

# Analysis

## Waste, Fertilising Product, or Something Else? EU Regulation of Biochar

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### ABSTRACT

The Intergovernmental Panel on Climate Change Sixth Assessment Report (report) on mitigation of climate change brought greenhouse gas removals (GGRs) under the spotlight. The report relied on the use of GGRs in all models suggesting how to comply with the Paris Agreement's temperature targets. The EU has adopted specific legislation to address one of the more technologically mature GGR methodologies—biochar—and its waste status dilemma. Here, biochar is analysed in more detail, focusing on the EU waste regime and the potential absolution of biochar from EU's waste obligations. Additionally, the recently enacted Fertilising Products Regulation (EU/2019/1009) is investigated, and its approach to label biochar a fertilising product. Ultimately, this study identifies regulatory inconsistencies and shortfalls of EU law as pertains to biochar's waste status, and recognises the need to establish a more comprehensive regulatory treatment of biochar that acknowledges its multifaceted nature, including helping the EU, and its member states to reach net zero.

**KEYWORDS:** biochar, greenhouse gas removal, waste, Regulation 2019/1009, Directive 2008/98.

### 1. INTRODUCTION

Since the adoption of the Paris Agreement (PA),<sup>1</sup> net-zero commitments have become the bread and butter of climate action. Article 4(1) of PA demands from its parties to achieve 'a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century', which spurred jurisdictions across the world, including the EU<sup>2</sup> and the UK,<sup>3</sup> to undertake net-zero commitments. Similarly, a myriad of private entities,

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<sup>1</sup> Paris Agreement, opened for signature 16 February 2016, UNTS I-54113 (entered into force 4 November 2016).

<sup>2</sup> European Commission, 'A Clean Planet for all, A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy' COM (2018) 773 final.

<sup>3</sup> Climate Change Act 2008, s 1(1).

such as multinational companies, and investment funds, not obliged by the PA, have pledged net-zero aims as well.<sup>4</sup>

PA makes it clear that emission *reductions* are only a part of the net-zero equation. Another salient piece is greenhouse gas *removals* (GGRs).<sup>5</sup> GGRs are not only a refuge for removing historical emissions in case of deficient progress in emission reductions for compliance with PA's temperature obligations, but also a necessary tool for emissions removal from hard-to-transition sectors, such as agriculture, industry, and long-distance transport.<sup>6</sup> Those residual emissions must hence be removed from the atmosphere if the parties were to abate all its emissions. For those reasons, the Intergovernmental Panel on Climate Change (IPCC) has relied on GGRs in all modelled pathways leading to compliance with 1.5 and 2°C targets,<sup>7</sup> and subsequently, it recognised these as a 'necessary element of mitigation portfolios to achieve net zero'.<sup>8</sup>

As parties to the PA, this finding is relevant to both the EU and the UK. In short, they will have to employ GGRs on a large scale to reach net-zero emissions. More precisely, to successfully reach their net-zero targets, the Commission estimates that at least 300–500 metric tons of carbon dioxide equivalent (Mt of CO<sub>2eq</sub>) per year will have to be removed in the EU by 2050 with the help of GGR methodologies—this is in addition to its objectives of removing 500–600 Mt of CO<sub>2eq</sub> from land use, land-use change, and forestry sectors.<sup>9</sup> Comparably, in its Net-Zero Strategy, the HM Government assessed that, in the same time period, the UK must grow its engineered removals from 75 to 81 Mt of CO<sub>2eq</sub> per year.<sup>10</sup> Furthermore, to reach the PA's temperature goals,<sup>11</sup> the IPCC projects that global GGR will have to absorb 192–1221 total greenhouse gas emissions equivalent (Gt CO<sub>2eq</sub>) cumulatively in this century.<sup>12</sup> This demands an unprecedented need for a new GGR-centred industry, which, some estimate, will exceed the market capitalisation of oil and gas majors by 2050.<sup>13</sup>

The law is crucial for the development of the GGR industry. The EU Climate Law provides a legally binding goal of reaching net-zero by 2050, and henceforth demands negative emissions.<sup>14</sup> Similarly, the Climate Change Act sets a legally binding net-zero target for the UK.<sup>15</sup> Furthermore, as a 'self-conscious agent of regulation', law will be one of the major forces that will affect the application of novel GGR methodologies in its own right, as well as through other regulatory modalities, such as markets and social norms.<sup>16</sup> The construction of the legal regime

4 For example, the United Nation's Race To Zero campaign connects cities, regions, businesses, investors, and educational institutions in the largest alliance of entities that are convinced to reach the net-zero target by at least 2050. For more on that, see Race To Zero, Campaign Overview (UNFCCC Climate Champions) <<https://climatechampions.unfccc.int/join-the-race/>> accessed 17 July 2022.

5 GGR methodologies are often denoted also as carbon dioxide removal methodologies because of the pronounced emphasis on carbon dioxide. This paper uses the former, broader denotation.

