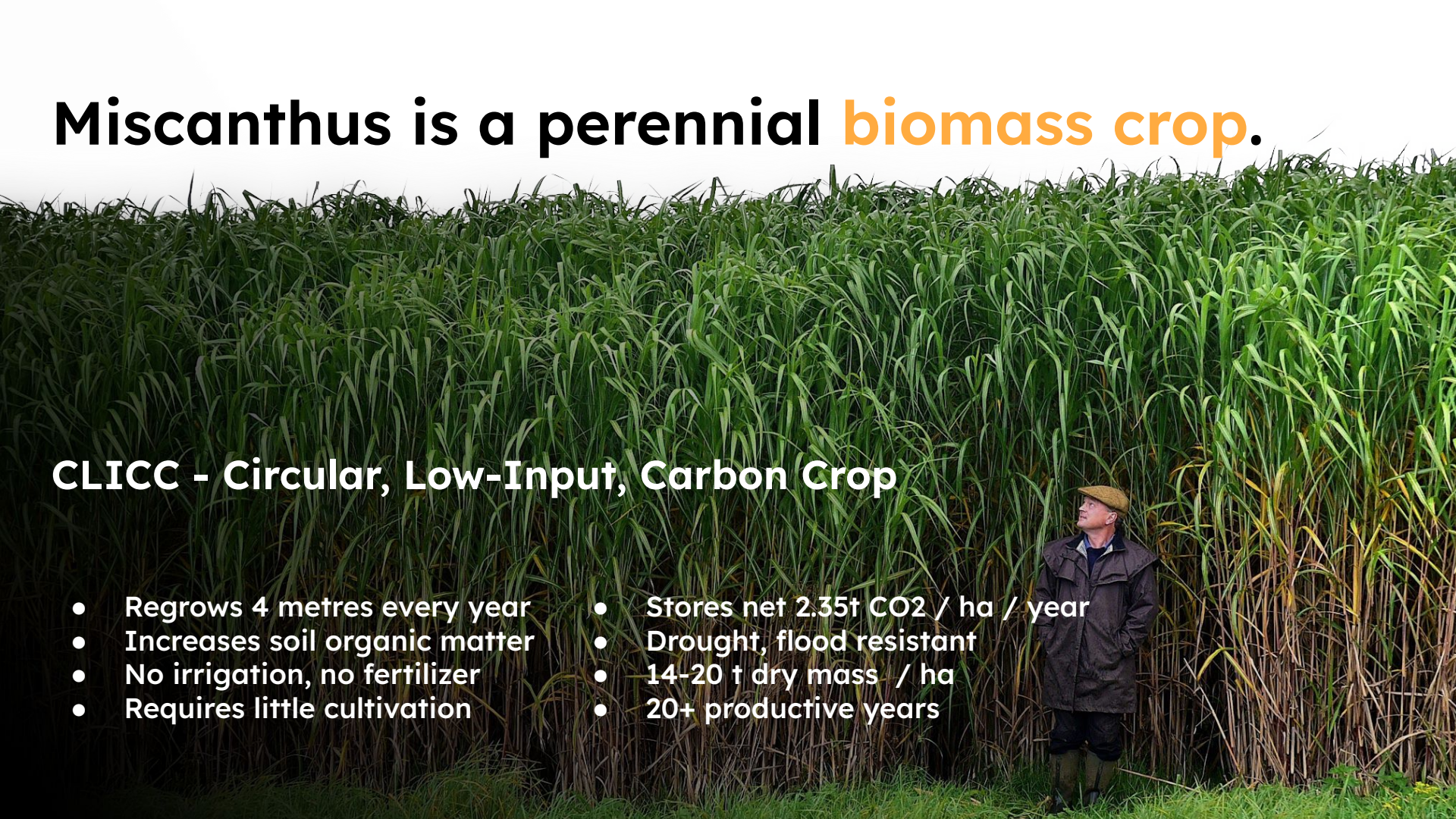
- Perennial
- Little maintenance
- Less productive fields
- No special machinery

In continental climates Miscanthus x giganteus grass grows prolifically.

