Call for Expert Evidence
Climate Action Plan 2023

Contributors:
Biomass to Biochar for Farm Bioeconomy EIP
(redacted)

Carbon Pricing and Cross-Cutting Issues

5. Are there any other cross-cutting issues that should be considered in the development of the 2023 Climate Action Pan?

The cross-cutting gaps and issues we see are as follows:

- Cross-cutting gaps include focusing on **Negative Emission Technologies (NET's)** such Pyrogenic carbon capture and storage (PyCCS) which produces biochar. We would like to see this addressed in the 2023 Climate Action Plan to include a scale from NET's to High Emission Technologies, so we have clarity and transparency with carbon pricing as a country.
- Biochar is high-concentration carbon. You can see it, touch it, smell it. Setting the **Gold Standard** is essential and Biochar should be the equivalent of the **Gold Standard** of Carbon Pricing. Carbon pricing for the agricultural sector producing biochar should reflect this in order to remove obstacles in production and mind-shifting.
- In order to prevent green-washing we would like to see clear guidelines, including ratings (similar to the BER energy ratings used in housing) for carbon offsetting. Examples of Carbon credits and pricing are discussed on international platforms in relation to biochar (such as International Biochar Initiative (IBI); Verra.org (verified carbon standards))

Electricity

6. What measures might be taken to improve the resilience of the electricity system to the impacts of climate change?

Electricity generation often uses a large amount of energy to produce heat. Biomass Pyrolysis Technologies produce heat. We must have a wider range of technologies available to suit different communities and improve resilience. One such example would be the use of **Biomass Pyrolysis or Gasification Technology** to supplement heating needs using community pyrolysis plants in rural towns which can provide district heating and hot water, such as the Carbofex, Biomass Pyrolysis Technology in Finland [1] or the Syncraft plant in Germany [2], which would suit rural and suburban communities. Such fixed-location plants fix and concentrate large quantities of carbon by producing biochar and generating heat energy as an additional output.

8. What financial incentives are needed to increase renewable generation capacity?

A robust carbon pricing system* and a robust carbon rating system which once set will serve Ireland well in the future.

(*see carbon pricing section)

Enterprise

2. What measures can be taken to decarbonise high temperature heating in industry?

- We must adapt a wider range of technologies available to suit different industries. One such example would be the use of **Biomass Pyrolysis Technology** to decarbonise high temperature heating in manufacturing e.g., Carbofex, Biomass Pyrolysis Technology in Finland [1] & PYREG [3]

4. How can we encourage the diversification away from products with high levels of embodied carbon, such as traditional cement in construction to lower carbon alternatives?

We have experimented with adding **biochar** to 20% cement to create **'carbon building blocks'**. There are many waste products that could accelerate carbon reduction in construction [4]

5. What role could Carbon Capture and Storage (CCS) have in industry, and what steps would encourage its deployment?

CCS (Carbon Capture and Storage) reduces the amount of CO2 emitted and is at best carbon neutral, whereas CDR (Carbon Dioxide Removal) removes CO2 and is **carbon negative**. Such systems are usually extremely expensive and require very large scales and extensive facilities resources to be efficient. However, pyrolyisis technology and products such as **biochar** are CDR and carbon negative and **can be efficient at medium to small scale** and so make it possible to have verifiable CCS schemes not only at local scale, but also as part of rural bioeconomies.

6. What other opportunities exist to drive the decarbonisation of the enterprise sector?

A robust carbon pricing system and a robust carbon rating system will help to drive innovation and the enterprise sector [5]

Built Environment

7. How could the roll-out of district heating be accelerated and what needs to be done to expand its coverage in Ireland?

Heating requires a huge amount of energy to produce. Biomass Pyrolysis Technologies produce heat as a by-product. We must have a wider range of technologies available to suit different communities and improve resilience. One such example would be the use of **Biomass Pyrolysis Technology** to supplement heating needs using community pyrolysis machines in rural towns which can provide process biomass waste streams in parallel with producing district heating and hot water, such as Syncraft Austria [2], which would suit both rural and suburban communities.