6 Mustafa Babiker and others, 'Cross-sectoral Perspectives' in *Climate Change 2022: Mitigation of Climate Change*, Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (Cambridge University Press 2022) chapter 12.

7 Keywan Riahi and others, 'Mitigation Pathways Compatible with Long-Term Goals' in *ibid*, chapter 3.

8 Babiker and others (n 6).

9 European Commission, 'Sustainable Carbon Cycles' COM (2021) 800 final.

10 HM Government, 'Net Zero Strategy: Build Back Greener' (HM Government, 2021) <[www.gov.uk/government/publications/net-zero-strategy](http://www.gov.uk/government/publications/net-zero-strategy)> accessed 5 April 2022.

11 Different goals considered in Riahi and others (n 7) are 1.5°C with substantial overshooting (median: 645 Gt CO<sub>2eq</sub>), 1.5°C with no or limited overshooting (median: 584 Gt CO<sub>2eq</sub>), and 2°C (median: 533 Gt CO<sub>2eq</sub>).

12 *ibid*.

13 Vivid Economics, 'An Investor Guide to Negative Emission Technologies and the Importance of Land Use' (Vivid Economics, 2020) <[www.vivideconomics.com/casestudy/an-investor-guide-to-negative-emission-technologies-and-the-importance-of-land-use/](http://www.vivideconomics.com/casestudy/an-investor-guide-to-negative-emission-technologies-and-the-importance-of-land-use/)> accessed 5 April 2022. In the relevant source, the referenced market capitalisation value of oil and gas majors is dated June 2020.

14 Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 [2021] OJ L 243/1 (European Climate Law) art 2(1).

15 Climate Change Act 2008, s 1(1).

16 Lawrence Lessig, 'The Law of the Horse: What Cyberlaw Might Teach' (1999) 113 Harvard Law Review 501.

will affect the ease of establishing this industry, shape how it will be formed, and which trade-offs of their utilisation will be considered admissible.

Notwithstanding the EU's and UK's recent explicit acknowledgement of the need for the application of GGR methodologies,<sup>17</sup> specific legal regulation of the subject area is still scarce. Differently from the UK, the EU has newly adopted a piece of specific legislation for one of the most technologically mature GGR methodologies—biochar.<sup>18</sup> Pursuant to the Fertilising Products Regulation,<sup>19</sup> the Commission has adopted Delegated Regulation,<sup>20</sup> which establishes biochar as a material that can be used in EU fertilising products.<sup>21</sup> By doing so, the EU legislator has complemented the most important general piece of legislation for biochar, that is, the Waste Directive.<sup>22</sup>

Previously, the Waste Directive has severely limited its utilisation potential of biochar by imposing waste-related obligations on biomass residues, and biochar by-products without providing a clear avenue for avoiding the application of waste status to biochar. Now, the Fertilising Products Regulation adds another layer of complexity to the regulation of biochar. This analysis piece aims to unravel some of these legal complexities and identify the shortcomings of the current EU legal regime in acknowledging biochar's GGR-related purposes.

This study starts with a short conceptualisation of what biochar is. Secondly, it inspects the applicability of the Waste Directive to biochar in the EU. It scrutinises the possibilities of evading the waste status imposed by the EU regime, and analyses the application of the recently enacted Fertilising Products Regulation to biochar.<sup>23</sup> Following the legislative overview, this analysis piece identifies a number of regulatory concerns relating to the EU's regulatory approach to biochar, and lastly, concludes with thoughts on ways in how to move forward with the current regulatory landscape of biochar.

## 2. WHAT IS BIOCHAR?

The scientific community presents a relatively clear denotation of biochar. In its 2019 Refinement of the 2006 Guidelines, the IPCC defined biochar as 'a solid material generated by heating biomass to a temperature in excess of 350°C under conditions of controlled and limited oxidant concentrations to prevent combustion process.'<sup>24</sup> Put differently, biochar is a charcoal-like substance manufactured by submitting virtually any type of biomass to a heating process in which the absence of a sufficient amount of oxygen averts its burning. Depending on the availability of oxygen and used temperature, that process is called either pyrolysis or gasification.

The definition characterises a material that can be used for a wide variety of purposes. As a start, biochar, like charcoal, can be used for energy production. Its properties make it also useful in agricultural production as a fertilising product. Depending on the variances of its feedstock

17 European Commission, 'Sustainable Carbon Cycles' (n 9) and HM Government (n 10).

18 According to the most recent evaluations, its technology readiness level is maxed out at 9 for production and ranges between 7 and 8 for its application. See Niki Bey and others, 'Certification of Carbon Removals. Part 1: Synoptic review of carbon removal solutions' (Umweltbundesamt 2021), <[www.umweltbundesamt.at/studien-reports/publikationsdetail?pub\\_id=2405&cHash=e6af7d1855770f2dc555831b8a74fade](https://www.umweltbundesamt.at/studien-reports/publikationsdetail?pub_id=2405&cHash=e6af7d1855770f2dc555831b8a74fade)> accessed 5 April 2022.

