for your information

FYI

LANDGEWINN INSIGHTS

Newsletter

Ausgabe April/Mai/Juni/Juli 2023

LANDGEWINN

Liebe Leserinnen, liebe Leser,

mit diesem Newsletter informieren wir über neue Fachpublikationen, Veranstaltungen und Meldungen zu ausgewählten Dekarbonisierungstechnologien an der Schnittstelle von Land- und Energiewirtschaft. Neue Publikationen und kommende Veranstaltungen werden auf Basis einer Recherche und externen Hinweise zusammengetragen.

Gefördert durch:

Bundesministerium für Wirtschaft und Klimaschutz

Aufgrund eines Beschlusses des Deutschen Bundestages

Der Newsletter wird im Rahmen des Projekts Landgewinn „Energiesystemanalyse von Dekarbonisierungsstrategien der Landwirtschaft“ veröffentlicht, das vom Bundesministerium für Wirtschaft und Klimaschutz (BMWK) gefördert wird. Ziel des Projekts ist die fachlich übergreifende Bewertung der drei landwirtschaftlichen Dekarbonisierungstechnologien Agri-Photovoltaik, Pyrolyse zur Herstellung von Pflanzenkohle sowie klimaneutrale Mobilität in der Landwirtschaft.

Die geteilten Informationen wurden sorgfältig zusammengestellt, dabei übernehmen wir keine Verantwortung für die Inhalte, Richtigkeit und Vollständigkeit der Informationen. Die Suchergebnisse werden entsprechend der Quellen auf Deutsch oder Englisch aufgeführt. Direkte Zitate sind über Anführungszeichen kenntlich gemacht und die Fundstelle angegeben oder auch verlinkt.

Der Newsletter erscheint in einem zwei- bis viermonatigen Turnus. Wir freuen uns, wenn Sie uns für den Landgewinn-Kontext relevante Veröffentlichungen, Veranstaltungen und neue Projekte, die Ihnen über den Weg laufen, zukommen lassen (hannes.bluhm@ioew.de).

Viel Spaß beim Lesen!

Ihr Landgewinn-Team

Neue Publikationen

Article: "We Could Be Much Further Ahead" -Multidimensional Drivers and Barriers for Agricultural Transition

Madita Olvermann, Johanna Hornung, Simone Kauffeld, 2023

Link: "We Could be Much Further Ahead "

Kurzbeschreibung: "Agricultural transition toward sustainability is subject to individual and political constraints, spurring the need to understand system dynamics from both a psychological and a public policy angle; however, empirical data remains limited. The present paper empirically contributes to theoretical frameworks on sustainability transitions and analyzes multiple dimensions related to the success of agricultural transition. This investigation employed a multidisciplinary, multimethodological approach that combined two empirical studies."

„Carbon Farming? Wir sprechen lieber von Humusaufbau" Kurzzusammenfassung der Ergebnisse aus einer Gruppendiskussion mit Ackerbaubetrieben vom 31. März 2023

Susanna Hönle

Link: „Carbon Farming? Wir sprechen lieber von Humusaufbau"

Kurzbeschreibung: „Humusaufbau, Carbon Farming oder regenerative Landwirtschaft – in den letzten Jahren hat das Interesse an landwirtschaftlichen Maßnahmen und Praktiken, die potentiell zu einer zusätzlichen Speicherung von Kohlenstoff in Böden und Biomasse beitragen und damit einen Beitrag zum Klimaschutz liefern könnten, stark an Bedeutung gewonnen. Vor diesem Hintergrund haben das Ackerbauzentrum Niedersachsen und das Thünen-Institut am 31.03.2023 Ackerbaubetriebe zu einer Diskussionsveranstaltung in das Forum des Thünen-Instituts in Braunschweig eingeladen. Im Fokus der Veranstaltung standen dabei die Gestaltung von Fördermaßnahmen und Vergütungsoptionen. Für die Landwirte können damit neue Einkommenschancen, aber auch neue Risiken verbunden sein."