What Terravesta does

- High performance varieties
- Planting material
- Establishment & machinery
- Biomass buyback contracts
- Biomass supply contracts
- Logistics

Miscanthus is a perennial biomass crop.

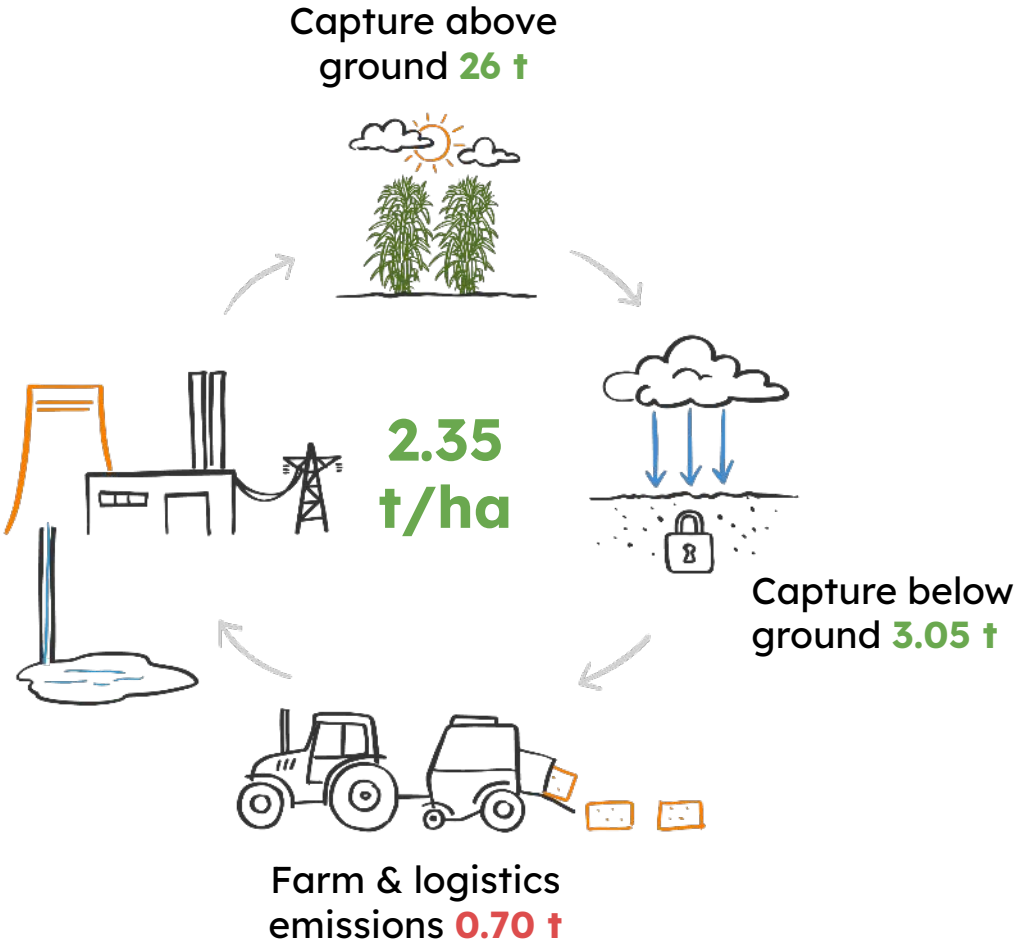


CLICC - Circular, Low-Input, Carbon Crop

- Regrows 4 metres every year
- Increases soil organic matter
- No irrigation, no fertilizer
- Requires little cultivation
- Stores net 2.35t CO_2 / ha / year
- Drought, flood resistant
- 14-20 t dry mass / ha
- 20+ productive years

Miscanthus is net Co2 negative (1)

even when considering how much is emitted to plant, collect, and move it.