19 Regulation (EU) 2019/1009 of the European Parliament and of the Council of 5 June 2019 laying down rules on the making available on the market of EU fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009 and repealing Regulation (EC) No 2003/2003 [2019] OJ L 170/1 (Fertilising Products Regulation).

20 Commission Delegated Regulation (EU) 2021/2088 of 7 July 2021 amending Annexes II, III, and IV to Regulation (EU) 2019/1009 of the European Parliament and of the Council for the purpose of adding pyrolysis and gasification materials as a component material category in EU fertilising products [2021] OJ L 427/149 (Delegated Regulation).

21 Here, the term 'fertilising product' encompasses fertilisers and soil improvers.

22 Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives [2008] OJ L 312/3 with amendments (Waste Directive).

23 Fertilising Products Regulation, art 53.

24 E. Calvo Buendia and others, '2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories' (IPCC 2019).

and on the production and activation procedures, its attributes will ultimately differentiate.<sup>25</sup> Biochar might improve nutrient retention features of the soil but could also provide the land with additional nutrients, increase the soil organic carbon and the porosity of the soil, decrease its bulk density, and discharge it from pollutants.<sup>26</sup> More novel utilisations of biochar comprise its use in water and air purification in the built environment,<sup>27</sup> and even as a feed supplement for animals.<sup>28</sup> More importantly, due to its longevity of carbon storage and recalcitrance to decomposition, biochar is hailed as a potential GGR methodology that can durably store the biogenic carbon previously captured from the air by biomass.<sup>29</sup>

When biochar is not used as a fuel, it can fulfil its GGR purpose simultaneously with other utilisations. However, certain manners of employment, such as land application, provide more carbon storage capacity, which is crucial for reaching biochar's GGR purpose.<sup>30</sup> Therefore, land application is seen to hold the most promise for fulfilling biochar's GGR potential.

Despite the benefits of biochar, both production as well as land application of biochar contains a certain level of risks. While the perils of biochar production are closely tied to issues of industrial production, the risks of land application are more nuanced. Its sum of effects will vary on the type of biochar, as well as the land to which it is applied.<sup>31</sup> Firstly, there is a risk of water and soil pollution with substances such as heavy metals, polycyclic aromatic hydrocarbons (PAHs), dioxins, and environmentally persistent free radicals.<sup>32</sup> Secondly, biochar is also capable of endangering the aerial environment due to particulate matter (PM) emissions and greenhouse gas emissions of nitrous oxide and methane.<sup>33</sup> Moreover, biochar application in larger quantities could affect the microbial composition of the soil,<sup>34</sup> decrease the albedo effect of the soil,<sup>35</sup> and cause flammability risks.<sup>36</sup>

As mentioned above, biomass feedstock co-determines biochar's features. Its feedstock can be sourced as biomass specifically grown for the reason of biochar production. However, that will often not be the case. For its relative abundancy, the feedstock will rather originate from agricultural and forestry residues, industrial biomass remnants, such as sawdust or woodchips, or biodegradable waste. It can also include organic feedstock from the paper industry, animal by-products industry, and sewage sludge. Furthermore, in line with the EU's circular economy ambitions,<sup>37</sup> and considering the perils of competition of biomass to food production and other socio-economic, as well as environmental hazards of agricultural production, discarded biomass commonly presents a preferable source.<sup>38</sup> Even in cases when the feedstock is specially designated to undergo pyrolysis or gasification, the production process will yield more outputs besides biochar, such as biogas, bio-oil, and heat, which risks making biochar a non-primary product. This risk is compounded by the traditional perception of chars, which legislation tends

25 Anil Kumar Sakhiya, Abhijeet Anand and Priyanka Kaushal, 'Production, Activation, and Applications of Biochar in Recent Times' (2020) 2 *Biochar* 253.

26 *ibid.*

27 *ibid.*

28 Ka Yan Man and others, 'Use of Biochar as Feed Supplements for Animal Farming' (2021) 51 *Critical Reviews in Environmental Science Technology* 187.

29 Jinyang Wang, Zhengqin Xiong and Yakov Kuzyakov, 'Biochar Stability in Soil: Meta-analysis of Decomposition and Priming Effects' (2016) 8 *Global Change Biology Bioenergy* 512.

30 Matti Kuittinen and others, 'How Can Carbon Be Stored in the Built Environment? A Review of Potential Options' [2021] *Architectural Science Review*.

31 Ling Xiang and others, 'Potential Hazards of Biochar: The Negative Environmental Impacts of Biochar Applications' (2021) 420 *Journal of Hazardous Materials* 126611.