Agriculture, Land Use and Forestry

1. What are the opportunities to increase take-up of measures identified in AgClimatise and encourage adoption of other practices which reduce emissions?

The adoption of other practices which reduce emissions: The role of Biochar

There are many measures identified in AgClimatise where the use of **biochar made from unutilized biomass** could present readily available **opportunities** to reduce emissions, but its generation also represents a verifiable carbon capturing and storage opportunity. We believe that biochar should be an essential part of the national plan for reducing emissions in the Agri sector.

In Ireland, the projects, organisations, cooperatives presently working on biochar solutions include:

Biomass to Biochar for Farm Bioeconomy (EIP)
Interreg NW Europe Three C Project (IrBEA)
The Irish Biochar Co-operative Society

Based on completed studies and work highlighting biochar as a sustainable carbon solution within the agricultural sector, we have shown that key tasks identified in AgClimatise can be achieved using biochar generation for:

- Energy production from biowaste processing
- Use of char as a soil amendment and alternative to chemical fertilizer* (as an additive to slurry) [6]
- Zero displacement of land use with positive economic implications for farmers [7]
- A decontaminant for water [8]
- Carbon Dioxide Removal (CDR) using unutilised agricultural biomass [9]

Pyrolyisis technology and as the production of **biochar** is an available and scalable example of CCS (Carbon Capture and Storage) which can produce an easily verifiable carbon negative outcome.

Biochar can be made:

- Using unutilized biomass such as rushes, furze, hazel, forestry thinning material
- on individual farms using no-tech methods** such as the Kon Tiki method [10]
- using community mobile pyrolysis machines on farms such as the prototype developed by *Biomass to Biochar* [11]
- using fixed-location community pyrolysis plants in rural towns which can process biowaste and provide district heating and hot water [12]

Biochar technology is already being used in Europe from high-tech to no-tech**:

- Carbofex, Biomass Pyrolysis Technology in Finland [1]
- Stockholm Biochar Project [12]
- PYREG [3] & Syncraft [2]
- Burning solution (to a burning problem)-biochar [13]
- Ithaka Institute for Carbon Strategies [14]

We believe that the biggest opportunity to **encourage the adoption** of new practices is through an international **carbon credit scheme** [15] [16] that recognises the tangible carbon-negative farming that biochar provides, unlike carbon offsets.

'The sector needs to find a way to reduce chemical nitrogen use, without compromising its ability to grow food, feed and fibre' (AgClimatise)
Biomass is a renewable resource and there are no critical considerations for the displacement of food production from the production of biochar from biowaste in Ireland (our farm studies [7] have shown that unutilised biomass is *already* present on farms and currently can be a costly nuisance to manage). The use biochar has the advantage of the availability and sustainability of feed material biomass which is currently underutilized (and currently contributing to GHG emissions when left to rot).

'Biogenic methane (CH4) from livestock accounts for ... approximately 65% of the total agriculture emissions' (AgClimatise).

In our laboratory tests we show that by adding biochar to slurry reduces methane by 33% and ammonia by 75% [17]

And in Teagasc study, biochar reduced NH3 emissions by 92, 54, 65 and 77% compared to the slurry control [18]

'A national liming programme for mineral soils to be rolled out by industry in 2021' (AgClimatise)
Biochar is known to have liming properties [19]

'Continue to invest in novel feed additives to reduce biogenic methane (AgClimatise)
We are presently undertaking a study with UCD to test the impact of using biochar as a feed additive for ruminant animal diet inclusion. There is increasing evidence that reductions in the emission of GHGs are possible as a result, potentially contributing to increased nutritional efficiency and greater sustainability in the dairy and beef sectors.

