ADEPT LIVE LABS 2 DEEP DIVE

Greenprint

Decarbonising highway verge management



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10 November 2026

Project partners

Session agenda

One-hour deep dive

How the trials inform decisions on verge services, processing and investment.

01	**Project origins and scope**	5 min
02	**Verge operations and engagement**	8 min
03	**Biomass processing and road trials**	13 min
04	**Carbon and whole-life cost evidence**	12 min
05	**Benefits, risks and local adoption**	12 min
06	**Peer discussion**	10 min

Technical appendix available for questions and follow-up

Documents Available

Strategic Outline Business Case >



End of Project Report



How To Guide



Process Report



ADEPT | LIVELABS2 Decarbonising Local Roads

A- A+

ABOUT | MEMBERSHIP | BOARDS & GROUPS | PROGRAMMES | PARTNERS | DOCUMENTS | NEWS & EVENTS | BLOGS

South Gloucestershire Council and West Sussex County Council: Greenprint

Related Documents:

- Greenprint Year 2 Final Report — Category: Live Labs 2 — Date: 6 November 2025
- Carbon baseline appendix: Greenprint proforma — Category: Live Labs 2 — Date: 13 February 2025
- Carbon baseline appendix: West Sussex cut and collect — Category: Live Labs 2 — Date: 13 February 2025
- Carbon baseline appendix: Greenprint cut and collect SG — Category: Live Labs 2 — Date: 13 February 2025
- Carbon baseline report: South Gloucestershire Council and West Sussex County Council - Greenprint — Category: Live Labs 2 — Date: 13 February 2025
- Carbon plenary - South Gloucestershire Council and West Sussex County Council: Greenprint — Category: Live Labs 2 — Date: 22 April 2024

Blogs

- Live Labs 2 blog - Greenprint update — Greenprint's Journey: overcoming challenges and celebrating successesThe latest Live — Read more >
- Live Labs 2 blog – update from South Gloucestershire: Greenprint - delivering innovation at the cutting edge — This month our Live Labs 2 blog comes from Chris Harris, lead officer for Greenprint, South G — Read more >
- Live Labs 2 blog - Greenprint (South Gloucestershire Council and West Sussex County Council) — Revolutionising Green Estate Management: Embracing Innovation for a Sustainable Future — Read more >

Find out more:

- beta.southglos.gov.uk
- www.westsussex.gov.uk

The origins of Greenprint

Two councils brought earlier verge work into Live Labs 2

2021 West Sussex

Trialled cut-and-collect with the South Downs National Park Authority to explore roadside biodiversity benefits.

2022 South Gloucestershire

Surveyed grassed areas for potential changes to management, drawing on Plantlife guidance.

2023 Greenprint

The councils joined forces to test emissions from mowing and decomposing cuttings, and whether collected grass could supply fuel or biochar.

DfT-funded Live Labs 2

Greenprint formed part of ADEPT's three-year, £30m UK-wide programme to decarbonise local roads.

The Greenprint system

Change the cutting regime

Compare cut-and-collect with the existing cut-and-leave service.

Test the operating model

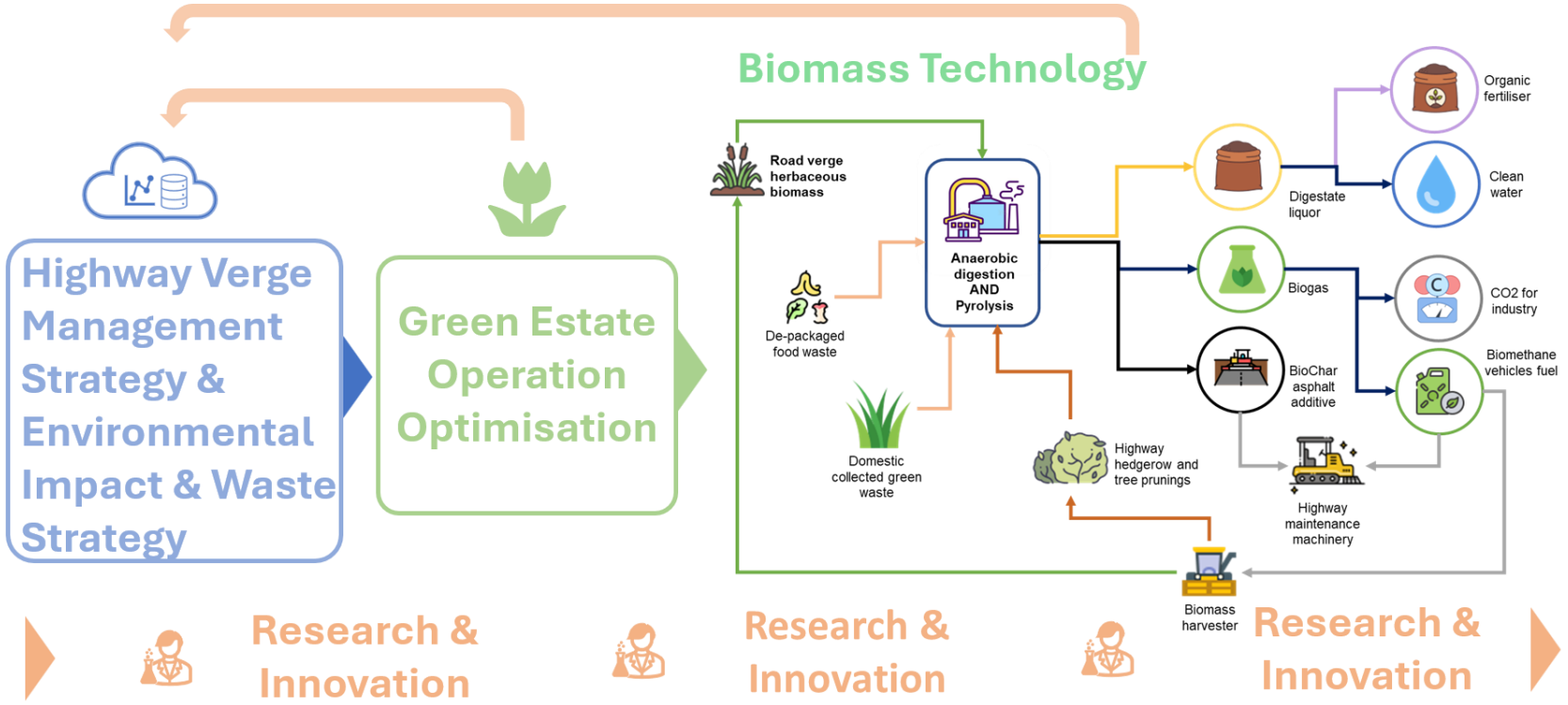
Measure crew and machinery performance, storage and haulage.

Test treatment routes

Assess anaerobic digestion, pyrolysis and hydrothermal carbonisation.

Find uses for the outputs

Explore energy, fleet fuel and biochar in road materials.



Delivery and assurance

The Outline Business Case set the questions

Delivery workstreams

Verge management strategy, operational trials, biomass treatment and end uses.

Published outputs

Thought Leadership Report, Process Guide, How to Guide and route business cases.

Evidence and assurance

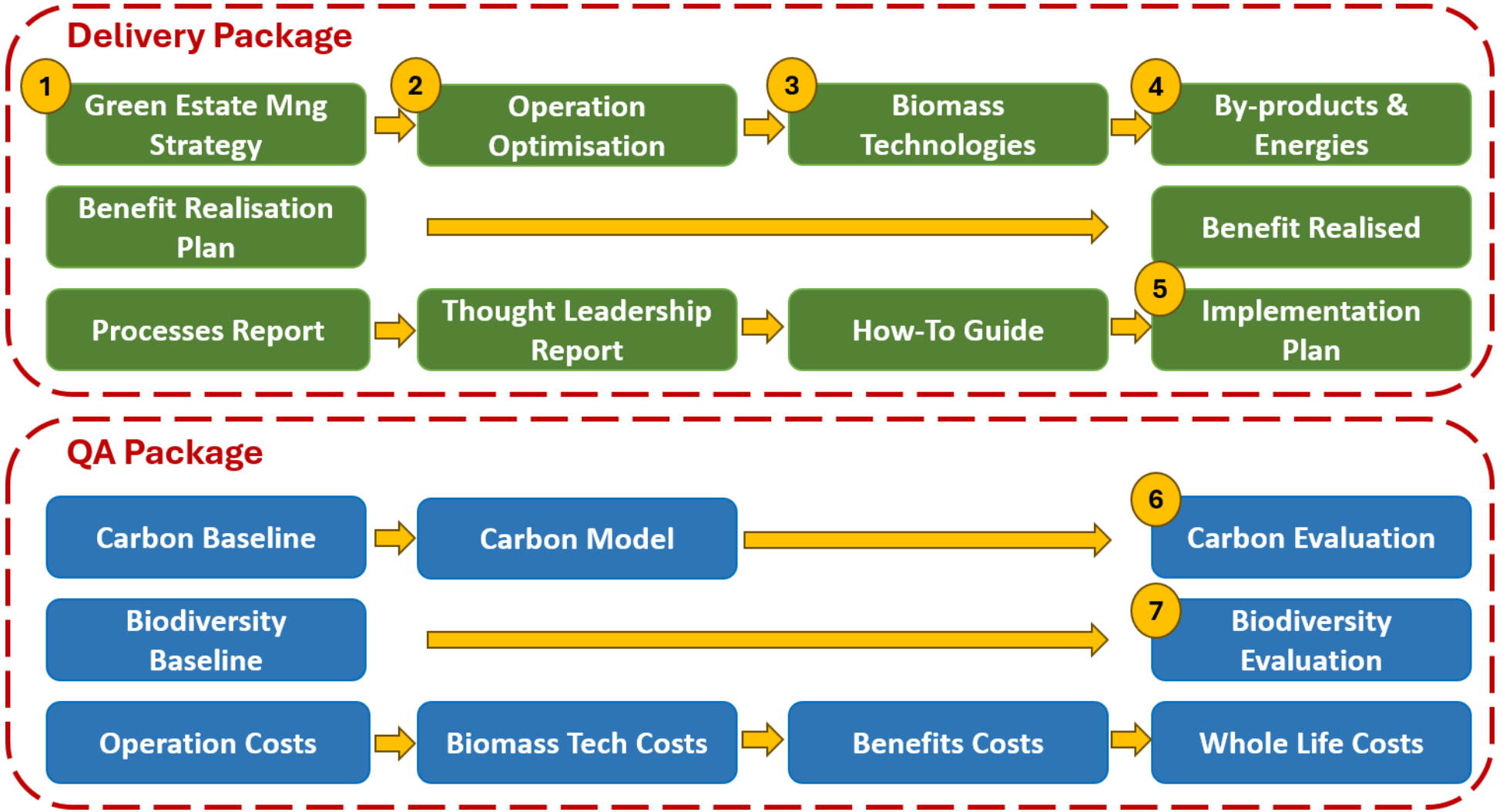
Use carbon and biodiversity baselines, whole-life costs and a benefits review to test the options.