Paper: Carbon Sequestration Strategies in Soil Using Biochar: Advances, Challenges, and Opportunities

Lei Luo, Jiaxiao Wang et al.

Link: Carbon Sequestration Strategies in Soil Using Biochar

Kurzbeschreibung: "[…] Here we identify five key issues closely related to the application of biochar for C sequestration in soil and review its outstanding advances. Specifically, the terms use of biochar, pyrochar, and hydrochar, the stability of biochar in soil, the effect of biochar on the flux and speciation changes of C in soil, the emission of nitrogen-containing greenhouse gases induced by biochar production and soil application, and the application barriers of biochar in soil are expounded. By elaborating on these critical issues, we discuss the challenges and knowledge gaps that hinder our understanding and application of biochar for C sequestration in soil and provide outlooks for future research directions. We suggest that combining the mechanistic understanding of biochar-to-soil interactions and long-term field studies, while considering the influence of multiple factors and processes, is essential to bridge these knowledge gaps. Further, the standards for biochar production and soil application should be widely implemented, and the threshold values of biochar application in soil should be urgently developed. Also needed are comprehensive and prospective life cycle assessments that are not restricted to soil C sequestration and account for the contributions of contamination remediation, soil quality improvement, and vegetation C sequestration to accurately reflect the total benefits of biochar on C sequestration in soil."

Manuskript: Potentials and barriers to land-based mitigation technologies and practices (LMTs) - a review

Lokendra Karki, Jenny Lieu et al.

Link: Potentials and barriers to land-based mitigation technologies and practices

Kurzbeschreibung: "Land-based mitigation technologies and practices (LMTs) are critical for achieving the Paris Agreement's aim of avoiding dangerous climate change by limiting the rise in average global surface temperatures. We developed a detailed two-level classification and analysis of barriers to the adoption and scaling up of LMTs. The review suggests that afforestation/reforestation and forest management are LMTs with wide application and high potential across all continents. BECCS (bio-energy with carbon capture and storage) and biochar have a higher potential in higher-income countries in the short term due to the availability of technology, funding, and existing low-cost biomass value chains. Although most LMTs can be cost-effective across multiple world regions, limited knowledge concerning their implementation and a lack of financing appear to be the main barriers to large-scale deployment. Without considering gender and the rights of marginalised and indigenous communities, the large-scale deployment of LMTs can further aggravate the existing inequalities. Therefore, the social and institutional implications of LMTs also need to be better understood to improve public acceptance and reduce negative impacts. A system approach is necessary to balance the ambitious land-based mitigation targets with the socioeconomic and broader environmental goals. "

Paper: Recent Advances in Biomass Pyrolysis Processes for Bio-energy Production: Optimization of Operating Conditions

Dina Aboelela,Habibatallah Saleh et al.

Link: Recent Advances in Biomass Pyrolysis Processes for Bioenergy Production

Kurzbeschreibung: “In this study, producing biofuels using a biomass pyrolysis process was investigated. This study explored the pyrolysis process and operating conditions to optimize the process parameters to maximize the desired product yields and quality. The pyrolysis process produces three main products, which are bio-oil, bio-char, and gas. There are three classifications for the pyrolysis method, with each of them producing a majority of a certain product. First, slow pyrolysis is conducted in the temperature range of 300–950 °C and residence time of 330–550 s. It produces around a 30% oil yield and 35% char yield, and thus, the majority yield of slow pyrolysis is char. Second, fast pyrolysis produces around 50% oil, 20% char, and 30% gas yields with a temperature range of 850–1250 °C and a residence time of 0.5–10 s. The average yield of flash pyrolysis was found to be 75% bio-oil, 12% bio-char, and 15% gas, which is conducted within less than 1 s. It was reported that the pyrolysis of biomass was simulated using ASPEN Plus, where the effects of several parameters, such as the temperature, heating rate, and residence time, on the product yield and composition were investigated. Pyrolysis was performed under different conditions ranging from 400 to 600 °C. The effects of different catalysts on the pyrolysis process were studied. It was found that the addition of a catalyst could increase the yield of bio-oil and improve the quality of the product. The optimal operating condition for the pyrolysis process was determined to be a temperature of 500 °C, which resulted in a higher bio-oil yield. It was found that the biofuel yield was enhanced by selecting appropriate raw materials, such as rice husk, along with the pyrolysis temperature (e.g., 450 °C) and particle size (350–800 µm), and using a low residence time and pressure.”

