



Committee and Date
Council

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Item

Public



Pyrolysis Second Site Increase in Budget

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Cabinet Member (Portfolio Holder):	Cllr Rob Wilson (Transport and Economic Growth))		

1. Synopsis

This report seeks approval for additional funds for the procurement, installation, and operation of a biochar plant which will process woody residual biomass into biochar, renewable energy, and associated carbon credits. Additional funds are to cover site remediation, draining and clearance of legacy tanks from the old Ludlow Anaerobic Digestion (AD) plant. The additional works also include increased construction and machinery costs plus additional demand for external technical expertise.

2. Executive Summary

- 2.1. The Shropshire Plan's Healthy Environment priority highlights the importance of investment and joint working to tackle climate change and maintain, protect, and enhance our outstanding natural environment.
- 2.2. Pyrolysis is the thermal breakdown of materials (in our case plant matter) in the absence of oxygen. The heat drives off gases and oil and what is left is mostly carbon in the form of char. If this char is burnt again as fuel, it's known as Charcoal. If it's kept as char and used in other ways, it is often called biochar; sometimes also activated charcoal. The primary difference from charcoal is the higher temperatures used and typically smaller particle size of the charred material.
- 2.3. Biochar can remain in soils or materials for hundreds, and even thousands of years without degrading. Biochar is typically between 60% and 80% pure carbon. We measure carbon emissions in weight of 'Carbon Dioxide equivalent'. From pure carbon this requires multiplication by 3.67 to add the weight of the two

oxygen atoms. This means that 1 tonne of biochar effectively stores over 3 tonnes of Carbon Dioxide.

- 2.4. The Council is already a leader in biochar production, with a joint venture (JV) in operation with Woodtek at their base location in Welshpool demonstrating the commercial return such plants can generate. Our success is being followed by this fully council-owned biochar plant in Ludlow.
- 2.5. The previously approved paper can be found here: [Council Paper - Pyrolysis](#).
- 2.6. Planning permission has been approved and the project is well advanced, however, additional funding is needed due to unforeseen and costly remediation and building works on the proposed site. While this brings an additional expense, the business case remains sound, and the anticipated benefits remain achievable.

3. Recommendations

- 3.1. Approve an increase in budget of the pyrolysis project by around £1.3m from £2m as outlined in the council paper, approved by full Council on 21st September 2023, to £3.3 million.
- 3.2. Delegate authority to the Service Director Strategy in consultation with the Portfolio Holder for Transport and Economic Growth, to negotiate and agree the terms of any and all agreements necessary for the implementation and ongoing operation of the project.

Report

4. Risk Assessment and Opportunities Appraisal

4.1. Risk Assessment (updated risks from 2023 paper plus new risks)

- I. **[New]. Not Increasing Budget:** there is a risk that increased budget is not secured, compromising the ability to remediate the current site in Ludlow to house the biochar plant. An alternative site would be needed, the legacy issues with the Ludlow plant would remain an outstanding liability, abortive costs would need to be covered, and the significant environmental and financial benefits would not be realised. Risk rating: High.
- II. **[Sept 2023] Feedstock Availability:** there may be a lack of availability of feedstock from Shropshire Council's own resources leading to higher costs of purchasing appropriate biomass from elsewhere and impacting on the business case or quality of the resulting biochar. Risk rating: Low.
- III. **[New]. Additional Costs:** there may be additional costs, such as the need for the purchase of a sprinkler system due to a Fire Risk Assessment (FRA) where other mitigations are not acceptable. This could lead to additional funding being

required and delaying delivery, or significant additional costs could change the business case to be unaffordability. Risk rating: Medium/Low.

4.2. Risk table

<i>Risk</i>	<i>Response</i>
I. Feedstock Availability. The project will process residual biomass targeting feedstock from Shropshire Council's own resources.	The revised business case is built on purchasing commercial woodchip throughout the year and remains comfortably positive. If Shropshire owned clean arboricultural arisings are available, these can be used by the plant and will improve the operational economics.
II. Planning Permission	Full planning permission granted on Ludlow site. Risk mitigated.
III. Budget increase not secured	The council is committed to the purchase and build of the equipment, so an alternative location would need to be found, potentially leased from the private sector. This would require a new planning submission and update of the business case to cover the lease agreement costs for the life of the programme. The council remains responsible for the remediation of the Ludlow AD site and disposal of the sludge left in the four silos that remain on site. The programme would be paused until a new suitable site could be found, and revised planning permission granted.
IV. There is a risk that the increase in budget has a significant impact on the viability of the overall business case.	Revised business case has been modelled with the increase in capital requirements and the return remains significantly positive.