Local decision and delivery

Each authority uses the evidence to build a business case and delivery plan for its service.

Delivery and assurance

Core Delivery Structure



Cut-and-collect field trials

Field trials in both councils

Tested cut-and-collect across more than several sites, equipment types and delivery arrangements.

What the crews measured

Productivity, labour, fuel, equipment performance, arisings and depot-to-plant logistics.

What affected the service

Weather, grass moisture, litter and access changed what crews could collect and what plants could accept.



Greenprint cut-and-collect machinery in the field

Equipment tested on verges

Machinery choice depends on the site and the collection chain



Roadside cutting



High-capacity collection



Compact cut-and-collect

Compare wet-grass performance, safe access, discharge time and the availability of parts and servicing.

Source Original Greenprint machinery trial photographs

How the councils engaged local communities

Actions during the pilot, expansion and delivery

2023 / Briefings and the Yate pilot

South Gloucestershire briefed parishes and ward members in February, agreed a communications strategy in June and selected 12.4 ha with Yate Town Council.

2024–25 / Parish discussions before rollout

The project and grounds teams discussed plots, service levels and costs with parishes. The South Gloucestershire trial reached 36.8 ha across seven parishes, including Yate.

West Sussex / One community contact

The council's Parish Council and Community Engagement Officer coordinated updates and events, gathered feedback and helped resolve issues, with support from communications staff.

How the project reached people

Publicity and frontline briefings

Yate used local press, Nextdoor and the council's residents' newsletter. Grounds crews carried an A5 flyer to hand out when approached.

Maps for site-level discussions

Parishes received browser maps of trial plots. The maps helped explain choices such as keeping a mown strip along popular walking routes.

Channels for ongoing feedback

Both councils used project webpages, newsletters and email. Feedback fed into project reviews and issues were logged and tracked.

Source Process Guide, pp. 10–14 and 49–50. Thought Leadership Report, pp. 15–16

Plantlife's biodiversity baseline

Ecology partner for the verge trials in South Gloucestershire and West Sussex

What Plantlife delivered

Selected and agreed trial sites

Worked with both councils to select urban and rural verges covering a range of soil conditions, with safety and access checks.

Set the trial mowing schedules

Specified cut-and-collect and no-change schedules, with at least six weeks before surveys to allow plant identification.

Surveyed the same plots in 2024 and 2025

Used marked quadrats in both June surveys to record species richness, grassland indicators, vegetation height and flowering.

What the baseline showed

2% difference in species richness across both areas

Positive grassland indicators increased by 19% overall, though their numbers remained low.

Two seasons established a baseline

Variable rainfall, lost markers and departures from the mowing schedules limit what the surveys can establish about long-term change.

A basis for five more years of monitoring

Both councils planned to retain cut-and-collect on biodiversity sample sites. Consistent mowing and plot marking will help assess longer-term change.

Source Greenprint Thought Leadership Report, pp. 62–63 and 74–75. Greenprint Process Guide, pp. 38–39.

South Gloucestershire's route to grass-only AD

SGC led the delivery trials. WSCC explored a separate local outlet.

The initial route used an existing waste chain

South Gloucestershire Council (SGC) worked through SUEZ's food-waste service. Yate Sort It was the proposed mixing point and GENeco's Avonmouth plant the intended processor.

Operator availability narrowed the options

Avonmouth went offline for extended maintenance. When SGC reopened discussions with GENeco in 2025, its partner plant at Evercreech declined due to contamination risk.

West Sussex found a willing local operator

The plant's Environment Agency permit did not cover roadside grass. The time and cost of varying it put the route beyond the 2025 season.

South Gloucestershire delivery timeline

2023 / Yate pilot and composting fallback

Ofgem scheme requirements delayed the proposed mixed route. SGC diverted 45.7 tonnes of Yate pilot cuttings to composting.

2024 / Cannington Bio Energy

Grass from seven parishes went to the Bridgwater-area plant. A short mixing attempt blocked equipment. Later loads went as grass-only.

Apr–Oct 2025 / Charlton Park Biogas

After a contaminated load blocked equipment at Cannington, SGC redirected grass to Wiltshire.

Source Greenprint reports, Thought Leadership Report, pp. 25–27

What the grass-only digestion trials showed

Field experience and carbon modelling answer different questions

Plants accepted grass as a separate feedstock

Cannington and Charlton Park took grass-only loads. Storage bunkers at Yate depot supported deliveries. The blockages showed why grass length and contamination mattered.

The proposed 20:80 mix remained challenging

The model evaluated a 20% grass and 80% food-waste mix. It showed higher emissions than cut-and-leave within its boundary, which omits avoided emissions from alternative food-waste treatment.

Carbon savings depend on the assumptions

The chart compares modelled grass-only AD with cut-and-leave. It assumes biomethane haulage and includes projected soil-carbon gains.

Modelled saving vs cut-and-leave



kg CO_2e saved per 1,000 m^2 of managed verge.
Scenario assumes grass-only AD and biomethane-fuelled haulage.

Permits and feedstock acceptance

Waste classification, feedstock acceptance and the proposed grass–food waste mix

Classify and describe the load before collection

Greenprint used EWC 20 02 01 for clean verge cuttings. The report identifies 20 03 01 for litter or mixed cuttings and litter. Confirm the code for each actual load.

Agree plant acceptance criteria up front

Agree handling, storage, grass length and contamination limits with the plant. Plan litter picking and check how contamination could affect digestate.

Check the permit and the energy scheme

Confirm that the Environment Agency permit covers the feedstock or whether a variation is needed. Check applicable Ofgem requirements for fuel classification and sampling.

What happened in Greenprint

West Sussex / Local plant lacked permit cover

The plant could not accept roadside grass from Pagham, Aldwick and Bersted. The time and cost of a permit variation took the option out of the 2025 season.

South Gloucestershire / Grass stayed separate

Mixing grass with food waste could have used existing infrastructure. Delays over permit and scheme requirements held up the proposed route, so grass went as a separate feedstock.

For a supported plant, confirm any payment implications with Ofgem before changing the feedstock.

Source Greenprint Thought Leadership Report, pp. 25–27. Environment Agency and Ofgem guidance

Pyrolysis trials on grass and blended feedstock

University of Nottingham lab work and WSCC trials at Ricardo and Invica Industries

University of Nottingham lab tests

Direct and post-HTC routes were tested at 650–750 °C. Direct pyrolysis preserved the grass-like structure, while post-HTC char agglomerated.

Ricardo pilot

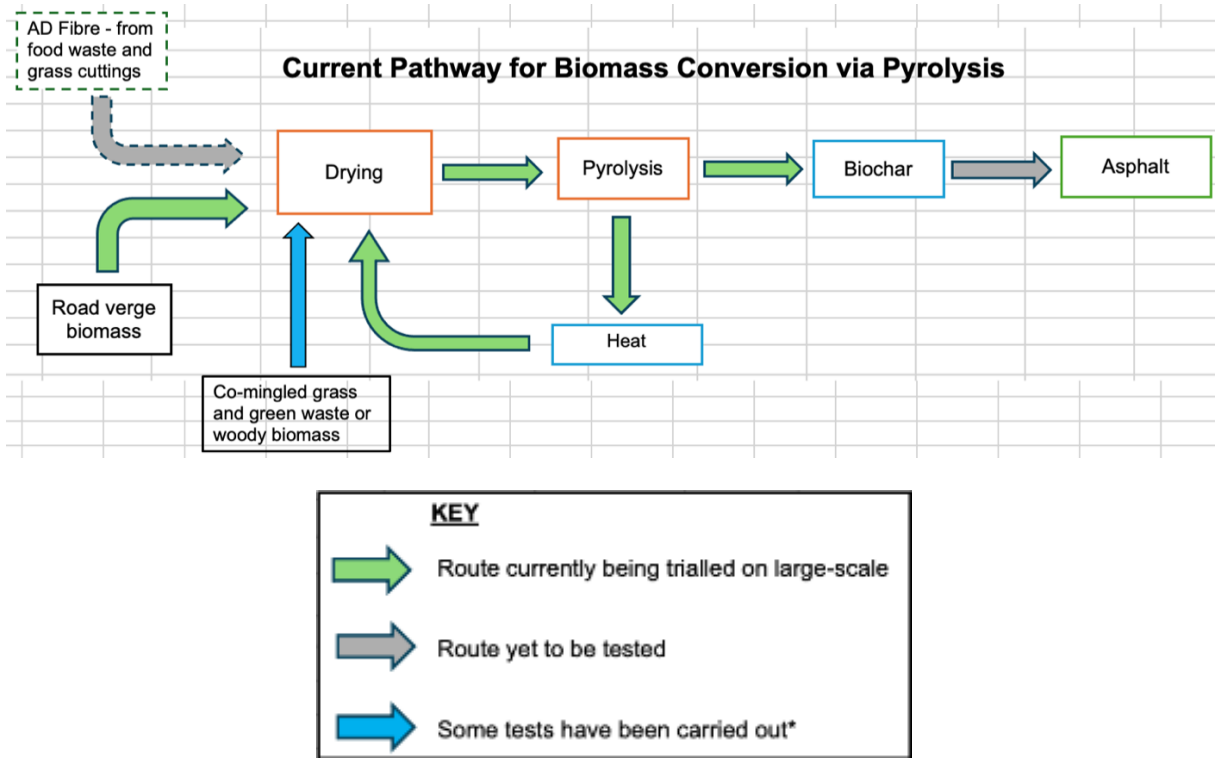
A roughly 50:50 grass–woodchip blend after drying produced about 50 kg of biochar.