32 *ibid.*

33 *ibid.*

34 *ibid.*

35 Gert-Jan Nabuurs and others, 'Agriculture, Forestry and Other Land Uses (AFOLU)' in (n 6) chapter.

36 Catherine E. Brewer and Robert C. Brown, '5.18 Biochar' (2012) 5 *Comprehensive Renewable Energy* 357.

37 European Commission, 'A New Circular Economy Action Plan for a Cleaner and More Competitive Europe' COM (2020) 98 final.

38 Babiker and others (n 6).

to present as unwanted residues, and hence waste.<sup>39</sup> Thus, biochar is tightly interconnected with the notion of waste, which is mirrored by the regulation framework. This interlined relationship between biochar and the law on waste will be analysed next.

### 3. BIOCHAR'S WASTE STATUS

EU law on waste is centred on the Waste Directive, which defines waste as 'any substance or object which the holder discards or intends or is required to discard'.<sup>40</sup> The Court of Justice of the EU (CJEU) has adopted a view that waste status of products needs to be determined 'in the light of all the circumstances' of a particular case.<sup>41</sup> The assessment should not construe the word 'discard' restrictively<sup>42</sup> but rather with the view to achieving the aims of the Waste Directive, that is, the protection of the environment and human health from adverse effects of waste management, as well as the 'precautionary principle and the principle that preventive action should be taken'.<sup>43</sup>

Biochar's status within this regulatory landscape depends on the waste status of the biomass feedstock. Biochar is subject to waste obligations in cases where it derives from feedstock that was discarded, for instance, as municipal biodegradable waste, or untreated sewage sludge. In cases of other organic feedstock, such as agricultural, forestry, and industrial residues, the factual circumstances of the specific case will play a determinative role in whether biochar of this kind is flagged as waste, which, in turn, will have a direct impact on the possible applications of biochar. In other words, the definition of waste in relation to biochar is hugely significant for both biochar producers and users.

To counteract the broad characterisation of waste, the Waste Directive excludes certain waste from its scope, including faecal matter, straw, and other natural non-hazardous agricultural or forestry matter which is used in farming, forestry, or for the production of energy.<sup>44</sup> Similarly, its provisions, subject to the criteria established therein, prevent materials from either becoming waste in the first place (by-products),<sup>45</sup> or causing the waste status to end.<sup>46</sup> In this way, the Waste Directive enables further handling of the material without the obligations of waste management. To assess the waste status of biochar these aspects must be considered.

#### 3.1 Waste Directive Exclusion

Biochar can often be made of woody biomass left from forestry activities, crop residues, and similar natural materials. Biochar produced from such feedstock, together with agricultural, forestry, and other natural residues, may benefit from the exclusion of the application of the Waste Directive.<sup>47</sup> The provision does not contain further clarification, nor has it been a case for the CJEU to clarify. While it *prima facie* appears capable of biochar exemption from waste obligations, its exact applicability is unclear.

Firstly, biochar utilisation is not a completely harmless process. As mentioned above, its production and use are riddled with environmental and human health risks, including risks of flammability, and pollution with heavy metals and PM. In its production process, those are

39 For instance, Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) Text with EEA relevance [2010] OJ L 334/17 with amendments art 43 and 53 defines solid residues from waste (co-)incineration as waste and demands its minimisation.

40 Waste Directive, art 3(1).

41 Joined Cases C-418/97 and C-419/97 *ARCO Chemie Nederland and Others* [2000] ECR I-4475 [73].

42 *ibid* [40].

43 Case C-9/00 *Palin Granit Oy v Lounais-Suomen Ymparistokeskus* [2002] ECR I-3533 [25].

44 Waste Directive, art 2(1)(f).

45 *ibid*, art 5(1).

46 *ibid*, art 6(1).

47 *ibid*, art 2(1)(f).



managed with other regulatory mechanisms, namely environmental impact assessment and environmental permitting of installations and waste (co)incineration facilities. Furthermore, non-wasted substances are submitted to REACH registration. In contrast, in EU law, beyond a limited obligation imposed on downstream users to produce a 'chemical safety report',<sup>48</sup> other biochar handling and application is not put under detailed regulatory scrutiny. Thus, a general exclusion might encroach on the aforementioned aims of the Waste Directive.

Secondly, the processes of biochar production to which such wasted biomass is subjected are not necessarily part of the agricultural, forestry, or energy production sectors, as demanded by the mentioned provision. Preparation of biomass for biochar production and the procedures of pyrolysis, or gasification present operations in which biomass is remade into new materials. This is additionally compounded in cases of industrial-scale production of biochar where production facilities are complex layouts of units juxtaposed to each other. In those cases, it would be difficult to argue that the process of biomass utilisation for biochar production presents simple re-utilisation of the agricultural and forestry material for agricultural, forestry, or energy production.