5. Financial Implications

- 5.1. Shropshire Council continues to manage unprecedented financial demands as budgeted for within the Medium Term Financial Strategy approved by Council on 27 February 2025 and subsequent updates. It is also addressed in our monitoring position presented to Cabinet on a monthly basis. Significant management action has and continues to be undertaken to ensure the Council's financial survival. While all reports provide the financial implications of decisions being taken, this may change as officers review the overall financial situation and make decisions aligned to financial survivability. Where non-essential spend is identified within the Council, this will be reduced. This may involve
- scaling down initiatives,
 - changing the scope,
 - delaying implementation, or
 - extending delivery timescales.

- 5.2. This project is targeting 2,000 tonnes of carbon removal per year through the medium term. The project is setting up the initial unit as a council-owned, commercial scale demonstrator, building on the success of our joint venture with Woodtek.
- 5.3. The current proposal includes acquisition and installation of the pyrolysis unit, planning and permit approval, connection to a local energy off-taker, an energy generation unit (an Organic Rankine Cycle or ORC), building repairs, technical programme delivery and quality assurance of the plant. As developments have emerged with the planning, permitting and remediation of the old Ludlow AD plant, available contingency has been fully utilised. The tables below show the current approved and revised budgets.

Original Budget

SETUP COST AREAS (APPROVED)	CAPEX (ex VAT)	
Biochar plant, supporting equipment, design, permitting, delivery and installation.	£	2,000K
Total Budget	£	2,000K

Revised Budget

SETUP COST AREAS (PROPOSED)	CAPEX (ex VAT)	
Legacy site remediation inc sprinkler system, biochar plant, supporting equipment, design, permitting, delivery and installation.	£	3,218K
Total Budget	£	3,218K

- 5.4. The capital programme includes a 'Commercial Investment Fund' which has been utilised for several years over different commercial projects. Currently, £3.012m has not been committed within the budget. The budget is financed through Public Works Loan Board (PWLb) borrowing, requiring investments from the funds to generate income or reduce council costs to the extent that they cover, as a minimum, the associated cost of borrowing.
- 5.5. The additional **£1.3m** requested in this report can be accommodated within the available £3.012m, and the increased cost of borrowing covered under the existing business case albeit with a commensurately lower return.
- 5.6. Assuming similar terms to the initial investment borrowing, the revenue cost of that financing is expected to be an interest rate of 4.5% over 20 years. This creates an annual repayment (principal and interest) of £0.25m.
- 5.7. Based on revised project assumptions, the project will deliver circa 10,000 tonnes of physical carbon removal over the MTFs period and provide an environmentally friendly alternative mechanism to handle green or food waste, thereby supporting the Council to achieve its NET Zero ambitions.
- 5.8. In addition, beyond 2030 Shropshire Council may choose to use CORCs to offset council emissions, rather than purchase from the open market, albeit such decisions could affect the ongoing financial returns of the project.

Financially the plant is still projected to deliver annual returns that will more than cover borrowing costs. The core case has a projected first operational year yield

of 4.5% and a 20-year average yield of 14%. The revised (£3.3m) capital expenditure is still estimated to be repaid by the 20th year of operation, with projected annual revenue of £1.0m and profit of £0.2m from year 3 over and above the loan repayment over the 20-year term. These receipts will have a positive impact on the forward profile of the MTFS.

Cashflow and net yield over 6 year medium term horizon.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	
	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	Totals
Finances							
Borrowing	-£ 52,596	-£ 109,925	-£ 114,872	-£ 120,041	-£ 125,443	-£ 131,087	-£ 653,963
Interest	-£ 74,250	-£ 143,766	-£ 138,820	-£ 133,651	-£ 128,249	-£ 122,604	-£ 741,339
Expenses							
Fuel Cost		-£ 283,333	-£ 297,500	-£ 312,375	-£ 327,994	-£ 344,393	-£ 1,565,596
Maintenance & remote monitoring		-£ 40,000	-£ 42,000	-£ 44,100	-£ 46,305	-£ 48,620	-£ 221,025
Grate Rebuild							£ -
Overheads		-£ 143,230	-£ 150,392	-£ 157,912	-£ 165,807	-£ 174,098	-£ 791,439
Income							
Biochar		£ 500,000	£ 525,000	£ 551,250	£ 578,813	£ 607,753	£ 2,762,816
Carbon Credits		£ 300,000	£ 315,000	£ 330,750	£ 347,288	£ 364,652	£ 1,657,689
Electric Export		£ 60,000	£ 63,000	£ 66,150	£ 69,458	£ 72,930	£ 331,538
Heat Export			£ 160,000	£ 161,600	£ 163,216	£ 164,848	£ 649,664
Total Expenses	-£ 126,846	-£ 720,255	-£ 743,583	768,078	-£ 793,797	-£ 820,803	-£ 3,973,362
Total Income	£ -	£ 860,000	£ 1,063,000	£ 1,109,750	£ 1,158,774	£ 1,210,184	£ 5,401,707
Net Cashflow	-£ 126,846	£ 139,745	£ 319,417	£ 341,672	£ 364,976	£ 389,381	£ 1,428,345
70% Profit Share	-£ 126,846	£ 97,821	£ 223,592	£ 239,170	£ 255,483	£ 272,567	£ 961,788
100% Leveraged ROI	-3.84%	2.96%	6.78%	7.25%	7.74%	8.26%	
Non Financed Return		£ 351,513	£ 477,283	£ 492,862	£ 509,175	£ 526,258	
Project ROI		10.65%	14.46%	14.94%	15.43%	15.95%	
BDC Income		£ 41,923.47	£ 95,825.02	£102,501.64	£109,492.89	£116,814.31	£ 466,557.32