Invica pilot at 700 °C

About 1.3 t of dry grass gave 162 kg of biochar. About 0.7 t of dry 50:50 grass–wood mix gave 225 kg. Both outputs contained about 39% moisture.

West Sussex grass is seasonal and volumes fall short of plant needs. Local green waste or woody biomass can supplement supply and limit haulage.

Pyrolysis pathway and heat recovery



Greenprint ruled out HTC after pilot testing

University of Nottingham lab work and WSCC trials at Ricardo and Invica Industries

Grass converted to hydrochar at pilot scale

Ingelia processed a consignment of about 10 t of West Sussex verge grass at its plant in February 2025.

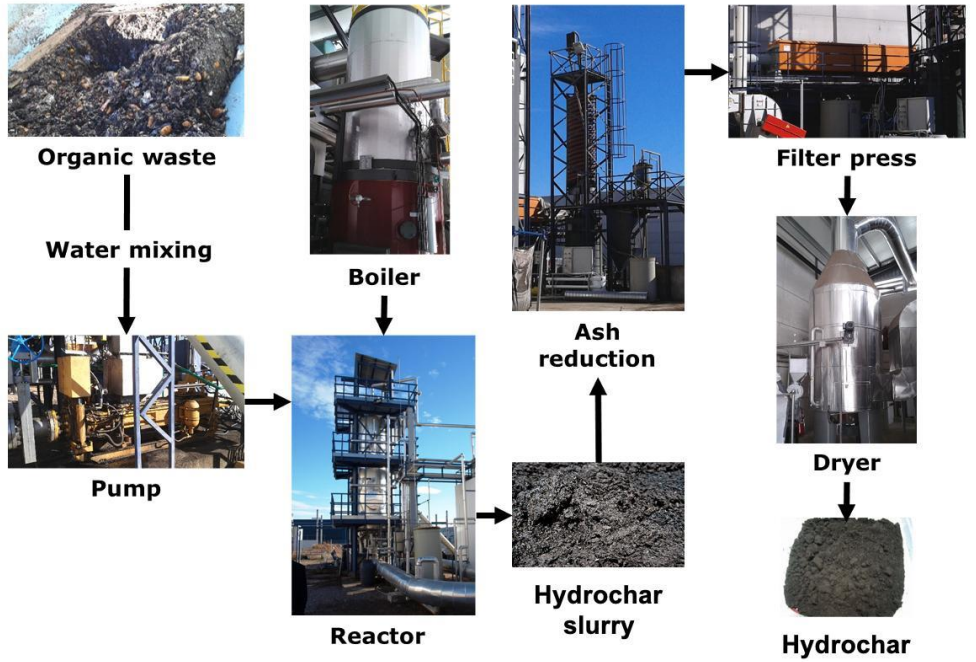
Plastics impaired digestate dewatering

In food-waste AD fibre tests, plastics left excess moisture after filter pressing, eroding the energy advantage over drying. Adding a small share of grass gave the same result.

Carbon stability and cost ruled out HTC

Hydrochar made at about 200 °C needed further pyrolysis for durable carbon storage. High capital costs required gate fees beyond those available for verge grass.

Ingelia pilot process



The pilot produced hydrochar pellets for planned post-pyrolysis.

Green waste underpins the pyrolysis business case

Proposed commercial plant / feedstock, process and unit costs

Grass is a small share of the practical blend

Two cuts could supply 275 dry t/yr at £383 per dry tonne. That is 2.75% of plant intake, versus 10% in the earlier model. A grass-only plant would require costly longer-distance haulage.

Adding grass raises production cost by £31/t

Modelled production cost rises from £409/t on green waste alone to £440/t with 2.75% grass. Arboreal waste and oversized compost are alternative feedstocks.

Drying limits energy exports

The base case excludes heat and power revenue. How much heat remains after drying depends on incoming feedstock moisture.

Modelled material flow

10,000 dry t/yr of feedstock
Mainly local green and garden waste, with optional grass.

↓

Screen and dry
Remove stones and plastics. Use recovered process heat for drying.

↓

Direct pyrolysis
The study favours this route over hydrothermal carbonisation.

↓

About 3,000 t/yr of biochar
About 30% mass yield on a dry-feedstock basis.

Source Greenprint Thought Leadership Report, Appendix I, pp. 36–39

Bellshill road trial used 1% biochar in asphalt binder

Crofthead Crescent, North Lanarkshire / 300 m² trial section

Crofthead Crescent, Bellshill

The team laid AC20 dense binder with 1% biochar by total mix mass at Crofthead Crescent after a plant breakdown delayed the original site.

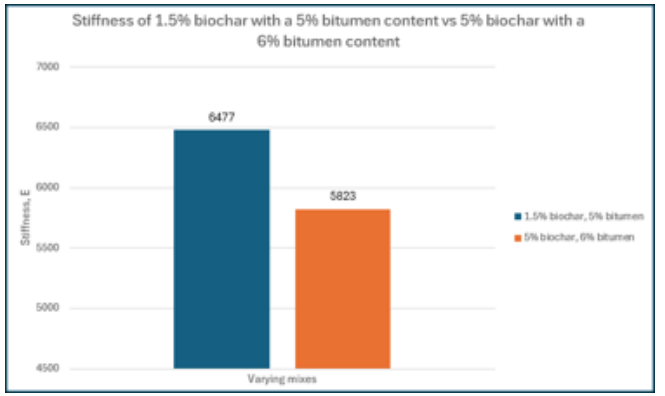
Granular biochar worked at 1%

The 10:90 grass–green-waste pellets broke down too slowly in hot mixing. Fine grass-only char posed a combustion risk. Granular green-waste char worked at 1%, while the 2% attempt failed.

Conventional binder provided the benchmark

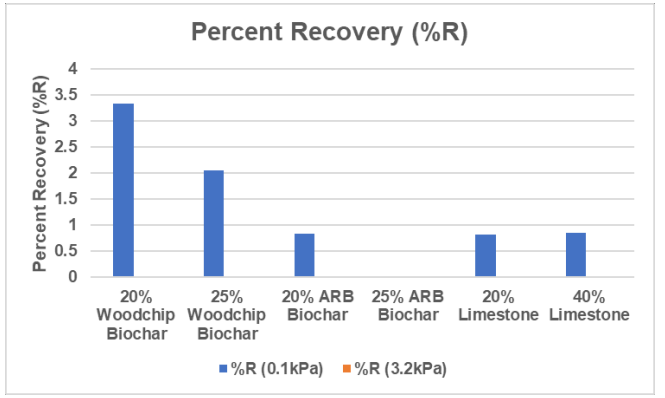
The asphalt plant produced both the biochar mix and the conventional AC20 binder used for comparison.

Separate laboratory tests



Fine aggregate

The lab comparison favoured the mix with 1.5% whole-tree biochar and 5% bitumen over the mix with 5% biochar and 6% bitumen.



Mastic filler

At 0.1 kPa, mastics with 20% and 25% woodchip biochar showed higher recovery than the limestone mixes. Fatigue life was comparable to 20% limestone.

Road sub-layer road trials comparison

Whole-life comparison of three uses for biochar from the 10:90 blend

Road sub-layer

Placing a biochar layer beneath new roads gives the lowest modelled GHG emissions and cost per tonne of CO_2e removed.

Asphalt binder mix

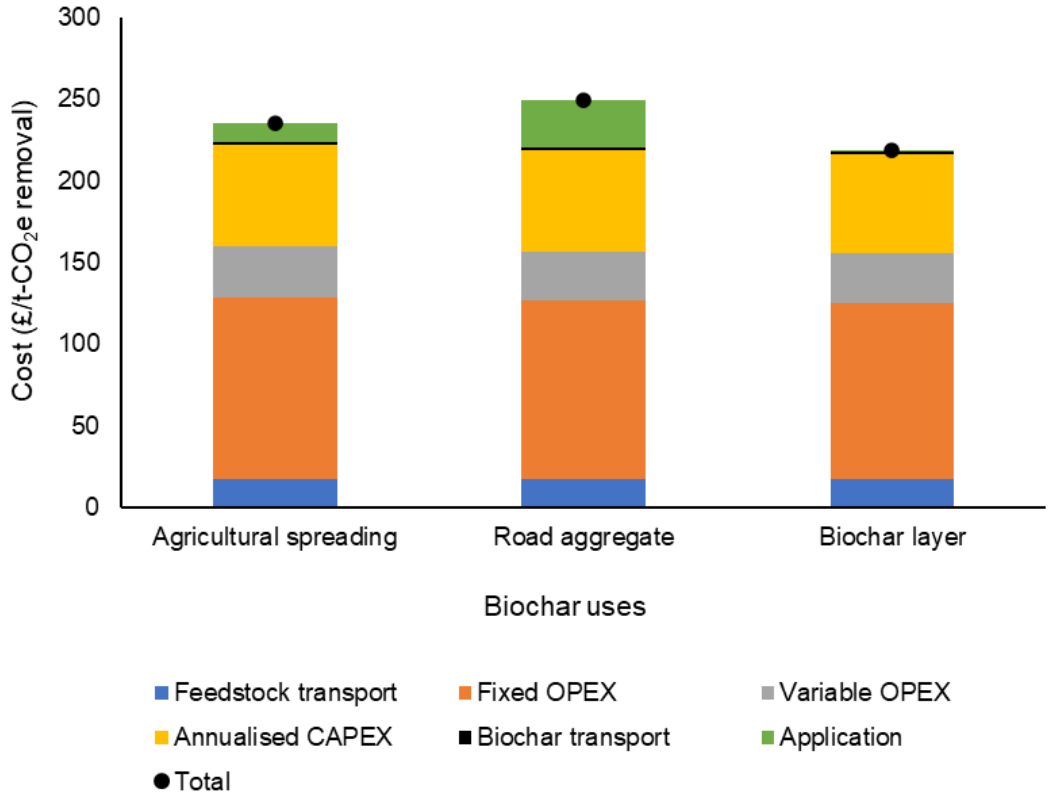
Grinding, pelletising and hot mixing raise the removal cost. The model assumes 0.6% biochar by mass in the mix.

Agricultural spreading

At 1 t/ha, spreading has the highest modelled GHG emissions of the three uses. Its removal cost is below the asphalt route.