Lastly, the conceptual construction of the exclusion could prove to be limited on application to biochar that is produced and applied by the same person that gathered the feedstock. Namely, the provision predicates the knowledge of the feedstock holder about the harmlessness of its future use that would exclude it from its present waste-related obligations. Such a level of knowledge would be probable when all biochar-related processes are carried out by the same person, who would assure compliance with environmental and human health protection. In commercial biochar processes, on the other hand, the case is that until the final user applies the biochar to the land, no part of its supply chain would have the available information to adequately assess the harms that its use would entail. Therefore, it would demand from all the chain links before its application to act as if the material is waste to prevent any possible adverse effects on the environment and human health. However, when such criteria of knowledge would be fulfilled, it is questionable if the exclusion is not redundant, as such material could hardly be regarded as discarded in the first place.

### 3.2 By-product Status

The second option of biochar to escape waste obligations would be in relying on rules applicable to by-products. Here, two situations with different outcomes on biochar waste categorisation need to be distinguished: when biomass feedstock could avoid waste status as a by-product, and when the finished product of biochar is not the primary product of its production process.

Agricultural and forestry residues could be exempt from waste obligations as a by-product when they are not the primary aim of production, and their further use as a biochar feedstock is certain.<sup>49</sup> This could be the case with organic industrial residues that are subsequently used in biochar production. If the feedstock avoids waste status as a by-product, biochar produced from it as a primary product would not be considered as waste either. Nevertheless, when analysing the by-product conditions, the Waste Directive may still be applicable as feedstock's expected use as biochar does not fulfil the condition of being 'used directly without any further processing'.<sup>50</sup> CJEU's case law establishes that this prerequisite is not fulfilled when the envisaged use

48 Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC [2006] OJ L 396/1 with amendments (REACH Regulation), arts 2(2), 37(4), and 38.

49 Waste Directive, art 5(1).

50 *ibid.*, art 5(1)(c).

demands a recovery operation.<sup>51</sup> For the creation of biochar, the biomass needs to undergo further processing in the form of pyrolysis or gasification, which would fall within recovery operations listed in Annex II of the Waste Directive, namely under the example of ‘recycling/reclamation of organic substances which are not used as solvents’.<sup>52</sup>

Differently from feedstock biomass, the by-product status could, in principle, apply to biochar when the primary aim of pyrolysis or gasification is the production of its co-originating products, such as bio-oil or biogas or when energy will be at the focal point of its production.<sup>53</sup> This change of focus might result in adjustments to the production procedure, for example, in the use of fast pyrolysis for bio-oil production, gasification for gas manufacturing, or for subsequent power or heat production by combustion of the gas.<sup>54</sup> In those cases, the proportion of produced biochar will normally be smaller because, in general, biochar yield decreases with increasing temperature.<sup>55</sup> Thus, biochar could earlier be seen as a residue of the production process although its quality would not necessarily be impaired.<sup>56</sup> Considering that no further processing beyond normal industrial practice is needed for its use, it could be a by-product if it fulfils the relevant requirements, particularly not to cause ‘adverse environmental or human health impact’.<sup>57</sup> In satisfying these demands, the criteria established by the mentioned Delegated Regulation will be important, as explained next.

### 3.3 End-of-waste Status

In most cases, biochar producers and users are unable to rely on either the exclusion from the Waste Directive, or the by-products rules in attempting to avoid biochar being classified as waste. According to what was discussed above, discarded biomass used for biochar production would be considered waste, at least until it has undergone the recovery process. When this is done, biochar still needs to comply with the preconditions enumerated in the Waste Directive to induce its end-of-waste status.<sup>58</sup>

The assessment of those criteria for specific materials is either carried out by the EU,<sup>59</sup> or by the national authorities should the EU fail to act.<sup>60</sup> In the case of scrap copper and metal, the Commission has enacted separate regulations for such end-of-waste materials. In the case of biochar, however, the EU legislature has approached the issue differently. More precisely, it has adopted the Fertilising Products Regulation, which recognises biochar’s usefulness as a fertilising product, and subsequently, it also appreciates its relevant market demand.<sup>61</sup> As such, biochar complies with the first two end-of-waste criteria, that is, its use ‘for specific purposes’ and existing ‘market or demand’.<sup>62</sup> Importantly, the Fertilising Products Regulation highlights the importance of standardised requirements for the evaluation of the remaining criteria in light of biochar’s potential harmfulness to the environment and human health.<sup>63</sup> For this reason, it entrusts the Commission to assess the risk of biochar to the environment, evaluate its agro-economic efficiency, and potentially, include it in Annex II of the Fertilising Product Regulation.<sup>64</sup>