1 Lask J., Kam., (2021), GCB Bioenergy

Miscanthus field in late winter prior to harvest

Harvesting dry biomass with a forage harvester

Baling & stripping after harvest into square bales


Transport to the user, approx 22 t / truck

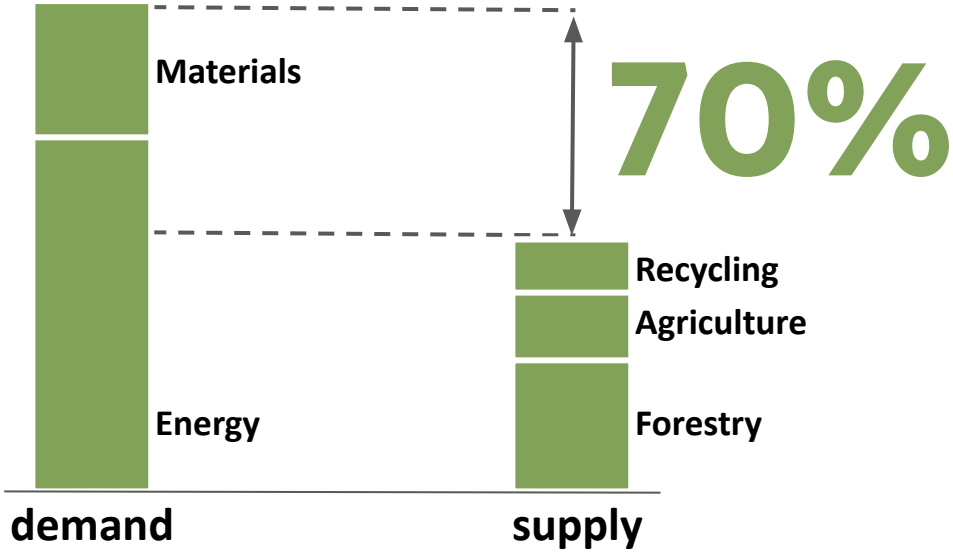
Biomass demand

Increase since 2000 (1)

3x

Demand vs Supply

Gap by 2050 (2)



1 European Environment Agency - The EU biomass puzzle

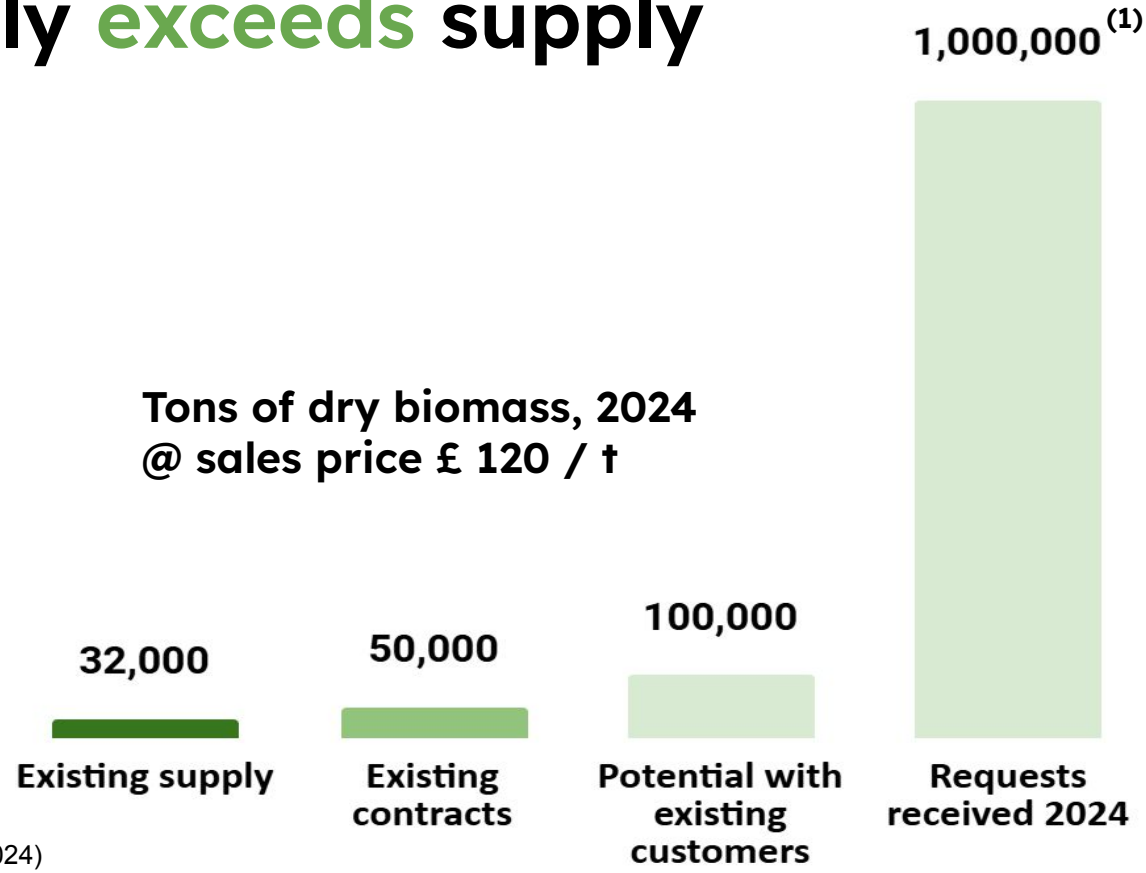
2 Material Economics by McKinsey & Company - EU biomass use in a net-zero economy, 2021 figures