The comparison assumes uniform biochar quality and a 10-mile delivery distance. Application accounts for a small share of whole-life impacts.

Whole-life removal cost (£/t CO_2e removed)



Carbon accounting for verge management

Adkins model for West Sussex and South Gloucestershire

One functional unit across both estates

The model reports kg CO_2e per 1,000 m^2 of managed verge and tracks fossil and biogenic flows separately. Cut-and-leave is the business-as-usual baseline.

The model adapts a biomethane method

Adkins uses the Green Gas Support Scheme actual-value method for anaerobic digestion (AD) and extends it to verge decomposition and pyrolysis.

The boundary shapes the comparison

The model tracks mowing, haulage, processing and carbon stock changes. It excludes capital goods, biomass combustion and indirect land-use change.

Modelled routes and carbon flows

Cut and leave

Clippings stay on the verge	→	**On-site decomposition**

Cut and collect / AD

Haul and digest grass	→	**Biomethane + digestate**

Cut and collect / Pyrolysis

Haul and process a blend	→	**Biochar carbon storage**

Both collection routes include a modelled soil-carbon credit.

Source Adkins Greenprint Carbon Model, pp. 2, 5–7 and 12–18

Grass-only digestion gives the lowest modelled totals

Anaerobic digestion compared with cut-and-leave / Table 1 results

Grass-only AD saves the most

With biomethane haulage, savings versus cut-and-leave are 39.56 kg CO_2e per 1,000 m² in WSCC and 34.55 in SGC.

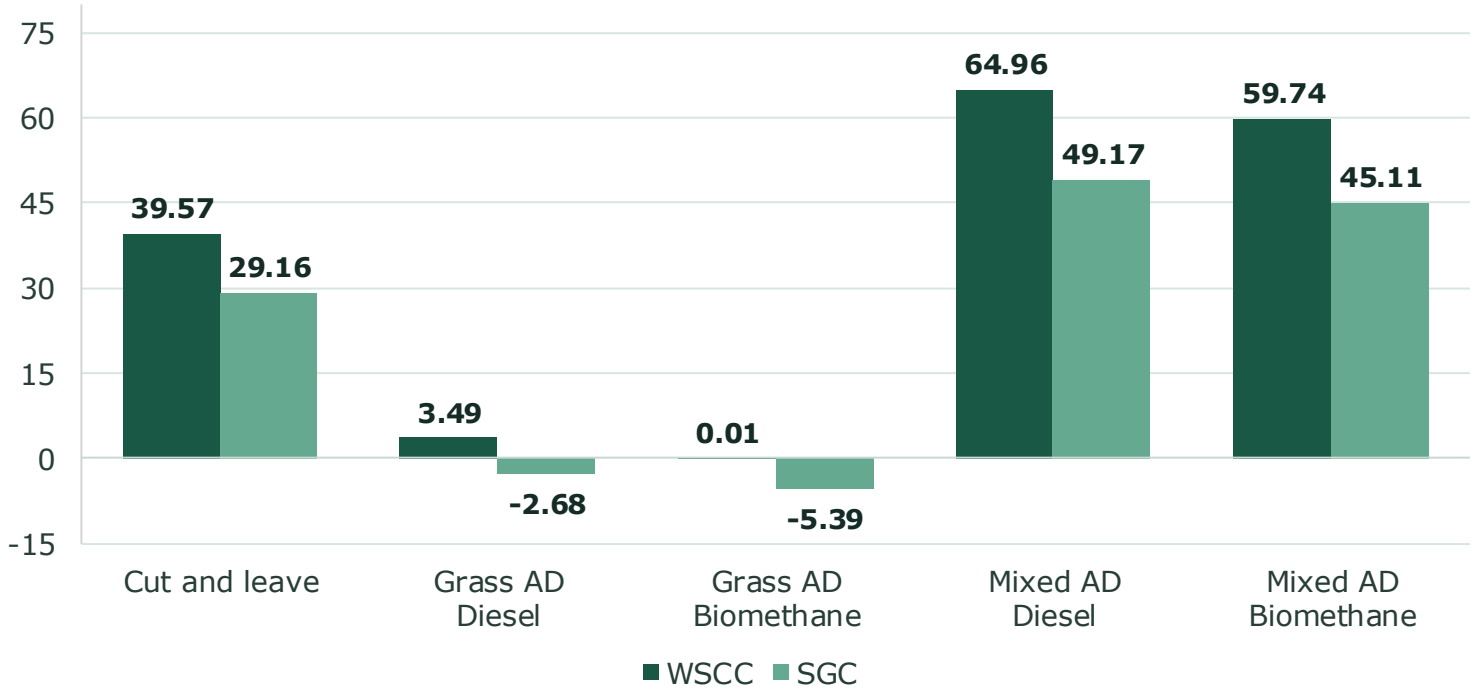
Food-waste comparison

The 20% grass / 80% food-waste cases are above baseline. The model omits avoided emissions from alternative food-waste treatment.

Higher harvesting emissions

Cut-and-collect fossil harvesting emissions were 2.4× baseline in WSCC and 7.7× in SGC, reflecting different trial operations.

Modelled net emissions (kg CO_2e per 1,000 m²)



Diesel and biomethane refer to haulage fuel. Mixed AD is 20% grass and 80% food waste.

Source Adkins Greenprint Carbon Model, pp. 3 and 8–9, Table 1

Both WSCC pyrolysis blends improve on the baseline

Grass-accounted scenarios using diesel haulage

Net totals remain positive

The 10% and 2.7% grass blends total 10.07 and 14.55 kg CO_2e per 1,000 m^2, respectively. The WSCC cut-and-leave baseline is 39.57.

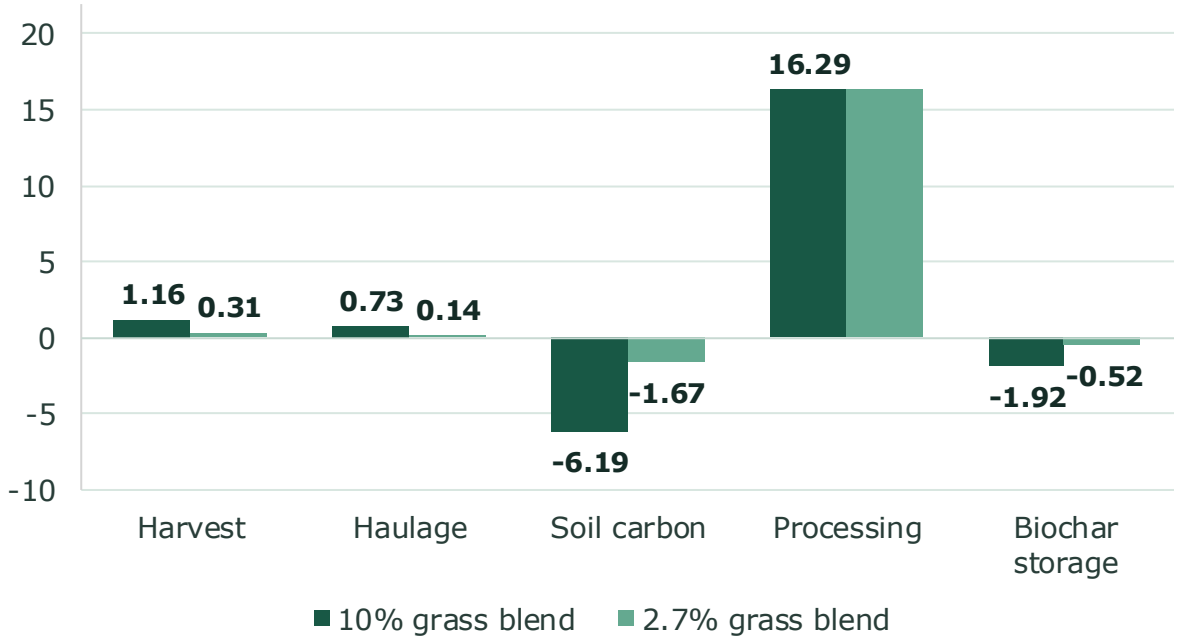
Processing is the largest positive term

The model assigns 16.29 kg CO_2e per 1,000 m^2 to processing in both cases. Soil-carbon and biochar storage credits reduce the totals.

The woody feedstock is partly outside scope

The model excludes woody biomass harvesting. These results describe the verge-grass pathway within the report boundary. A full-plant assessment would need to account for the co-feedstock.

WSCC carbon balance (kg CO_2e per 1,000 m^2)



Negative bars are modelled soil-carbon and biochar storage credits.

Source Adkins Greenprint Carbon Model, pp. 4, 6–8 and 16, Table 1

Modelled AD savings hinge on soil carbon (biogenic)

Annual extrapolation to 466 ha in West Sussex and 473 ha in South Gloucestershire

Scaling assumes estate-wide application

The results apply the modelled emissions per unit area across each managed estate. Actual savings would depend on the area served and how the routes operate.

Soil-carbon gain is projected over 20 years

The grass-only AD cases use a credit of 61.92 kg CO_2e per 1,000 m^2. The model projects the gain from a measured 2024 soil-carbon baseline.

The credit changes the AD result

With all else fixed, grass-only AD with biomethane haulage rises to 61.93 in WSCC and 56.53 in SGC (kg CO_2e per 1,000 m^2). Both exceed cut-and-leave.