51 Case C-114/01 *Proceedings against AvestaPolarit Chrome Oy* [2003] ECR I-08725 [41-42].

52 Waste Directive, Annex II(R3) and footnote 9.

53 Ibid, art 5(1).

54 Robert C. Brown, ‘The Role of Pyrolysis and Gasification in a Carbon Negative Economy’ (2021) 9 *Processes* 882.

55 Ibid.

56 Namely, biochar quality depends on a multitude of factors, see Sakhiya, Anand and Kaushal (n 25).

57 Waste Directive, art 5(1)(d).

58 Ibid, art 6(1).

59 Ibid, art 6(2).

60 Ibid, arts 6(3) and (4).

61 Fertilising Products Regulation, rec 19.

62 Waste Directive, arts 6(1)(a) and (b).

63 Fertilising Products Regulation, rec 19 and Waste Directive, arts 6(1)(c) and (d).

64 Fertilising Products Regulation, arts 42(1) and (2).

This, however, can only be followed through if it is determined that biochar complies with end-of-waste criteria.<sup>65</sup>

The Commission has since found that biochar could be in line with set conditions, and it has adopted the relevant Delegated Regulation, which relies on the findings of the Joint Research Centre's report that establishes a set of recovery rules ensuring the safety of its use.<sup>66</sup> The Commission included biochar in the Fertilising Products Regulation with the application date of the 16th of July 2022.<sup>67</sup> Henceforth, biochar will be provided with unified criteria throughout the EU to cease being waste when presenting a component material of EU fertilising products.<sup>68</sup> Additionally, it will benefit from the free movement of EU fertilising products in the EU.<sup>69</sup>

In order for this to take place, biochar will have to comply with the general demands of the Fertilising Products Regulation, and meet the requirements of the newly established category 'CMC 14: Pyrolysis and gasification materials'.<sup>70</sup> The latter sets a biochar standard, and demands that the use of biochar should not pose 'risk to human, animal or plant health, to safety or to the environment'.<sup>71</sup> It provides limits on the types of usable feedstock,<sup>72</sup> restricts contamination and production processes,<sup>73</sup> caps the content of certain hazardous substances,<sup>74</sup> and demands registration of the material according to REACH Regulation.<sup>75</sup> While this standardisation of biochar presents a sense of increased legal certainty, it also invokes several questions about its scope and adequacy of governing GGR purpose of biochar. These questions will be addressed in the next section.

#### 4. OPEN QUESTIONS

The waste status dilemma may come across as a mere technicality but it comes with significant legal obligations. The entire supply chain of a product, such as biochar, can be affected by onerous obligations that are imposed on waste. These include the Waste Directive's all-encompassing permitting<sup>76</sup> and registration<sup>77</sup> obligations and the responsibility of every waste-holder to ensure compliance with a list of legal obligations.<sup>78</sup> Other EU laws may also apply, for example in the case of waste transport<sup>79</sup> and depositing 'waste onto or into land'.<sup>80</sup> These waste obligations combined with the legal uncertainties invoked by the waste status, would therefore present a high barrier to commercial utilisation of every material, let alone an emerging GGR methodology, such as biochar.

Biochar's waste status dilemma primarily arises from the general lack of clarity in the waste definition. This is caused by the directive's conflicting tensions between the waste prevention

65 *ibid*, art 42(3).

66 Delegated Regulation, rec 5 and 8.

67 Fertilising Products Regulation, art 53(2).

68 Delegated Regulation, rec 3.

69 Fertilising Products Regulation, art 3(1).

70 *ibid*, Annex II(CMC 14) corresponding Delegated Regulation, Annex I(2)(c).

71 Delegated Regulation, rec 8.

72 Fertilising Products Regulation, Annex II(CMC 14)(1) and (4) corresponding Delegated Regulation, Annex I(2)(c)1 and 4.

73 Fertilising Products Regulation, Annex II(CMC 14)(2) and (5) corresponding Delegated Regulation, Annex I(2)(c)2 and 5.

74 Fertilising Products Regulation, Annex II(CMC 14)(3) and (6) corresponding Delegated Regulation, Annex I(2)(c)3 and 6.

75 Fertilising Products Regulation, Annex II(CMC 14)(7) corresponding Delegated Regulation, Annex I(2)(c)7.

76 Waste Directive, art 23.

77 *Ibid*, art 26.

78 *ibid*, art 15(1).

79 Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste OJ L 190/1 with amendments.

80 Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste [2009] OJ L 182/1 with amendments, art 2(g).



policy that aims to achieve a useful role for the material that would otherwise be discarded.<sup>81</sup> To the Waste Directive establishes an all-encompassing definition of waste, with mentioned exceptions for by-products and end of waste.<sup>82</sup> As explained, biochar place among these definitions is uncertain, leaving the relevant market operators, and the use of biochar-related GGRs activities in limbo. Furthermore, biochar is plagued by the short-sightedness of the CJEU-produced waste definition, which sacrifices the long-term effects of such protection in its pursuit of prevention of immediate environmental harm.<sup>83</sup> In the long term, the environment could benefit from a narrower waste definition in the case of biochar.<sup>84</sup> Namely, as recognised by the IPCC, production of specially designated biomass ensues major socio-economic and environmental risks regarding competition for resources, ecosystem health, biodiversity, livelihoods, and food security.<sup>85</sup> Additionally, the long-term benefits of utilising readily available waste for biochar production could encompass its contribution to mitigating climate change by enabling necessary removal of carbon from the atmosphere,<sup>86</sup> as well as to climate change adaptation by providing co-benefits such as soil improvement. Conversely, the existing waste regime with its all-encompassing definition of waste leaves little manoeuvring space for business models to harness those benefits.<sup>87</sup> The EU has responded to some of these legal ambiguities through the recently adopted Delegated Regulation that allows EU fertilising products consisting of biochar to freely circulate in the internal market.<sup>88</sup>

