WRITTEN EVIDENCE SUBMITTED BY FUTURE BIOGAS (SH0059)

Future Biogas is one of the UK's largest producers of biomethane, injecting over 500 GWh of green gas into the grid each year – enough to heat over 40,000 homes.

Founded in 2008, Future Biogas is a highly experienced developer and operator of AD plants across the UK, responsible for over £120m in biogas infrastructure. At present, it operates 11 large-scale AD plants, primarily located across the East and North-East of England. Of these plants, ten focus on the production of biomethane, injecting it into the UK gas grid and one uses biogas to generate power for a local RAF base.

Future Biogas is now leading the development of 'Project Carbon Harvest' – a venture to design and operate the next generation of AD plants delivering Bioenergy with Carbon Capture and Storage (BECCS). Crucially, the Project will operate without government subsidy, where GGR credits can replace income historically provided by tariff support (e.g., FIT, RHI, GGSS).

DIGESTATE

Each year, our existing AD plants produce around 400,000 tonnes of organic biofertiliser, also known as digestate. With a successful deployment of Project Carbon Harvest, digestate production could increase by over 1.8 million tonnes per year. This biofertiliser is rich in key nutrients (NPK), trace elements and organic carbon – all of which are recycled from the digested feedstock.

Digestate consists of solid and liquid fractions. Spreading each component to land can greatly improve soil health (WRAP, 2012). Its fibrous content replenishes soil with organic carbon (SOC), developing its structure and sequestering carbon from the atmosphere. And the liquid component provides a renewable source of plant nutrients (NPK), displacing the need for non-renewable and carbon-intensive artificial fertilisers – whose over-use is largely responsible for the degradation of farmland across the UK.

The following resources are useful tools when quantifying the benefits of digestate use:

- Nutrient Management Guide (RB209). This resource, from the Agriculture and Horticulture Development Board (AHDB), establishes standard nutrient concentrations found with food- and agricultural-based digestate. It can be used to estimate digestate ability to displace artificial fertilisers. In addition, there are several plant nutrient management data bases (e.g. MANNER) that can calculate the fertiliser requirement of a crop, based on RB209 principles.
- BioGrace. An EU-funded project which provides standard values of the GHG emissions released through the production of key nutrients within artificial fertilisers (e.g. kgCO2 per kg of Nitrogen). These values can be used to estimate the GHG emissions avoided through the use of digestate.

Under Project Carbon Harvest, Future Biogas' plants will primarily be fed by locally grown maize, grass and whole crop rye. All feedstocks will be grown under longer term contracts with local farmers, thus diversifying their revenue and securing a supply of local, organic fertiliser. These contracts ensure all biomass is grown using sustainable, low-carbon practices, namely:

- **Crop rotation**. Fundamental to sustainable agriculture, crop rotations deliver multiple benefits to the farmer and environment – improved soil fertility, increased soil carbon, greater crop yields – while also helping to control the spread of pests and disease. Biomass grown as part of a food production rotation can be digested to produce biogas. In Project Carbon Harvest, such crops will be grown in between conventional food crops thus minimising impact on food production, diversifying agricultural income and improving soil resilience.

- **Minimal/no tillage**. This minimises the risk of soil erosion and mitigates risks of soil compaction while encouraging the build-up of soil organic matter, and multiple associated benefits (e.g., hydrological, biological etc).
- **Spread digestate to land**. Displacing demand for artificial fertilisers, returning organic carbon to soils and kick-starting the increase in soil organic matter.

Overall, Project Carbon Harvest aims to grow crops with a carbon intensity between **-5 and 10 kgCO_2e/MJ** – i.e., potential to be carbon negative. Any sequestration on-farm can be quantified and accredited, such that the farmer will be able to claim credits and further diversify income. For context, crops currently supplied to Future Biogas for plants claiming RHI have an intensity of 15-30 kgCO_2e/MJ, and biomass supplied to biomass power stations such as Drax has an intensity of **>31 kgCO_2e/MJ**.

Consultation Questions

The health of soil in the UK – soils ability to function as a vital living ecosystem that sustains plants, animals, and humans – faces challenges from contamination, nutrient loss, erosion and compaction. The impact of this is likely to be significant through accelerating climate change, increasing the chance of flooding, reducing the productivity of farms and losing an important ecosystem for bacteria, fungi and invertebrates. The inquiry will look at why soil health continues to be a problem and consider how the UK Government can accelerate soil restoration in England.

The Committee invites submissions on the following:

1. **How can the Government measure progress towards its goal of making all soils sustainably managed by 2030? What are the challenges in gathering data to measure soil health how can these barriers be overcome?**

By definition, the term 'sustainable' should mean that activities can continue indefinitely, while maintaining (or improving) the state of the environment. Agricultural productivity cannot be deemed sustainable if it results in any degradation of soils, reduction of biodiversity, and contamination of ecosystems. Consequently, any measurements of 'soil health' must be coupled with complementary monitoring of the local environment.

However, the definition of "sustainably managed soils" must also extend to decarbonisation efforts. While GHG emissions may not directly impact soil health, resultant climate change will have severe impacts on agricultural and natural environments. Soils are a critical carbon sink, containing 2-3 times more carbon than the atmosphere. Therefore, as shown by the 4 per 100 initiative[1], relatively small changes in soil carbon can have significant impacts on GHG emissions. Increasing carbon concentrations in soils by 0.4% worldwide would counteract the annual increase in GHG emissions.

Moreover, the quality and composition of soil determine its options of land use. These management options can support the decarbonisation of wider sectors. For example, bioenergy crops (grown within a diverse crop rotation) can be used to deliver bioenergy with carbon capture and storage (BECCS) via AD; here, biogas is decarbonising the energy sector and providing an opportunity for much-needed GHG removals (GGR).