Change from cut-and-leave (t CO_2e/yr)

Pathway and haulage fuel	WSCC	SGC
Grass-only AD, diesel	−168.1	−150.6
Grass-only AD, biomethane	−184.3	−163.4
Mixed AD, diesel	+118.3	+94.7
Mixed AD, biomethane	+94.0	+75.4
10% grass pyrolysis, diesel	−137.5	N/A
2.7% grass pyrolysis, diesel	−116.6	N/A

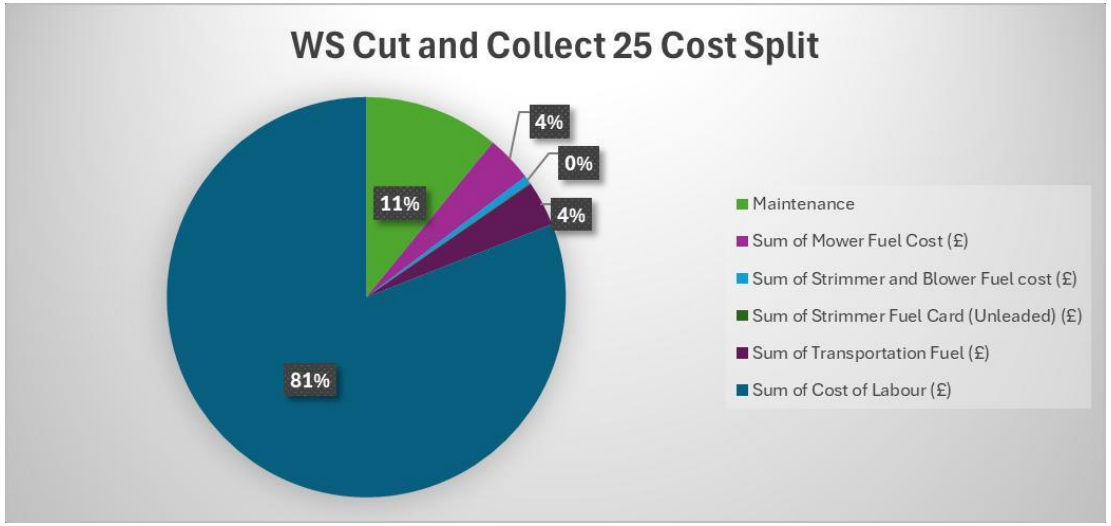
Negative values are savings. The model gives no SGC pyrolysis result.

Source Adkins Greenprint Carbon Model, p. 11, Table 2, and p. 17, Annex F

Labour dominated both 2025 collection trials

Original operating-cost charts / four-cut trial evidence

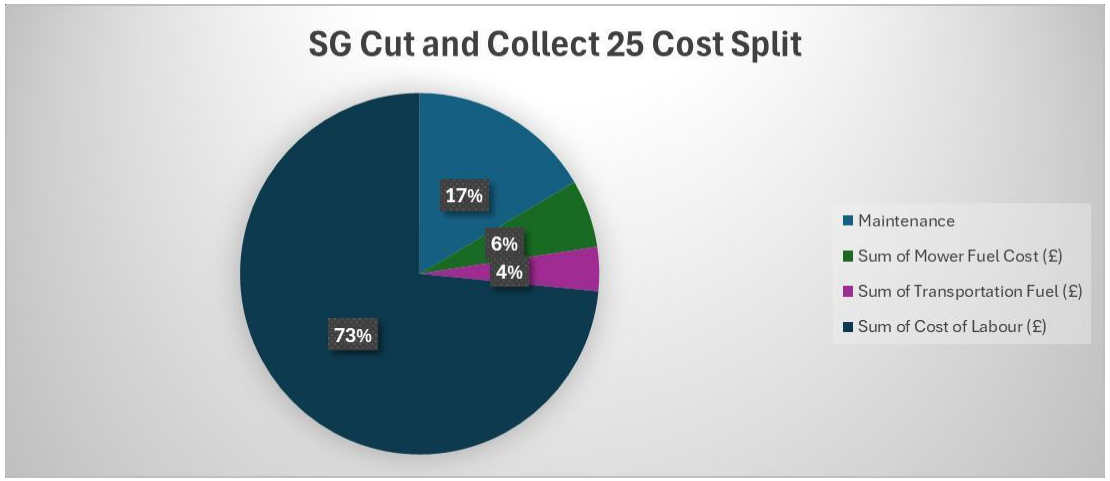
West Sussex (WSCC)



81% labour / 11% maintenance

Trial cost per m² cut: £0.08 collect vs £0.03 drop.

South Gloucestershire (SGC)



73% labour / 17% maintenance

Trial cost per m² cut: £0.11 collect vs £0.04 drop.

The report puts collection at about 2.6× the cost of cut-and-drop per m² in each council. Compare each council with its own baseline.

Source Greenprint Thought Leadership Report, pp. 33–37

Cut frequency drives estate-wide costs

Annual budget scenarios / compare each council against its own current service

WSCC / Two cuts were close to the baseline

With onward haulage, two cuts total £808k before assumed income and £684k after it, against £677k for the current five-cut service.

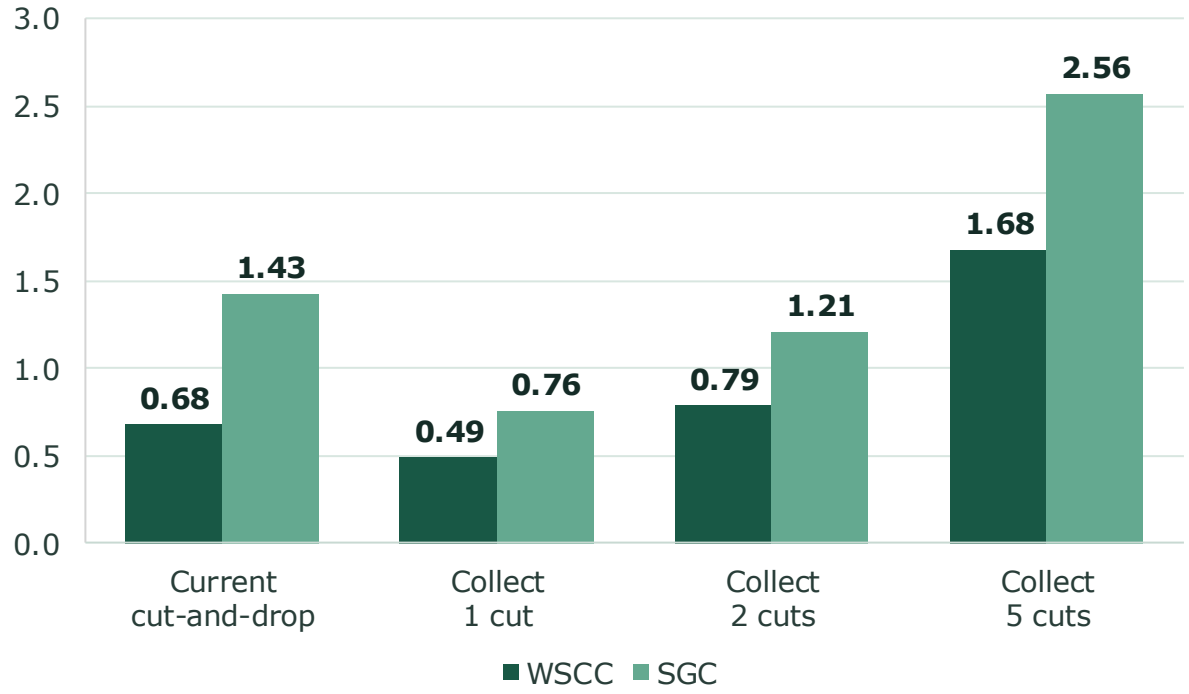
SGC / Two cuts were below the baseline

With onward haulage, two cuts total £1.262m before assumed income and £1.250m after it, against £1.426m for the current mixed-frequency service.

Check service levels and sales assumptions

The scenarios change how often verges are cut. West Sussex's near-parity result depends on about £124k of assumed biochar income, which the report calculates from dry grass tonnage.

Annual maintenance costs (£m)



The bars exclude onward haulage and sales income. The text shows those adjustments for the two-cut cases.

Source Greenprint Thought Leadership Report, pp. 38–40, scenario tables and two-cut estimates

Benefits realisation

What Greenprint demonstrated and what still needs evidence

Benefit area	Evidence at project close	Status
Carbon and energy	Grass went to anaerobic digestion (AD) and produced electricity. The model estimated savings for grass-only AD with biomethane haulage.	Energy produced. Carbon savings modelled.
Materials and cleaner arisings	Road trials used biochar in asphalt and in a sub-base. Targeted litter picking before cutting reduced contamination in collected grass.	Trial applications demonstrated. Longer-term performance under review.
Biodiversity and soil carbon	Plantlife established a monitoring baseline. The soil-carbon benefit depends on projected gains over time.	Long-term benefits still to verify.
People and capability	Public feedback was generally positive. Apprenticeships and equality, diversity and inclusion work built capability.	Practical benefits reported.
Costs and income	Cut-and-collect cost about 2.6× cut-and-drop per m² in the trials. The project reported no revenue realised.	Cost and revenue benefits unrealised unless reduced to 2 cuts a year.

Source Greenprint Thought Leadership Report, pp. 50–58 and 63–64

Limits of the trial evidence

Where the evidence stops and what a wider rollout would need to establish

The evidence window was short

The project ran for three years, with two seasons of ecological surveys. Longer monitoring is needed to assess changes in biodiversity and soil carbon.

Some results rely on estimates

Gaps in the carbon baseline led to modelling and extrapolation. The estimated benefits depend on those assumptions and on where the model draws its boundary.

The design reflected two local systems

Both councils worked within their own service, contract and market conditions. A full Waste-led assessment of an integrated biomass service was outside the time available.

Limits on what the trials could prove

A closed loop remained a model

The project had no consistent permitted route for all collected biomass and relied on third-party outlets.

Plant capacity and feedstock matter

Hydrothermal carbonisation (HTC) was unsuitable for verge arisings. Commercial pyrolysis requires scale, a stable blend and suitable infrastructure.

Whole-life savings remained volatile

Trial operations cost more than the baseline. Market demand and income from recovered materials remained variable.

Delivery challenges and risks at scale

What made the trials harder to deliver and what the team learned

Delivery challenge	What Greenprint encountered	Risk to manage before scaling
Machinery and productivity	Mower failures and delays in getting parts interrupted work.	Check productivity in wet conditions and secure maintenance and spare capacity.
Weather and haulage	Wet grass affected collection and quality. Longer haulage increased cost and emissions.	Test depot and haul routes. Allow for seasonal changes in yield and moisture.
Crews and contracts	Training, staff turnover and existing contracts limited changes.	Agree skills, staffing and contract flexibility with operations and procurement.
Permits and markets	Approvals delayed treatment routes. Biochar markets remained uncertain.	Confirm permits, plant acceptance and a fallback outlet. Test offtake before investment.
Public expectations	Fewer cuts made changes to appearance and access more visible.	Agree safety cuts and routes for feedback. Explain changes before the first cut.