Despite these efforts, uncertainties remain relating to the waste status of biochar that falls outside of the Fertilising Products Regulation. Considering that the regulation establishes only a voluntary system of EU-wide approval,<sup>89</sup> explicitly limits the applicability of end-of-waste criteria to EU fertilising products,<sup>90</sup> demands a declaration of conformity for inducing end-of-waste status,<sup>91</sup> the power to adopt requirements for biochar's end-of-waste status stays with the member states to either determine their own set of general 'detailed criteria',<sup>92</sup> or decide these on a case-by-case basis.<sup>93</sup> Such competing systems established by the EU's Waste Directive, on one side, and the Fertilising Products Regulation, on the other, may not only increase legal uncertainty but also risk a regulatory race to the bottom in which member state's biochar standards could be spurred to accommodate the market. This is particularly risky, considering the rising demand on voluntary carbon markets,<sup>94</sup> and the role of biochar therein.<sup>95</sup> Compounded by the novelty and complexity of the subject, environmental and human health considerations connected to biochar quality could be in danger of being ignored. It would be vital to uphold high standards regarding categories, such as the content of heavy metals and PAHs, as well as contamination levels. The recalcitrance of biochar and the difficulties of reversibility of its application make it important to get those considerations right. Therefore, it could be more

81 Eloise Scotford, 'Trash or Treasure: Policy Tensions in EC Waste Regulation' (2007) 19 *Journal of Environmental Law* 367.

82 *ibid.*

83 Julia Hoernig, 'Towards 'Secondary Raw Material' as a Legal Category' (2022) 24 *Environmental Law Review* 111.

84 *ibid.*

85 Babiker and others (n 6).

86 *ibid.*

87 Hoernig (n 83).

88 Fertilising Products Regulation, arts 19 and 42(3).

89 Fertilising Products Regulation rec 5.

90 *Ibid.*, rec 19.

91 *Ibid.*, art 19.

92 Waste Directive, art 6(3).

93 *Ibid.*, art 6(4).

94 Voluntary carbon markets could increase up to 15 times in size until 2030 and 100 times in size until 2050. See Taskforce on Scaling Voluntary Carbon Markets, Final Report (Institute for International Finance) <[www.iif.com/tsvcm](http://www.iif.com/tsvcm)> accessed 6 July 2022.

95 For example, Puro.earth and Carbonfuture utilise biochar for the creation of 'CO<sub>2</sub> removal certificates' (Puro.earth) or for 'cf-certificate' (Carbonfuture).

favourable to have one regulatory regime that, albeit gradually and with time, legislates the topic appropriately.

Similarly, the EU's regulation of biochar is also problematic for its lack of consideration of biochar uses beyond its fertilising properties, and particularly its use as a GGR. As explained, the Waste Directive allows regulatory exemption for by-products and end-of-waste status,<sup>96</sup> and the Fertilising Products Regulation ceases biochar's waste status when it is used as a fertilising product.<sup>97</sup> In the case of GGRs, however, biochar has a broader range of uses maximising soil quality the uptake of carbon quantity in the land. This leads to different considerations of the requirements for its quality and use, such as the carbon content of biochar, its longevity of storage, and maximisation of its storage relative to the size of land. It induces different risks that are tied to the high content of biochar in the land. Additionally, biochar, in its agricultural application, endangers food safety<sup>98</sup> which does not need to be the case when used for its GGR purpose. Its GGR function does not demand application to agricultural soil, thus, not necessarily ensuing food safety risks. Therefore, considering that the member states are precluded from establishing their standards only when there are EU detailed criteria, there is no reason why they could not reassess the biochar's harmfulness to the environment and human health for other purposes than as a fertilising product.<sup>99</sup>

Biochar's sole conceptualisation as a fertilising product can produce inconsistencies and improper regulatory treatment of biochar's subsequent use. It can lead to redundant regulatory obstacles that incongruously with biochar's properties hamper the employment of its GGR potential. For instance, the Nitrates Directive establishes demands for the application of fertilisers containing nitrogen compounds for limiting nitrogen leaching,<sup>100</sup> which would equally apply to biochar despite its properties to prevent such leaching.<sup>101</sup> Furthermore, incongruous regulatory regimes can simultaneously fail to properly address the protection of values that biochar could impede when employed as a GGR methodology. This is the case in the regulation of fertiliser use which is in member states, such as Germany, governed predominantly through the limitations of nutrient intake and by demanding nutrient efficiency corresponding to the needs of the plants.<sup>102</sup> Conversely, when maximisation of sequestered carbon is sought, issues may arise, such as biochar runoff, flammability risks, decrease of soil's albedo effect, heavy metal and PAHs contamination and increase of aerial PM. Furthermore, the choice of appropriate land for its application is vital. Currently, those are not the issues that would be at the forefront of fertiliser use governance. Those risks are additionally inflated by the need to scale up its utilisation to provide a meaningful contribution of GGR to mitigating climate change.