Demand vastly exceeds supply

30x

of current supply

Tons of dry biomass, 2024
@ sales price £ 120 / t



1 Terravesta “industrial request” list (2024)

Robotized seed-based planting

2007 - Wild varieties

Planting rate: 4-5 ha / day
People required: 4
Emergence rate: 48%
Scale: hundreds of hectares
Limited to short distance deliveries

2018 - ATHENA™

Planting rate: 3-4 ha / day
People required: 5
Emergence rate: 82%
Scale: hundreds of hectares
Limited to deliveries within Europe

2027 - Aphrodite 43™

Planting rate: 10 ha / day
People required: 1-2
Emergence rate: 94%
Scale: tens of thousands of hectares
Allows worldwide expansion

Animal bedding

- **Naturally dry**
- **Highly absorbent**
- **Does not degrade fast**

Use case US: “Manure as a service”

- Rent land from chicken farmer
- Deliver fresh bedding material
- Collect manure from farm
- Send to biogas plant
- Press digestate into pellets and sell as fertiliser

Heating glasshouses

- **Naturally dry**
- **High calorific value**
- **Little ash residues**

Use case UK: “Reverse carbon”

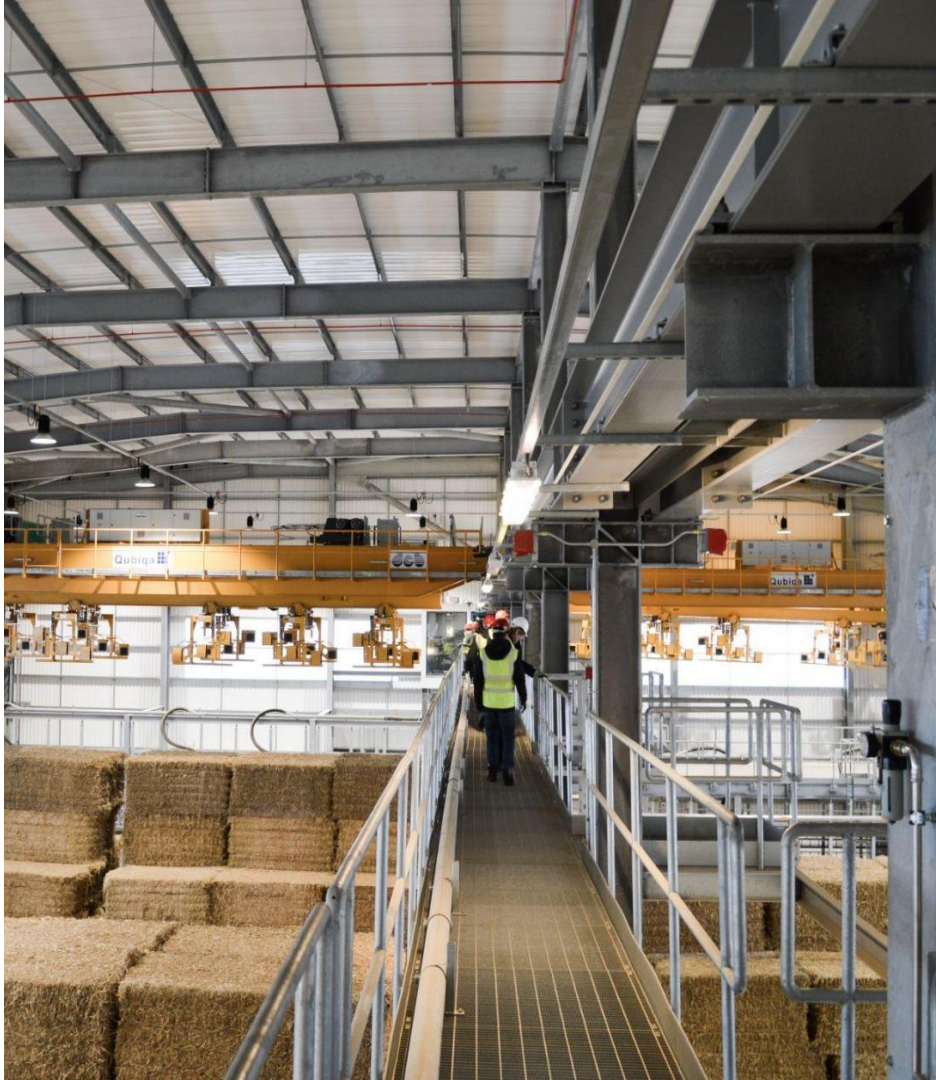
- Grow on marginal land
- Heat the vegetable glass house
- Put biochar back to the soil to improve its long-term fertility
- Get paid in carbon credits