Source Greenprint Thought Leadership Report, pp. 20–21 and 66–67

Conclusions 1 of 2 · Comparing the routes

The best route depends on plant access, feedstock and the local service baseline

Pathway assessed	What Greenprint concluded	Condition for adoption
Cut-and-leave	Lowest cost in the trial comparisons. Clippings remain on site and decompose.	Use as the local cost and carbon baseline.
100% grass to AD	The most practicable near-term processing route where a plant can take grass.	Secure a permitted outlet, haulage and feedstock acceptance.
20% grass / 80% food waste to AD	Could use existing food-waste infrastructure. The sustained mixed route remained challenging in Greenprint.	Confirm site approvals and model the alternative with food waste.
10% grass / 90% green waste to pyrolysis	A higher grass share needs more grass than the modelled two-cut service supplies.	Check seasonal feedstock volumes and blending requirements.
About 2.7% grass to pyrolysis	A lower grass share reflects the West Sussex feedstock estimate. Biochar offers durable storage potential.	Secure woody feedstock, processing capacity and a buyer or end use.

Source Greenprint Thought Leadership Report, pp. 25–27, 46–48 and 69–71

Conclusions 2 of 2 · Phasing adoption

Extend the service where the operating evidence and budget support it

Collection costs come first

Labour, machinery reliability and transport determine much of the budget. Lower cutting frequencies may narrow the gap where safety, access and service requirements allow.

Test the local carbon result

Use the authority's cut-and-leave baseline. Test how projected soil-carbon gains, haulage and the alternative fate of co-feedstocks change the result.

Work across Highways and Waste

Plan grass collection alongside other biomass streams, depot capacity and contract renewal dates. This gives the authority more options for treatment and end use.

A phased approach

01 / Start with suitable sites

Select sites where cut-and-collect is practical, the community supports the change and a permitted grass-only AD route is available.

02 / Improve the service before expanding

Track productivity, yield, costs and environmental outcomes. Refine cutting schedules, equipment and haulage before expanding.

03 / Integrate feedstocks where justified

Develop co-digestion or blended pyrolysis only where volumes, approvals, investment and demand support the case.

Source Greenprint Thought Leadership Report, pp. 31–40 and 69–71

Legacy · Each council needs its own business case

Use Greenprint's guidance and evidence to design a service that fits local conditions

South Gloucestershire / Continue in Yate

The report sets out continued cut-and-collect with Charlton Park as the initial AD outlet, Severnside discussions and an ICaN sponsorship route.

West Sussex / Refine longer-term options

The report records a short-term return to cut-and-leave, with collection retained at biodiversity sample sites and Waste and Sustainability involved in future options.

Keep sharing and testing the evidence

ADEPT's Year 4 knowledge-sharing, Arup's five-year monitoring and evaluation, and follow-on research with FHRG and Amey support wider use.

How to build a bespoke local business case

01 / Use the How to Guide to structure the work

Cover communications, operations, biomass processing and markets. Use the Process Guide to plan sites, crews, equipment and monitoring.

02 / Rework the evidence using local data

Rebuild the carbon baseline and whole-life costs. Use trial reports and route business cases to test local tonnage, contracts, permits, haulage and markets.

03 / Turn the business case into a delivery plan

Compare the options with the current service. Set out funding, responsibilities, procurement, milestones and how benefits will be tracked.

Source Thought Leadership Report, pp. 73–76. Greenprint How to Guide, p. 6. Process Guide, pp. 7–32 and 49–50

Discussion with highway and waste professionals

What would your authority need to proceed?

Service constraints

Which sites could move to fewer cuts while maintaining visibility, access and the required level of service?

Processing and procurement

Which permitted outlet could accept your grass and what would you need to agree before collecting it?

Evidence for investment

Which assumptions on costs, soil carbon or offtake would your decision-makers need to test?

Thank you

Greenprint publications

Greenprint documents and how to use them

Thought Leadership Report

Programme findings, trial evidence, benefits and limitations.

How to Guide

A practical structure for developing a local verge and biomass service.

Process Guide

Site selection, equipment, crews, logistics and monitoring.

Route business cases and models

Inputs for testing carbon, whole-life cost, feedstock, permits and markets using local data.

[ADEPT / Greenprint Thought Leadership Report]

Original Outline Business Case workstreams

Strategic Carbon Analytics	Verge Management	Biomass Processing	Biomass Applications	Strategic 'Greenprint' Outputs
Highway carbon emissions Leveraging the data from carbon calculators, this workstream will construct predictive analytics overlay on top of the existing Future Highways Research Group Tool to compare and contrast	**Verge emissions analysis** Develop and test a methodology for monitoring, reporting and verification of carbon emissions from verge management	**Anaerobic Digestion** Model mix of verge biomass and timing of harvests to optimise AD scale, feedstock mix and outputs identifying value, size and usability of outputs, alongside lifecycle carbon emissions OUTPUT: BIOFUEL	**Heat and power** Use of AD and pyrolysis plant as a source of heat, power and flexibility for buildings or processes e.g. Local plant or buildings, Connecting to the grid, EV Charging (incl mowers and harvesting equip)	**Systems blueprint** Mapping a circular economy system for repetition in further authorities
Fugitive emissions model Model and assess levels of fugitive emissions; identify sites with high emissions; develop tools for replications	**Biodiversity optimisation** Demonstrate how enhanced management drives improvements in verge biodiversity which feed into local green infrastructure strategics and Local Nature Recovery Strategies. Identify and monitor sites of biodiversity interest that need sympathetic management and adjusting harvesting schedules to match	**Pyrolysis** Model mix of verge biomass and timing of harvests to optimise pyrolizer scale, feedstock mis and outputs identifying value, size and usability of output, alongside lifecycle carbon emissions OUTPUT: BIOFCHAR	**Biofuel** Investigate potential for purifying and liquifying biogas to produce biomethane for transport fuel, Test and develop modification kits to convert fossil fuel engines to run on biomethane.	**Business case for scale** Constructing a validated and detailed business case for investment into Live Lab technology
	Cut and collect technology Model and test a range of technologies for cutting, collecting and transporting verge biomass	**Hydrothermal Carbonisation** Enables both wet and dry biomass input within high-tech, high temperature process. Analyse outputs identifying value, size and usability of output, alongside lifecycle carbon emissions OUTPUT: HYDROCHAR	**Biochar asphalt additive** Investigate potential for biochar products to be used to reduce lifetime costs and carbon emission of highways infrastructure, as a fertiliser or as a livestock food additive	**Scale in lab** Model testing on five further authorities DURING the Live Lab programme to test assumptions in different environments
	Cut and collect logistics Model cut and collect logistics and develop tools for replication. To include urban and rural settings, collection capacity, logistics for use and storage, lifespan costs, fuel consumption and carbon emissions.	**Combined mechanisms** Investigate technologies for and benefits of combined Pyrolysis and Anaerobic Digestion processes	**Digestate fertiliser** Investigate role of digestate as fertiliser to replace synthetic fertilisers and peat compost. Could also consider potential feedstock for Energy from Waste plants	**Knowledge sharing** Alongside partners, develop tools and approaches to ensure that learning is distributed and socialised to maximise impact
	Verge litter Consider impact of verge litter and how to remove it: current processes for collection, technology for removal and separation, designation as waste stream, implication for licensing and transport and downstream processing		**Hydrochar asphalt additive** Investigate potential for biochar products to be used to reduce lifetime costs and carbon emission s of highways infrastructure, as a fertiliser, or as a livestock food additive	

Engagement planning and feedback

Why it mattered and how Greenprint planned engagement

A change residents could see

Longer grass and fewer cuts can prompt questions about appearance, access and safety. Early engagement helped residents understand why maintenance was changing.

Local knowledge shaped the trial plots

Parish input helped Greenprint decide which plots to include. The team also considered how people used the sites, safety, biodiversity and operational practicality.

The trials drew positive public feedback

The project reported no material increase in complaints. West Sussex received little feedback where cutting frequency changed very little.

Engagement strategy

01 / Plan early and agree who does what

Map residents, parishes, councillors and local groups. Brief council leaders and delivery teams. Agree timing, channels and sign-off.

02 / Explain what changes and why

Show which plots are affected and when they will be cut. Explain the biodiversity and carbon aims, and where access or safety cuts stay in place.

03 / Keep a named contact and act on feedback

Resource a liaison lead, answer concerns promptly and review feedback during delivery. The report recommends at least six months of liaison cover during transition.

Conditions for a viable digestion route

Checks for a repeatable route / post-project plans reported in March 2026

SGC planned to continue at Yate

Climate and Nature Emergency funding supported continued cut-and-collect, initially with Charlton Park as the AD outlet. SGC was discussing a Severnside outlet for beyond 2027.

WSCC opted to return to cut-and-leave

Contractual and financial pressures shaped the decision. Cut-and-collect was to continue at biodiversity sample sites.

Labour dominates the fleet-fuel case

The SGC feasibility study put labour at about 90% of operating costs in its model. Fuel savings and revenue did not close the gap.

Checks before committing to an AD route

01 / Confirm permit and scheme requirements

Check that the site permit covers the feedstock and confirm what the applicable Ofgem scheme requires for classification and sampling.

02 / Agree feedstock acceptance with the plant

Agree litter and contamination limits, maximum grass length, and whether screening or pre-processing is needed.

03 / Match local capacity to collection logistics

Confirm tonnes by waste stream, storage and haulage capacity, and an alternative outlet. Compare whole-route costs and emissions.

Source Greenprint reports, Thought Leadership Report, pp. 25–27, 30 and 74–75. How To Guide, pp. 11–13

Why Greenprint ruled out HTC

Hydrothermal carbonisation (HTC) of verge grass and anaerobic digestion (AD) residues

Grass converted to hydrochar at pilot scale

Ingelia processed a consignment of about 10 t of West Sussex verge grass at its plant in February 2025.