Overall, one could attribute those regulatory shortfalls to the definitional deficit of the present legislative regime of the EU. Currently, biochar commonly falls in the broad waste definition. A consequence of the Fertilising Products Regulation is that it can escape the denotation of waste if it fulfils the standard-setting definition of the Delegated Regulation which is predominantly set on its physicochemical features and its production.<sup>103</sup> Additionally, it has to be a component material of an EU fertilising product that is tied to the 'purpose of providing the

96 *ibid*, arts 5(1)(a) and 6(1)(a).

97 Fertilising Products Regulation, rec 19.

98 Jian Wang and others, 'Polyaromatic Hydrocarbons in Biochars and Human Health Risks of Food Crops Grown in Biochar-Amended Soils: A Synthesis Study' (2019) 130 *Environment International* 104899.

99 Waste Directive, art 6(1)(d).

100 Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources [1991] OJ L 375/1 with amendments, art 2(e).

101 Nabuurs and others (n 35).

102 For example, *Düngeverordnung* s 3(1) establishes principles of application of fertilisers, namely that a balance between nutrient requirements and nutrient supply must be reached.

103 Fertilising Products Regulation, Annex II (CMC 14) corresponding Delegated Regulation, Annex I(2)(c).

plants or mushrooms with nutrient or improving their nutrition efficiency.<sup>104</sup> While the first is encompassing the umbrella term of what can be considered as biochar and of what quality it should be, the second is sufficient to clearly separate biochar's fertilising product function from some biochar uses, for instance for water and air purification or for use in the building sector. However, it is not adequate when considering biochar's feature of a GGR. Namely, the overlapping nature of both purposes, the similarities of its effects on the land by improving its nutritional value, and the differences in their risks all speak for a more concise definition and for an establishment of explicit governance of its GGR purpose. The opportunity for doing so will already be in the EU's forthcoming regulation of GGR certification.<sup>105</sup>

## 5. CONCLUSIONS

The EU has recently adopted specific legislation regulating one of the most developed GGR methodologies—biochar. In the EU, biochar has been riddled with the question of whether it enjoys waste status, or not, which depends on multiple factors, including whether it has feed-stock's waste status, or indeed is excluded from the waste regime due to it being non-hazardous waste, a by-product, or end of waste. By adopting the Fertilising Product Regulation, and the relevant Delegated Regulation, the EU legislator has established EU-wide criteria to help biochar enjoy the status of a by-product, or end of waste.

The EU has thus taken steps towards dealing with the legal uncertainties surrounding the waste status of biochar. However, the limitedness of the adopted criteria to EU fertilising products makes biochar's EU-wide waste relief only partial. In absence of by-product and end-of-waste criteria for biochar beyond the scope Fertilising Products Regulation and biochar that aims to satisfy its GGR potential, the member states are left to decide on those criteria. This risks inconsistency across the EU. Finally, a labelling approach that considers only biochar's fertilising product function relies on further regulation of fertilising products, rather than considering the specificities of specific GGR application. Generally, this could be attributed to definitional deficiencies of the EU regime which does not distinguish between the use of biochar as a GGR, and as a fertilising product.

In its Sixth Assessment Report, the IPCC clearly stated the necessity of large-scale GGR deployment to reach the relevant climate targets.<sup>106</sup> It has recognised biochar, particularly in combination with bioenergy, as showing 'significant mitigation potential', while simultaneously providing many co-benefits.<sup>107</sup> The said issues of EU law have the potential to adversely affect these benefits, and so undermine EU's net-zero ambition. What the EU will have to do, as well as any other country which has not yet examined its national legislation applicable to the use of biochar as a GGR methodology, is to address biochar more concisely in its regulatory regime. The rapidly approaching net-zero due date, the slow progress in emission abatement, and the risks of poor GGR governance suggest directed legislative action towards GGR purpose of biochar is required. It is recommended to avoid biochar definitional bifurcation into waste and fertilising products, recognise its positive effects in terms of climate mitigation, and establish a more comprehensive set of rules better tailored to the multifaceted nature of biochar.

104 Fertilising Products Regulation, art 2(1).

105 European Commission, 'Sustainable Carbon Cycles' (n 9).

106 Babiker and others (n 6).

107 Nabuurs and others (n 35).

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