Land use sits at the nexus of multiple challenges facing the UK. How it is managed will determine the UK's delivery of Net Zero by 2050, our food and energy security, and the overall health of our natural environment. Neglecting any one of these challenges would have severe environmental, social, and economic repercussions. Consequently, we must seek land management options capable of addressing multiple issues simultaneously, while mitigating against localised environmental degradation (including soil health).

[1] https://4p1000.org/?lang=en

Countless factors determine the health of soil, from land use to climate, making it difficult to measure or quantify. However, soil organic carbon (SOC; which typically correlates with soil organic matter, SOM) arguably represents the best individual metric. Academic research has shown that increasing SOC (or SOM) can:

- Increase agricultural productivity [2,3]
- Improve water retention in soils [4]
- Increase above and belowground biodiversity [5,6]
- Sequester more atmospheric carbon [7,8,9]

Soil degradation typically relates to the removal of organic matter. The UK's Environmental Agency estimate that intensive agriculture has caused arable soils to lose about 40 to 60% of their organic carbon, the impact of which costs the UK an estimated £1.2 billion each year[10].

Degradation is driven by intensive agriculture. On arable farms, food crops are often grown intensively using high levels of artificial inputs. These chemicals fail to replenish the soil with organic matter, and thus pre-existing organic matter is eroded over time by farming activity (namely tillage) and weather. As the soil degrades, farms may further increase use of fertilisers and herbicides/pesticides to maintain crop yields. Both from a soil health and carbon perspective, this approach to farming is fundamentally unsustainable.

Soil restoration requires an immediate transition to sustainable agricultural practices, including the use of organic fertilisers, reduced tillage, diverse crop rotations, and use cover crops. Regular soil measurements of soil organic matter (SOM) can monitor change across the UK. Moreover, these soil assessments can underpin the growing market for nature-based solutions to decarbonisations, essential for the delivery of Net Zero.

To note, while both SOM and SOC levels may be used as an indicator for soil health, they can be difficult to quantify. Their concentration can substantially vary from field-to-field and from year-to-year. Spot measurements may not always be representative of entire fields.

2. Do current regulations ensure that all landowners/land managers maintain and/or improve soil health? If not, how should they be improved?

There are multiple regulations in place to protect different aspects of the environment; for example, 'Farming Rules for Water' and 'Nitrate Vulnerable Zones (NVZ)' are primarily designed to protect freshwater systems.

However, soil health is <u>not</u> protected or encompassed under UK regulation. While the intensive use of chemical fertilisers is responsible, in part, for soil degradation, application limits only seek to address nutrient run-off and water contamination. Agricultural practices also known to drive soil degradation, such as tillage and monocropping, are not regulated/limited at all.

Instead, efforts to improve soil health may be captured in compliance with payment schemes and non-statutory codes of practice. ELMS' soil standard, for example, rewards farmers (£/ha) for assessing levels of soil organic matter, planting cover crops and spreading of organic fertiliser. Having been introduced last year, the effectiveness of this policy remains to be seen.

---

[2] Edmeades (2003)
[3] Lal (2004)
[4] Lal (2020)
[5] Thiele-Bruhn et al. (2012)
[6] Jia et al. (2023)
[7] Holland (2004)
[8] Scharlemann et al (2014)
[9] Lal et al (2015)
[10] EA (2023)

In general, there are two possible approaches to ensure land managers maintain or improve soil health:

- Directly monitor changes to soil organic matter (SOM)
- Indirectly incentivise practices which increasing soil organic matter (as seen within ELMS Soil Standard)

3. Will the standards under Environmental Land Management schemes have sufficient ambition and flexibility to restore soils across different types of agricultural land? What are the threats and opportunities for soil health as ELMs are introduced?

Overall, ELMS' soil standard – incentivising the assessment of soil organic matter and the application of organic fertilisers – is a positive addition to the Scheme. However, its success will be determined by several factors:

- **Payment level**. Spreading organic fertilisers requires specific on-farm infrastructure (e.g. storage tanks) and spreading equipment. The Scheme's payment level may not be sufficient to cover these additional costs, and therefore fail incentivise a change in on-farm activity.
- **Availability of organic fertilisers**. The east of England is dominated by arable farming. A local supply of livestock manure may not be available. Consequently, farms may not be able to fulfil the requirements of the Soil Standard.

By integrating bioenergy crops within a diverse crop rotation, AD can help supply organic fertiliser to the UK's prime arable farmland – thus supporting the recovery of soil health.

4. What changes do we need to see in the wider food and agriculture sector to encourage better soil management and how can the Government support this transition?

- The agricultural sector needs a government-backed certification scheme to verify and report the use of sustainable/regenerative farming techniques (e.g., no/min tillage, organic fertiliser use, diverse crop rotations etc.).
- In addition, the government must support development of the nascent market for soil carbon credits. With clear guidance on monitoring, reporting and verifications, farmers can implement new techniques to increase carbon sequestration in soils. The carbon market can help diversify agricultural incomes (replacing income from CAP), while improving the sustainability of production.

5. What does UK Government need to do to tackle other stressors on soil health such as soil contamination?

All solutions required cross-sectoral collaboration. Efforts to improve soil health must support wider government objectives, including Net Zero, agricultural sustainability, and food and energy security.

There is an urgent need to have land-based regulation that moves in a strategic unified direction. At present there is too much regulation which operates in a silo – without considering the bigger picture.

The UK Government must resource their regulatory departments with technical expertise, so they can be at forefront of UK soil health strategy. At the moment, our regulatory system lacks flexibility and dynamism needed to act quickly and strategically.

February 2023