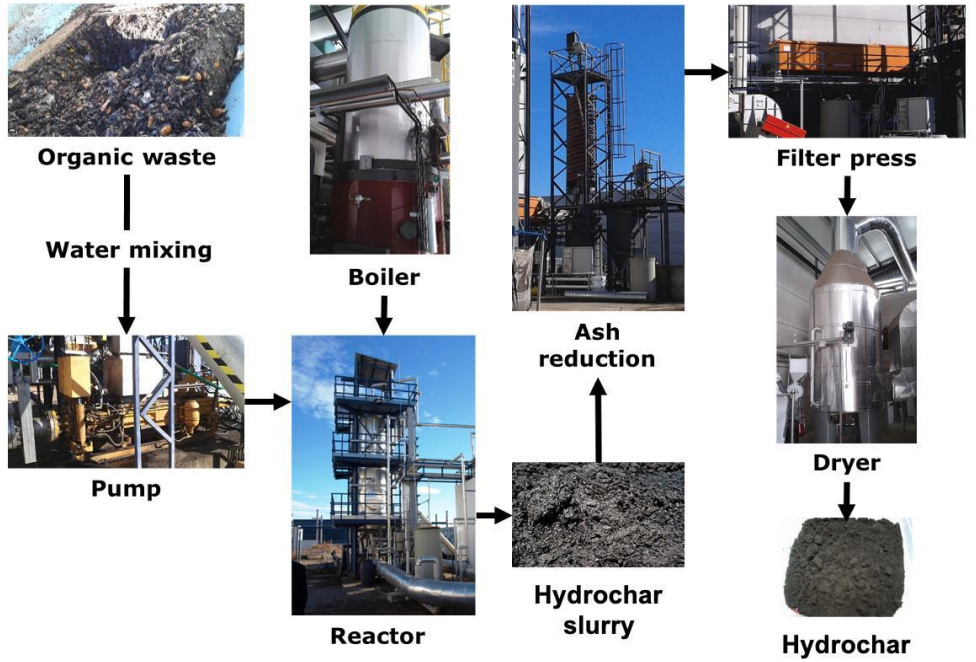
Plastics impaired digestate dewatering

In food-waste AD fibre tests, plastics left excess moisture after filter pressing, eroding the energy advantage over drying. Adding a small share of grass gave the same result.

Carbon stability and cost ruled out HTC

Hydrochar made at about 200 °C needed further pyrolysis for durable carbon storage. High capital costs required gate fees beyond those available for verge grass.

Ingelia pilot process



The pilot produced hydrochar pellets for planned post-pyrolysis.

Local supply favours blended pyrolysis

Commercial-scale model for Warnham, West Sussex / 10,000 dry tonnes of feedstock per year

Grass-only supply falls short

The plant would need 50,000 wet t/yr of grass against a local potential of about 5,600. Extending the haul from 10 to 100 miles nearly doubles production cost and reduces net CO_2e removal.

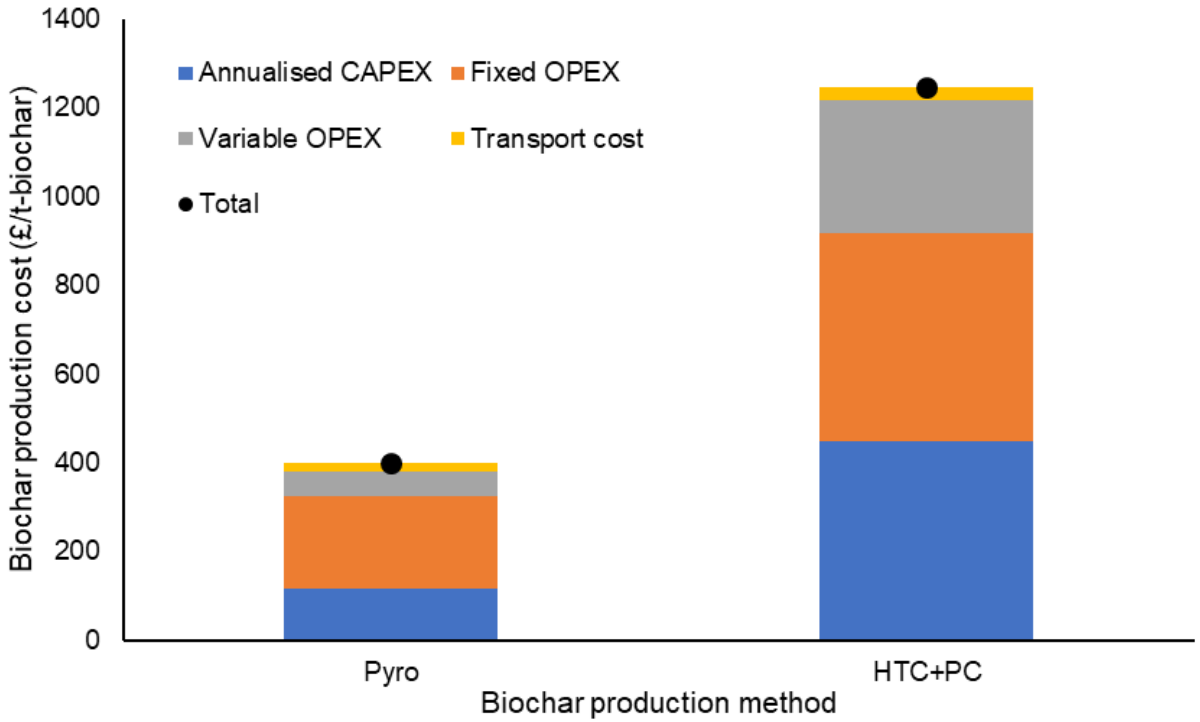
A 10:90 blend fits potential local supply

The dry-mass blend is 10% grass and 90% green waste. It needs 5,000 wet t/yr of grass and 18,000 wet t/yr of green waste, assuming near-maximum urban and rural grass collection.

Direct pyrolysis has the lower cost

At 750 °C, pyrolysis yields 35% biochar on dry solids versus 25% for HTC plus post-carbonisation, with lower energy use and modelled GHG emissions.

Modelled production cost (£/t biochar)



HTC+PC = hydrothermal carbonisation followed by pyrolysis.

Source Greenprint Thought Leadership Report, Appendix D, Figure 5

Comparing three end uses for biochar

Whole-life comparison of three uses for biochar from the 10:90 blend

Road sub-layer

Placing a biochar layer beneath new roads gives the lowest modelled GHG emissions and cost per tonne of CO_2e removed.

Asphalt binder mix

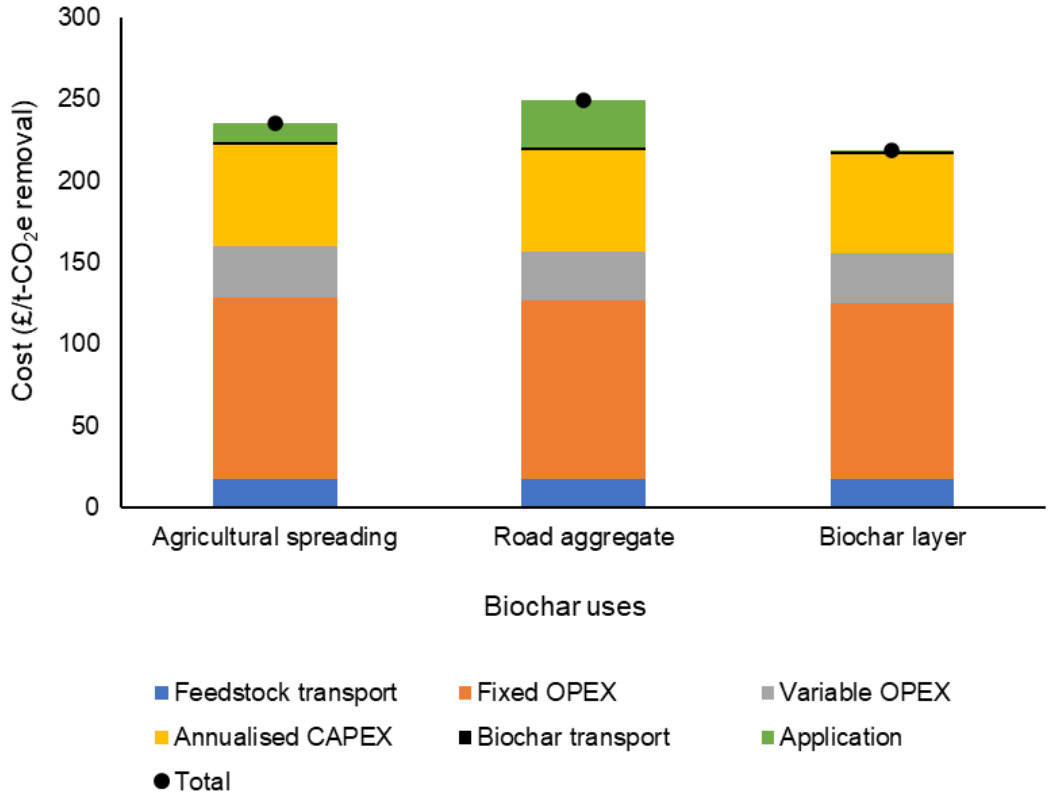
Grinding, pelletising and hot mixing raise the removal cost. The model assumes 0.6% biochar by mass in the mix.

Agricultural spreading

At 1 t/ha, spreading has the highest modelled GHG emissions of the three uses. Its removal cost is below the asphalt route.

The comparison assumes uniform biochar quality and a 10-mile delivery distance. Application accounts for a small share of whole-life impacts.

Whole-life removal cost (£/t CO_2e removed)



Source Greenprint Thought Leadership Report, Appendix D, Figure 7

Drayton sub-base trial proposal

Original Appendix F design for Drayton Depot access road, Chichester

Burial could store more carbon

The proposal aimed to place more biochar in the pavement than hot-mix asphalt could accommodate.

Four patches under comparable traffic

The proposal set out four 15 m² patches on the same depot access road, giving a 60 m² trial area under the same incoming traffic.

Type 1 was proposed for compaction

Pure biochar could not be compacted in the proposed method. The design called for machine mixing one bulk bag of biochar per tonne of Type 1.

Proposed patch depths (mm)

Patch	Biochar / Type 1 sub-base	Total excavation
1	100	300
2	80	280
3	50	250
4	20	220

Common pavement layers

40 mm surface course / 60 mm binder course / 100 mm base

Source Greenprint Thought Leadership Report, Appendix F, pp. 27–28

Keeping carbon credits raises the required sale price

Modelled production-cost coverage per tonne of biochar / excludes other project revenues

Credit revenue assumed at £237.50/t

The trading case values 1.9 tCO_2e of net removal per tonne of biochar at £125/tCO_2e. Selling the credits transfers the removal claim in this model.

Avoided composting cost drives the result

Using the appendix's £180/t allowance, credit sales cover green-waste production costs and leave a £22.50/t gap for the grass blend.