Article: A critique of the effectiveness of biochar for managing soil health and soil biota

Saurabh Sharma, Manisha Negi et.al

Link: A critique of the effectiveness of biochar for managing soil health and soil biota

Kurzbeschreibung: “Although a plethora of literature has focused on the ecological and agricultural advantages of using BCH, scant attention has been given to its potential adverse impacts on the ecosystem. Soil-borne pathogens are known to significantly impair crop productivity and soil fertility by impeding nutrient release. As a management strategy, BCH has been proposed as a potential approach to mitigate the negative impact of soil-borne diseases and reduce yield losses. This review presents a comprehensive analysis of the different facets of BCH, including its potential positive and negative impacts on soil fertility, biology, and pathology. The incorporation of BCH in soil has been shown to boost plant growth, promote bacterial activity, and increase invertebrate populations. The specific type of BCH utilized, including the feedstock (FS) and pyrolysis temperature, in conjunction with pollutant concentrations, play a crucial role in determining the ultimate impact of this material on soil. Adverse effects of BCH on soil can manifest due to multiple factors, underscoring the need for meticulous and appropriate measures prior to its use in agriculture.”

Review: Biochar from agricultural crop residues: Environmental, production, and life cycle assessment overview

Maga Ram Patel, Narayan Lal Panwar

Link: Biochar from agricultural crop residues: Environmental, production, and life cycle assessment overview

Kurzbeschreibung: “In circular economies, it is imperative to implement effective environmental management solutions to address resource depletion. Over the past few years, there has been a growing recognition of the potential of agricultural crop waste in mitigating greenhouse gas (GHG) emissions and promoting global carbon neutrality. Despite lacking practical management options, open-field burning of crop residue contributes significantly to greenhouse gas emissions and air pollution. This challenge may be addressed by producing biochar through the pyrolysis of agricultural crop residues. A biochar application in agriculture can contribute to reducing global warming through the sequestration of atmospheric carbon and reducing greenhouse gas emissions from the soil. As part of the life cycle assessment of biochar, the yield and greenhouse gas emissions during its production are critical factors, which emphasize the importance of selecting a production method suitable for producing biochar. The objective of this paper is to present a comprehensive overview of the environmental and agronomic advantages associated with biochar, along with a detailed analysis of its life cycle assessment (LCA). Furthermore, it provides an overview of how biochar can facilitate local energy production and contribute to sustainable resource management within the nexus of agroecosystems, environment, and energy.”

Review: Biochar for Soil Carbon Sequestration: Current Knowledge, Mechanisms, and Future

Simeng Li, Desarae Tasnady

Link: Biochar for Soil Carbon Sequestration: Current Knowledge, Mechanisms, and Future

Kurzbeschreibung: “[…] This comprehensive review analyzes the current knowledge on biochar’s application in this context. It begins by examining biochar properties and production methods, highlighting its recalcitrant nature as a potential stable carbon sink. The influence of various feedstocks and pyrolysis conditions on various physicochemical properties of biochar and its soil carbon sequestration potential is explored. Mechanisms through which biochar enhances soil carbon sequestration are discussed, including its role as a physical barrier against carbon loss and its ability to promote stable soil aggregates and influence soil microorganisms. Challenges and limitations, such as variations in biochar properties and optimal application rates, are addressed, along with strategies for maximizing biochar effectiveness through amendments. The review concludes by emphasizing the importance of long-term field studies, standardized protocols, and economic assessments to support the widespread adoption of biochar for soil carbon sequestration and its potential in climate change mitigation.”