Electricity generation

- **Naturally dry**
- **High calorific value**
- **Little ash residues**

Use case UK: “Renewable energy”

- Grow on marginal land
- Deliver to power station
- Blend with straw for better burn rate
- 25% less maintenance, higher up-time



Peat substitute

- **Suppresses weeds**
- **Maintains moisture**
- **Locally sourced**

Use case DE: “Re-peat”

- Rent land from nearby farmers
- Dedicated processing facility
- Reduce use of peat
- Sell growth medium at higher margins

Wind break

- **Grows fast and tall**
- **Drought resistant**
- **Very dense**

Use case EG: “Ismailia strawberries”

- Plant at the border of fields to shield from warm winds
- Cut at the end of the growth season
- Chip and use as mulch and growth medium

TiO2

- **High lignin content**
- **High calorific value**
- **Low chloride content**

Use case EG: “Titanium dioxide”

- Use as coal substitute
- Reduce CO2 emissions
- No change to production process

Non woven fabric

- **Medium sized fibre length**
- **Easy to process**
- **High availability**

Horizon Europe: “FibraVita”

- Use of low-impact feedstocks
- Cellulose from non-toxic solvents
- Spin into microfibrillated cellulose (MFC)

Low carbon biogas

- **High water content (green)**
- **Acceptable biogas potential**
- **Negative CO2 footprint**

Use case UK: “FibraVita”

- Cut green once or twice a year
- Cut into short chips
- Put to clamping
- Blend to reduce CO2 footprint
- Sell low carbon footprint biogas at higher margins

Xylooligosaccharides

- **High fiber content**
- **High lignin content**

Use case UK: “XOS sugars”

- Extract sugars from biomass for animal feed, and prebiotic dietary fibres
- Sell lignin and residual fibres
- Convert to biochar for use in steel production

Woodcrete

- **Very sturdy canes**
- **Simple processing**
- **Very low moisture content**

Use case UK: “Ecobrix”

- Bond with cement
- High margin low-carbon footprint product
- Earn CO2 credits for long term storage