'Investigating how the bioeconomy can interact and synergise activities in a circular fashion that deliver organic nutrients to primary production, capture and reuse waste generated and deliver environmental sustainability with due regard to food safety implications' (AgClimatise)
A reduction of chemical pesticides and fertilisers will mean more reliance on liquid manure or slurry to close nutrient loops as part of farming's **Circular Economy**. However, liquid manure or slurry spreading produces GHG emissions. By converting unutilised biomass to recalcitrant biochar, using it as an additive for slurry which is then spread on land, this closes the nutrient loop, limits run-off losses and reduces GHG emissions produced by slurry for a **carbon-negative farming solution**.

*The recent allowance of biochar based material to be utilised within Organic Fertilisers at a European level should help further drive the development of the production and use of biochar containing fertlisers and soil amendments.
**low-tech methods offer immediate teaching opportunities from the ground up and are particularly relevant to rural Ireland.

2. What policies and measures would be needed to support farmers diversify their farm activities to include opportunities such as bioenergy, vegetable growth, forestry, organic farming, etc.?

The policies and measures needed to support farmers to diversify their farm activities to include opportunities such as producing biochar from unutilized biochar would be as follows:

Immediate

- Establish system for verifiable carbon credits [15] [16] on farms and stimulating a farm/rural scale bioeconomy
- Provide training on farms nationwide for making and activating biochar (low-tech*/no-tech) using known low emission methods and available materials to hand eg Kon tiki* [10]
- Develop national roll-out through Farmer-led teacher networks, biochar farm networks/cooperatives and involving other relevant stakeholders

Short to Medium Term

- Establishing protocol for activating biochar using different methods for different settings, prior to adding to soil, beginning with current knowledge base within biochar networks and working towards publication & roll-out
- Establishing protocol for adding biochar to slurry: biochar type, incorporation percentages, time before spreading etc

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6. What measures would support increased sustainable management of grasslands, including those areas on drained organic soils?

The measures we recommend to support increased sustainable management of grasslands, including those areas on drained organic soils are to implement carbon farming solutions, using biochar from unutilised biomass, using it as an additive to slurry prior to being spread on land, closing the nutrient loop but more importantly it is likely to reduce the opportunity for runoff. [6] [20]

7. What opportunities exist for increased use of cover crops, incorporating straw into tillage and for the application of regenerative agriculture practices? How can farmers be supported to take up these practices?

A Danish long term study of using straw that showed there was actually no increase in soil organic carbon over 20 years using that straw incorporated into the soil. [21]

Incorporation of straw alone will release GHGs as it rots. Superior opportunities exist from adding biochar (made from underutilized biomass) to fresh animal bedding (e.g., straw) which is a traditional co-composting method where nutrients from animal manure are adsorbed by the biochar which then acts as a carrier for plant nutrients. The carbon remains captured in the soil, as described in 'The cascaded use of biochar in animal farming' and 'Use as a soil conditioner' [6]

Farmers can be supported with training on how to produce biochar starting with the signpost farms plus farms identified as having a large amount of underutilized biomass [7]

9. What other opportunities exist to support the decarbonisation of the agriculture, land use and marine sectors?

Using biochar as an additive to slurry pits increases the nutrient value and reduces ammonia and methane production [17], [18]
When added to cattle feed it adsorbs toxins in the rumen and gut of cattle [22]
In water purification, biochar adsorbs pesticides and removes biological & chemical contaminants [23]
Using underutilized biomass to produce biochar could even help supplement the farmers' income with carbon credits, while developing a more sustainable agriculture sector.