Review: Biochar from animal manure: A critical assessment on technical feasibility, economic viability, and ecological impact

Dilani Rathnayake, Hans-Peter Schmidt, et al.

Link: Biochar from animal manure

Kurzbeschreibung: “Animal manure has been used to manage soil fertility since the dawn of agriculture. […] In the last decades, animal husbandry has been significantly expanded globally. […] Potentially toxic elements (PTEs), pathogenic microorganisms, antibiotic residues, biocides, and other micropollutants in manure threaten animal, human, and environmental health. Hence, manure application in crop fields is increasingly restricted, especially in hotspot regions with intensive livestock activities. Furthermore, ammonia volatilization and greenhouse gas (GHG) emissions during manure storage, field application, and decomposition contribute to air pollution and climate change. Conventional manure management scenarios such as composting and anaerobic digestion partially improve the system but cannot guarantee to eliminate sanitary and contamination risks and only marginally reducing its climate burden. Hence, this review discusses the potential of pyrolysis, the thermochemical conversion under oxygen-limited conditions as an alternative treatment for animal manure providing energy and biochar. Manure pyrolysis reduces the bioavailability of PTEs, eliminates pathogenic microorganisms and organic micropollutants, and reduces GHG emissions. Pyrolysis also results in the loss of nitrogen, which can be minimized by pretreatment, that is, after removing soluble nitrogen fraction of manure, for example, by digestion and stripping of ammonia–nitrogen or liquid–solid separation. However, conclusions on the effect of manure pyrolysis on crop yield and fertilization efficiencies are hampered by a lack of nutrient mass balances based on livestock unit equivalent comparisons of manure and manure biochar applications. Hence, it is essential to design and conduct experiments in more practically relevant scenarios and depict the observations based on the amount of manure used to produce a certain amount of biochar.”

Article: Biochar application to temperate grasslands: challenges and opportunities for delivering multiple ecosystem services

Robert W. Brown, David R. Chadwick, et al.

Link: Biochar application to temperate grasslands

Kurzbeschreibung: “[…] However, with the renewed push to achieve “net zero” C emissions by 2050, grasslands may offer an additional C store, utilising tools such as biochar. Here, we critically evaluate the potential for biochar as a technology for increasing grassland C stocks, identifying a number of practical, economic, social and legislative challenges that need to be addressed before the widescale adoption of biochar may be achieved. We critically assess the current knowledge within the field of grassland biochar research in the context of ecosystem service provision and provide opinions on the applicability of biochar as an amendment to different types of grassland (improved, semi-improved and unimproved) and the potential effect on ecosystem provision using a range of application techniques in the topsoil and subsoil. We concluded that the key question remains, is it possible for managed grasslands to store more C, without causing a loss in additional ecosystem services?”

Article: Environmental impacts and techno-economic assessments of biobased products: A review

Seyed Hashem Mousavi-Avval, Kamalakanta Sahoo et al.

Link: Environmental impacts and techno-economic assessments of biobased products

Kurzbeschreibung: "[...] Based on the review of recent literature, this study aims to provide insights into the technical feasibility, costs, and environmental impacts of biobased products produced from different renewable biogenic resources, especially in reference to their fossil-based counterparts. Although biobased products are very diverse, this study focuses on the most promising set of biobased materials such as bio-chemicals, bioplastics, bio-adhesives, bicarbonates, nanocellulose, biochar, and activated carbon. By identifying the bottlenecks for reduction of costs and life cycle environmental impacts and the directions for future research needed in this area, this study would be useful for stakeholders of bioeconomy including researchers, policy-makers, and producers who want to achieve the costs and environmental impacts reduction goals for sustainable development of biobased products."