Phytoremediation

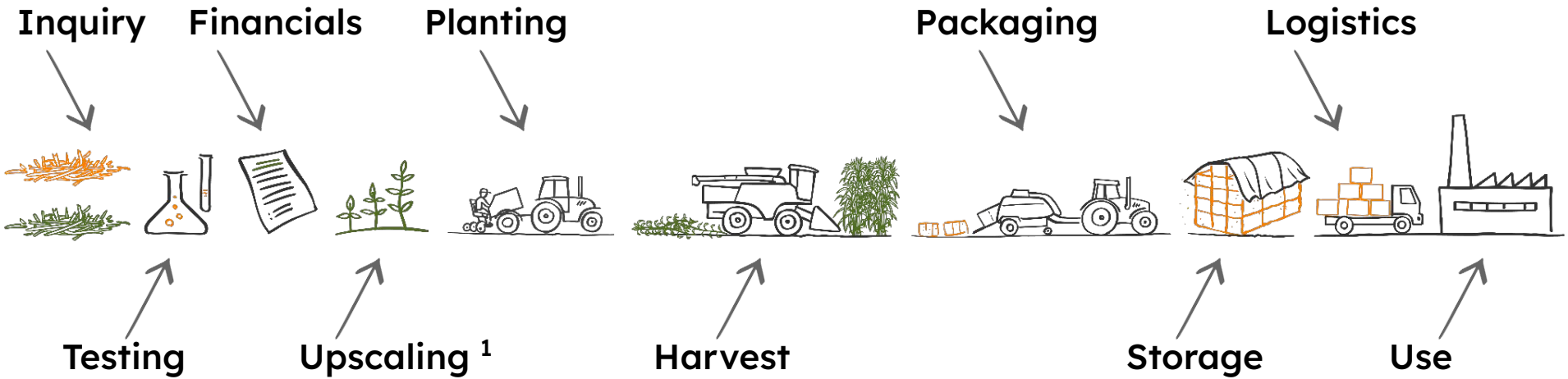
- **Proven to clean the soil from heavy metals and toxic contaminants**

Use case UKR: “Energy crop”

- Plant on contaminated soils to remove contamination
- Use for heating and electricity generation
- Provide income opportunities to returning decommissioned soldiers without farming knowledge

No spot market

Miscanthus isn't traded—It's cultivated on demand.



1 Worst case scenario, requiring nursery upscaling first before planting

Biomass grown on less productive land.

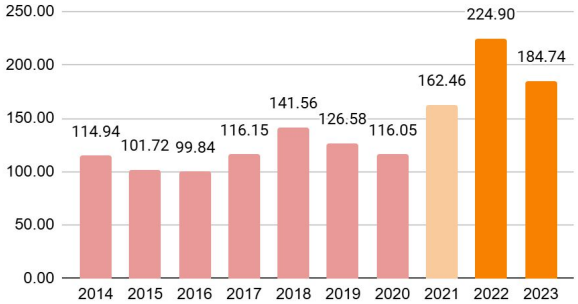
- Idle, under-utilised, abandoned
- Distant, oddly shaped
- Subject to erosion, salinization, flooding
- Stony, less fertile, low on organic content
- Polluted

Food, carbon, countryside - farmers do it all, and need income to keep doing it.

Biomass crops: ditching the high-input trap

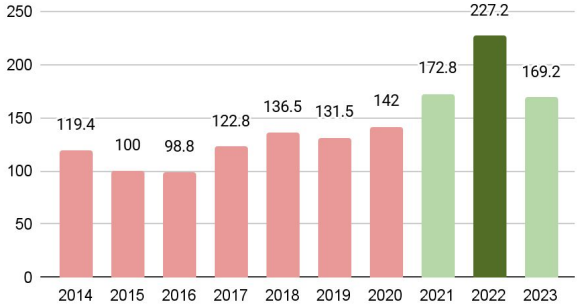
Low yielding land

UK barley prices GBP



Market prices with no return / loss for grower

UK wheat prices GBP



UK Miscanthus

	£ / ha
Gross output	1,300
Transport	172
Cutting, baling	310
Gross margin	818

Average UK farm margin by soil type[1]:

- Average **183** £ / ha
- High **363** £ / ha

1 Strutt & Parker 2023
2 John Nix Pocketbook 2024, statista.com

The next revolution?

Mechanical age
Mass production with machines

Energy age
Progress with oil, gas and electricity

Information & AI age
Digitally connected and smarter world

Farming renewable biomaterials?
Redefine energy, materials and pollution

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