- 5.9. The greatest ongoing costs are for feedstock costs, system maintenance and plant operation, projected between £0.5m and £1.0m.
- 5.10. The unit has four primary sources of income: sale of biochar, sale of CORC carbon credits, electricity exports and heat offtake from year 3. Heat offtake has been included due to the impressive results seen at our Joint Venture plant, and the potential from local businesses adjacent to the Ludlow plant. To claim carbon credits the biochar requires around six months operation as Puro Earth only permits sale of CORC credits in blocks of 1,000. Credits can be back dated but the income would most likely be delayed by several months.
- 5.11. The financial modelling for future years has assumed current rates for variables such as biochar sale price, feedstock income, heat & electricity rate. There remain uncertainties with this project given the emerging nature of this market. As per 5.6 and 5.7 the project has healthy forecast returns and can reasonably be expected to make a positive contribution to the council's revenue position.
- 5.12. There could be a further indirect revenue benefit to the council in terms of using our own sources of feedstock. Dying ash trees that are being removed from roadside are a clear example of a source of biomass that is currently costing many tens of thousands of pounds to remove. A detailed assessment of biomass availability is currently being undertaken. Such biomass would reasonably be expected to lower the operation costs of the plant, as the economics have been calculated on paying £50 per tonne for woodchip

feedstock. Work is currently being undertaken to assess the option for the pyrolysis plant to pay the Council for feedstock generated from the Council's own estate thereby providing revenue for the Council.

- 5.13. All components being purchased would have high a resale value – notably given the long lead-in times for much of the equipment and the increased pricing now being charged by Woodtek since the Council tender was awarded in October 2024.

6. Climate Change Appraisal

Energy and fuel consumption

- 6.1. Net positive effect, since the 'embodied carbon' in the manufacture of the biochar plant will take a little time to be compensated. Estimates by the manufacturer suggests around 6 months of unit operation before the stored carbon compensates for the embodied carbon. A full 'Life Cycle Assessment' will be commissioned to examine the carbon performance of the unit over its lifetime. Such an assessment is a requirement of carbon trading standards set by Puro Earth and includes the carbon cost of transporting feedstock to the site plus carbon costs for delivering the biochar to the point of use. Over time pyrolysis units become carbon net negative and allow carbon trading. Here are some examples: https://puro.earth/CORC-co2-removal-certificate/?carbon_removal_method%5B0%5D=7363.

Renewable energy generation

- 6.2. Positive effect, since the pyrolysis of biomass releases oils and gases which are burnt within the C1000 chamber to create excess heat and electricity via an ORC generator. This renewable heat and electricity displaces grid energy that is still largely produced from fossil fuels. Around 80% of what is left is stable carbon in the form of biochar. There is a grid connection at the site to take the excess electricity. Once operational discussions will take place with the neighbours on the local industrial park to provide heat, reducing the reliance on gas-powered heating.

Carbon offsetting or mitigation

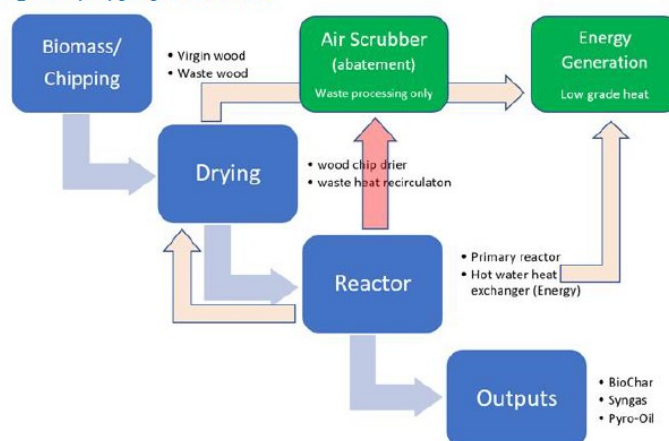
- 6.3. Significant positive effect since biochar production is a means of partially stopping the carbon cycle. Atmospheric carbon dioxide is temporarily stored in biomass; including wood and leaves. Typically, this carbon releases over a relatively short time period when plants rot (sometimes via composting) or are burnt. Diverting this biomass to biochar production sequesters around 2.4 tonnes of CO₂ in long term storage.