Paper: Environmental life cycle assessment of biomass conversion using hydrothermal technology: A review

Farihahusnah Hussin, Nur Nadira Hazani et al.

Link: Environmental life cycle assessment of biomass conversion

Kurzbeschreibung: "Among thermochemical approaches, hydrothermal technology such as hydrothermal carbonization, hydrothermal liquefaction, and hydrothermal gasification are gaining research interest due to their cost-effectiveness, environmentally-friendly method, and produce high product yield. Hydrothermal technology is developed to transform different types of wet biomass into value-added products such as biochar or hydrochar, bio-oil, and syngas. This systematic review aims to describe hydrothermal technology and the life cycle assessment (LCA) of hydrothermal biomass conversion. Firstly, a systematic review of hydrothermal technology and LCA was carried out using the PRISMA method to analyze publication trends, current research developments, hot topics, and knowledge gaps. Secondly, this review presents the fundamental concept of hydrothermal technology and summarizes the up-to-date technology on hydrothermal carbonization, liquefaction, and gasification. Next, LCA guidelines and the current progress on LCA of biomass conversion using hydrothermal technology are discussed. In addition, the available literature that related to techno-economic evaluation of the hydrothermal process is reviewed. Currently, very limited study has reported on the environmental and economic impacts of hydrothermal biomass conversion. Therefore, to provide a sustainable and green process that can be applied in a commercial plant, a study on environmental impact is critical to show the benefits of biomass hydrothermal processing. This review also presents a step-by-step guideline for beginners and researchers to venture into this field to understand the LCA framework. Transfer of success in lab-scale to large-scale setups (industrial) demands consideration of several criteria, as well as careful and holistic analyses such as the environmental impacts of the overall process from feedstock (biomass) to final process (product)."

Article: The costs and benefits of biochar production and use: A systematic review

Luca Campion, Madina Bekchanova et al.

Link: The costs and benefits of biochar production and use

Kurzbeschreibung: “Besides being an opportunity to valorize biomass residues, biochar (i.e., the solid product of biomass pyrolysis) has many potential environmental benefits, such as climate change mitigation and reduced nutrient leaching. Even though the academic interest in biochar has increased, it is not being used at a large scale yet, mainly because of its economic infeasibility compared to fertilizers and because farmers are either unaware of or skeptical about its effects. In this paper, the economics of biochar are examined by performing a systematic review, following the guidelines of the Collaboration for Environmental Evidence. Specifically, it has been examined to which extent the production and application of biochar are yet profitable from an investor's perspective and desirable from a societal perspective. For the first time, this review investigates the extent to which previous studies have included external costs and benefits. We find that profitability and desirability of biochar production and use are highly uncertain and case-specific, depending on factors like location, feedstock, scale, pyrolysis conditions, biochar price, cultivated crop, and the potential internalization of externalities, which hampers private investment. To advance biochar development and deployment, those factors must be considered carefully for each case. Although externalities are included in the literature to some extent, the focus is mostly on external benefits rather than external costs, often focusing on its carbon sequestration potential. The inclusion of externalities in economic assessments is necessary to provide solid arguments to develop policies for the acceleration of market uptake of biochar technology.”

Article: Leveraging the bioeconomy for carbon drawdown

John P. Dees, William Joe Sagues et al.