The stated inputs imply a lower saving

£20/t of wet feedstock, 50% moisture and 30% dry yield imply about £133/t of biochar. This raises the required sales price by about £47/t when WSCC retains the credits.

Minimum biochar sale price (£/t)



Chart uses the reported £180/t avoided composting cost. A zero sale price means credits and avoided costs cover production cost.

Offtake and the fate of biochar carbon

Product grade, market depth and the fate of the carbon

Soil and compost markets

Agricultural outlets depend on meeting the relevant product specification. Compost blends and livestock uses may offer value, but the report identifies limited market depth.

Engineered uses need an end-of-life route

Aggregates and road materials are candidate outlets. Flue-gas treatment could earn revenue first, provided subsequent handling supports durable storage.

Multi-year offtake underpins the case

The appendix cites indicative values of about £200/t for flue-gas treatment and £220/t for synthetic soils. It identifies no established UK outlet at plant scale.

How end use affects the removal claim

Direct placement

Soils or aggregates	→	**Demonstrate durable storage**

Use followed by storage

Flue-gas treatment	→	**Verify final placement**

Fuel substitution

Steelmaking fuel	→	**Emissions displacement only**

Credit eligibility depends on the end use, evidence and applicable method.

Biochar production and land spreading in England

The rules for making biochar and spreading it on land are separate

LRWP 60 covers small-scale production

LRWP 60 lists eligible waste codes and limits throughput to 50 kg/hour. Check the plant's authorisation for other feedstocks or a larger operation.

Land spreading has a separate set of conditions

RPS 366 is an enforcement position. It requires U10 or U11 registration, a nutrient need and eligible feedstock, among other conditions.

Feedstock cost affects viability

Greenprint identified tree trimmings and green waste as potentially attractive inputs. Their waste codes and the plant's authorisation still determine what it can accept.

Spreading conditions and research evidence

Up to 1 t/ha in any 12 months

Application limit under RPS 366 for qualifying biochar spread to benefit land in England.

Up to 20 t/ha in arable research

Greenprint reports no adverse soil effects at this total dose in the research it reviewed. The total dose may matter more than the annual rate.

The research dose describes the trial evidence. RPS 366 sets the conditions for the Environment Agency's enforcement position.

South Gloucestershire fleet fuel feasibility

CAGE Technologies study for South Gloucestershire Council, December 2025

The pilot supplied grass for electricity

In 2024, Cannington recorded 22.1 MWh of electricity from 127.34 tonnes of verge grass. The plant processed about one-third of the grass collected.

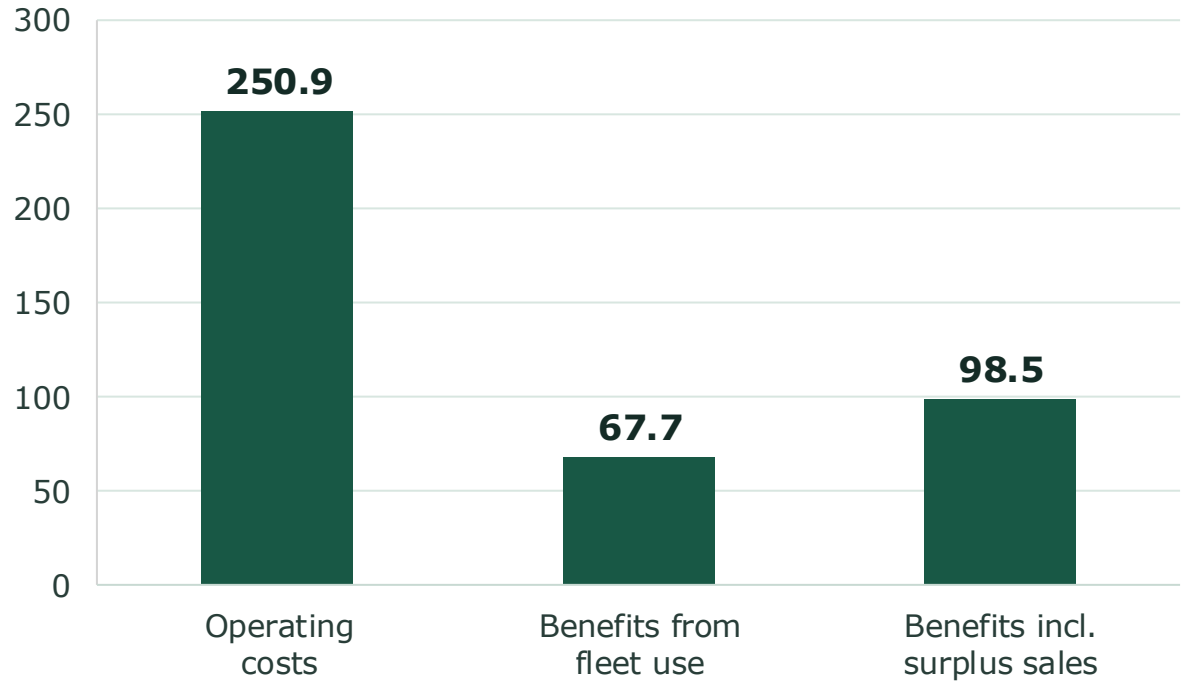
Modelled gas output exceeded fleet demand

At four cuts a year across 30% of the managed area, the model gives 63,200 m³ of biomethane against 42,165 m³ for mowing and haulage. The study estimates a fuel-switch saving of about 79 t CO_2e/yr.

Labour accounted for 89% of annual costs

Estimated capital cost was £1.64m. The study identifies substantial labour savings or an ongoing subsidy as conditions for proceeding.

Annual costs and benefits (£k)



£183k annual operating deficit in the base case

About £152k with surplus sales, before financing and capital recovery.

Source Greenprint reports, Mowing Fleet Feasibility, Tables 3, 13 and 17, §§9.2–10. Thought Leadership Report, p. 30

ICaN local sponsorship modelling

Objective / Price a local carbon unit

Eunomia compared two uses for grass sent to anaerobic digestion and estimated what ICaN sponsorship would need to cover. The model uses 2025 pilot data and Charlton Park plant data.

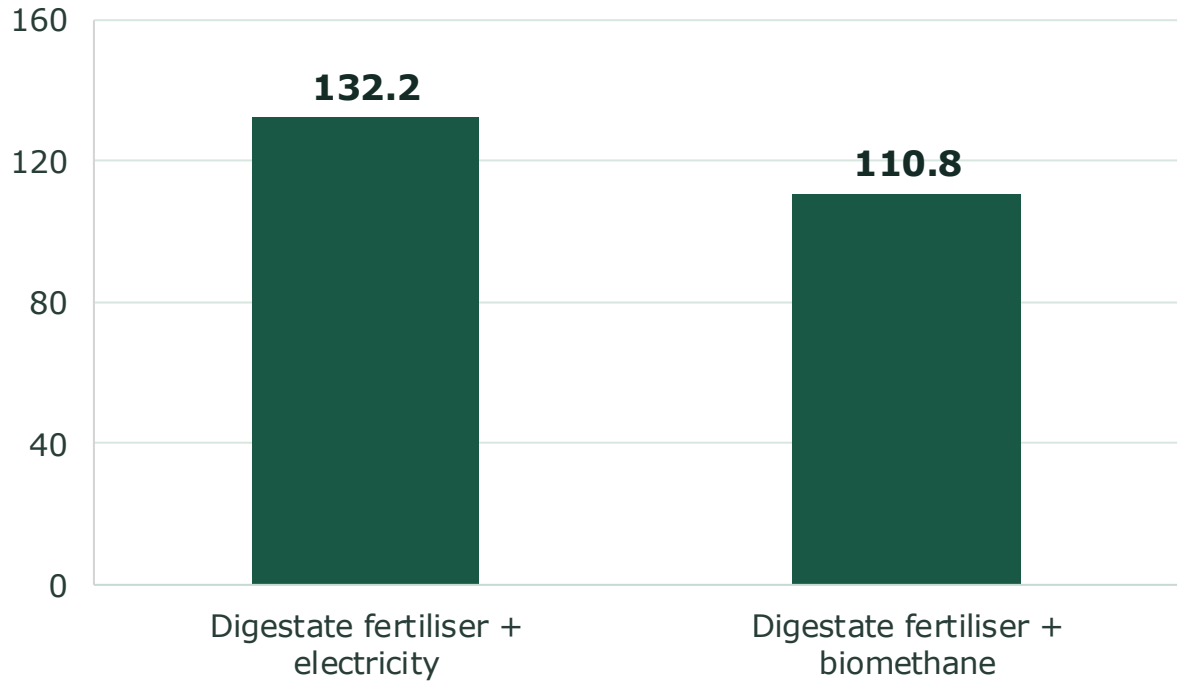
Cut-and-collect cost about £73 more

The model estimates £91.72 for cut-and-collect versus £18.94 for cut-and-leave per 1,000 m² per year. Haulage from the depot to the plant was the largest added cost.

Biodiversity tips the social balance

Including expected biodiversity gains gives a modelled net social benefit of about £46–£54 per 1,000 m² per year. The council still faces higher operating costs.

Modelled emissions avoided



kg CO_2e per 1,000 m² per year, compared with cut-and-leave.

The model excludes potential savings from using biomethane in the council fleet.

Source Eunomia, ICaN Greenprint Modelling v3.0, pp. 1–3 and 10–14, Tables 6–9

Whole-life cost method

Whole life cycle cost model / scope and method

Compare maintenance options within each council

The model tests how switching from cut-and-drop to cut-and-collect affects annual costs at different cutting frequencies.

Count operating costs and annualised equipment

The trial comparison adds labour, fuel and maintenance to the annual cost of machinery. The full-estate scenarios also consider onward haulage and assumed income.

Budget for the transition

The report also identifies transition costs for business-case preparation, community liaison and communications.

How the model works

01 / Establish a cost per square metre

Divide trial expenditure by the area cut across the trial. Repeat for the business-as-usual comparator.

02 / Scale to the managed estate

Model cut frequency and crew numbers separately for each council. Annualise equipment over its expected life.

03 / Add route-specific costs and income

Model onward haulage to the processor and test whether assumed sales income offsets part of the cost.

Source Greenprint Thought Leadership Report, pp. 31–38