7. Background

- 7.1. The background to this project remains unchanged from the information provided in the **September 2023 Pyrolysis** Council Report referenced at the start of this document.
- 7.2. The establishment of a local biochar production facility in Ludlow will serve as a tangible demonstration of the benefits associated with biochar production.

- 7.3. **The** Ludlow AD site was chosen for the demonstrator project for the following reasons:
- I. The existing freehold building is vacant, previously used as an Anaerobic Digester (AD) plant.
 - II. The building and yard area is of a sufficient size to accommodate the pyrolysis operation and store supplies of feedstock and biochar on site. There is an existing grid connection, used when the site was previously in operation.
 - III. The site is in an industrial area, has direct access from a major road and sits within Employment land allocation. The site previously held a Part B environmental permit.
 - IV. Planning for the biochar plant was approved in March 2025.
 - V. Proximity to nearby businesses as potential off-taker(s) for the heat and electricity produced.
- 7.4. During site surveys, it was identified that the building needs major repairs due to over 10 years' disuse since the previous AD plant was closed.
- 7.5. The AD storage/digester silos at the rear of the building are approximately half full of AD residue. Before the tanks can be demolished, they will need to be drained, and their contents disposed of safely. Dealing with this and construction legacy issues are forecast to add circa £0.4m to project delivery costs.
- 7.6. These costs will be borne by the council in the future if they are not addressed: the AD waste is toxic and is the responsibility of the Council.

Fig.2 Simple pyrolysis schematic



8. Additional Information

The additional information to this project remains in line with the information provided in the original cabinet paper.

9. Conclusions

- 9.1. The additional funding requested in this paper is necessary and will; 1. address legacy costs arising from the former operation of the AD plant that the Council has deferred since the plant was mothballed. And 2. meet additional construction costs arising from repurposing the existing building. The legacy cost is unavoidable, and would either be met by the Council or would be netted off the future value of the site, if the biochar project did not proceed. The construction costs are necessary to deliver an effective, compliant building. The sprinkler costs are included to mitigate the risk that insurance is predicated on the installation of an appropriate sprinkler system. Contingency has been returned to 5% of remaining spend on the project. The forecast revenue streams from the Biochar project are sufficiently healthy to accommodate these extra initial costs.
- 9.2. The increase in costs do not materially affect the overall business case, which remains financially positive with a significant return on investment.
- 9.3. Learning from this biochar project will help inform further installations by Shropshire Council and will inform the framework advice and guidance sold to other Councils, which generates revenue that contributes to repayment of the investment Shropshire has made into biochar production.

List of Background Papers (This MUST be completed for all reports, but does not include items containing exempt or confidential information)

[Council Paper - Pyrolysis](#)

Local Member: Cllr Vivienne Parry

1. INCREASE IN SHROPSHIRE SET UP COST'S BREAKDOWN

Shropshire Set Up Costs - May 25 Bus Case	£ Cost
Programme, technical and legal costs for delivery	
Building - Tank Demolition & Removal, concrete pad removal, internal strip out	
Legacy waste removal costs from AD tanks	
Incremental build cost Extension	
Insurance	
Drainage & Foul water Connection	
Bird boxes & landscaping	
Updated costs for a new telehandler and roller shutter door	
Revised total for set up costs	£848k
Costs for an insurance-grade sprinkler system in Ludlow AD plant	£300k
Contingency - circa 5% of remaining spend, which has been reduced in line with the progress made with the programme to date	£153k
Total	£1,301k

Additional items further information

- *Identification, extraction, removal and disposal of anaerobic digestate sludge in four large tanks, left in situ following the closure of the AD facility*
- *Early insurance quotes indicated a sprinkler system may be required. Although not confirmed (the biochar is quenched and comes out of the plant wet) the project team thought it prudent to include this cost*
- *The programme has been extended by a forecast 9 months due to the sludge uncovered in the tanks at the Ludlow plant and subsequent activity to address the legacy issue, and revisit the design to optimise usage of space once the tanks are removed*
- *The building was found not to have connection to the public drainage system*
- *Insurance quotes are higher than initial estimates*
- *Biodiversity Net Gain costs (landscaping and birdbox) now added*