10. What specific measures can be taken in agriculture, forestry and land use to adapt to climate change?

Specific to biochar as follows:

- Establish biochar test farms (e.g. Teagasc Signpost Farms) to develop protocols for using biochar products, using farms with high volumes of underutilised biomass (rushes, furze, hazel) [7]
- Investigate fully the current information for adding biochar to animal housing/bedding/ cattle slats to immediately reduce ammonia emissions
- Run further laboratory tests on available biochar types, establishing a production base line (minimum temperature and duration of pyrolysis) and recommended on-farm uses (soil amendment, water purification, food additive, ammonia reduction) for each biochar reviewing current knowledge base within biochar networks and building upon present knowledge
- Develop life systems and infrastructure for closed system processing, including collecting, drying and storage of underutilised biomass
- Build on alternative biochar production models to capture heat, to suit small to medium farms, cooperatives, large farms, rural communities, urban settings, schools, hospitals etc based on current models abroad, particularly in damper climates.
- Develop test sites nationally for different models (maintaining low-tech/no-tech*) suitable for rural areas
- Build larger community pyrolysis units in test sites with heat capture in conjunction with national bodies (ESB, Bord na Mona, Coilte) to improve infrastructure

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Public Sector Leading by Example

1. What opportunities exist for the public sector to step up its climate ambition?

Heating requires a huge amount of energy to produce for public buildings such as schools, hospitals, government buildings etc. **Biomass Pyrolysis Technologies** produce heat as a by-product and is **carbon negative.** We must look at a wider range of technologies available to suit different public sector situations to improve resilience. One such example would be the use of **Biomass Pyrolysis Technology** to supplement heating needs which can provide district heating and hot water, such as the Syncraft Plant in Germany [2], which would suit both many public sector buildings and provide an opportunity to develop best practice and new innovations for the private sector to transition to.

Just Transition

2. Are there any emerging skills gaps that need to be addressed that haven't already been identified by the Expert Group on Future Skills Needs in its *Skills for Zero Carbon* report?

There has been no inclusion for skills gaps in **Biomass Pyrolysis Technologies which are carbon negative.** The production of biochar needs to be achieved using high-tech to no-tech* plants (at a range of scales) and for the benefit of the agricultural sector in particular it would be prudent to include knowledge of pyrolysis systems in order to supplement farm income with carbon credits for verifiable carbon removal.

Biochar technology is already being used in Europe from high-tech to no-tech:

- Carbofex, Biomass Pyrolysis Technology in Finland [1]
- Stockholm Biochar Project [12]
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Research and Innovation

2. Have you identified any research and innovation gaps which need to be addressed? If so, how can these gaps best be addressed?

There has been no inclusion in research & innovation calls for development of **Biomass Pyrolysis Technologies (which are carbon negative).**

Research gaps exist in the development and testing of products and end-uses of biochar material to extend the utility and range of services to be gained from biochar. Further research is also required into the relationship between pyrolysis conditions and char qualities, in particular in relation to varying feedstock types.

Biochar technology is already being used in Europe from high-tech to no-tech* situations:

- Carbofex, Biomass Pyrolysis Technology in Finland [1]
- Stockholm Biochar Project [12]
- Burning solution (to a burning problem)-biochar [13]
- Ithaka Institute for Carbon Strategies [14]
- PYREG & Syncraft [3], [2]

We have a number of organisations in Ireland who are well placed to educate and inform an emerging markets:

Biomass to Biochar for Farm Bioeconomy (EIP)
Interreg NW Europe Three C Project (IrBEA)
The Irish Biochar Co-operative Society

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Biomass to Biochar for Farm Bioeconomy EIP

The purpose of this initiative has been to pilot the conversion of unutilised agricultural biomass, arising from management of pasture with rushes (Juncus spp.) and other problem species, into stable forms of recalcitrant biocarbon which can, when redeployed to the soil, confer multiple ecosystem benefits, driving an innovative bio-economy on and off the farm. A prototype Mobile Pyrolysis Unit (MPU), suited to Irish conditions, has been built and tested to produce biochar on-site with farmers/landowners who will act as producers and end-users. In doing so, this initiative demonstrates a methodology for Irish agriculture to develop a carbon-neutral approach to the management of undesirable biomass while at the same time increasing farm productivity and sustainability.

The Irish Biochar Co-operative Society (Trading as +Char)

A membership-based platform to research, produce, certify, process, market and record the agricultural use of biochar-based products.