Link: Leveraging the bioeconomy for carbon drawdown

Kurzbeschreibung: “[…] This article provides a qualitative overview of prominent BiCRS technologies from which a set of the most promising technologies are assessed quantitively through life cycle assessment. There are numerous opportunities to incorporate carbon removal and management within the bioeconomy, but the majority of immediate carbon removal potential exists in four bioproducts: bioenergy, bioplastics, biochar, and wood products. We analyze the life cycle greenhouse gas emissions and disposition of sequestered carbon over 10[thin space (1/6-em)]000 years for four bioproducts representative of each broader category: an advanced BECCS pathway, biopolyethylene, oriented strand board, and biochar soil amendment. We find that the BECCS pathway has the greatest magnitude and durability of CO2 storage over all time horizons. However, non-BECCS pathways achieve 34–64% of the drawdown magnitude relative to BECCS and retain 55–67% of their initial drawdown over 100 years (central estimate). We identify three engineering strategies for enhancing carbon drawdown: reducing biomass supply chain emissions, maximizing carbon stored in long-lived products, and extending the term of carbon storage. Finally, we highlight the need to characterize both the magnitude and permanence of carbon drawdown as a means for policymakers and technology developers to deploy limited biomass resources to maximize mitigation benefits.”

Preprint Paper: Unveiling Biochar Research: Trends, Influential Authors, and Ethical Dilemmas in Hyperprolific Publishing

Akira J Abduh

Link: Unveiling Biochar Research

Kurzbeschreibung: This article presents a comprehensive review of the publication trends and influential authors in biochar research based on an analysis of articles published between 2008 and April 2023 in the Web of Science database. The study reveals a significant increase in the number of publications on biochar over the years, reflecting a growing interest in this field. The analysis of highly cited papers reveals the presence of tight clusters of authors, with notable leaders from Korea and China. These individuals demonstrate strong connections within their research networks. The article further identifies the most prolific authors in biochar research, highlighting their significant number of papers and citations. However, the article raises concerns about these hyperprolific authors who publish an unusually high number of papers and authors with excessively high citation counts. Such practices raise questions about feasibility, quality, and ethical conduct in research. Further investigation is necessary to understand the mechanisms behind hyperprolific authorship and ensure the maintenance of rigorous scientific inquiry and ethical standards. The article demonstrates the hyperbole in biochar research publications that may include citation manipulation and boosting. It pointed to worrisome practices by some hyperprolific authors in pursue of high citations. Finally, it emphasizes the importance of balancing productivity with the integrity and rigor of research to uphold the principles of quality and responsible scientific practice.

Article: Can synergies in agriculture through an integration of solar energy reduce the cost of agrivoltaics? An economic analysis in apple farming

Max Trommsdorff, Michaela Hopf, et al.

Link: An economic analysis in apple farming

Kurzbeschreibung: “This work analyses the economic performance of agrivoltaics in apple farming […]. The analysis is based on literature, expert interviews, and data of three pilot projects in Germany. The results show that average investment cost from the farming system could be reduced by 26% mainly due to partially replacing the hail protection structure. Annual operating costs of the farming system reduce by up to 9% through lower cost for land and maintenance works. However, annual revenues also decrease by about 9% due to an expected reduction in high quality apple yield. Overall, the cost of apple production decreases by about 5%. Regarding the total cost of agrivoltaics, though, the potential contribution from cost savings in the farming sector to reduce the cost of electricity only amounts to <1%. The expected Land Equivalent Ratio of the analyzed agrivoltaic system amounts to 1.54. The results indicate that agrivoltaics in orcharding is only economically feasible if the regulatory framework provides sufficiently high feed-in tariffs or comparable support payments. The work also shows that the theoretical potential of agrivoltaics in apple farming in Germany amounts to 23.8 GWp which could contribute to 13% of the PV development required to meet Germany's climate goals by 2030.”

Preprint Study: Experimental results, integrated model validation, and economic aspects of agrivoltaic systems at northern latitudes

Pietro Elia Campana, Bengt Stridh et al.

Link: Experimental results, integrated model validation, and economic aspects of agrivoltaic systems at northern latitudes

Kurzbeschreibung: "[...] This study aims to analyse experimental results on ley grass yield and quality response to shadings in the first agrivoltaic system in Sweden and validate an integrated modelling platform for assessing agrivoltaic systems' performances before installation. An economic analysis is carried out to compare the profitability of agrivoltaic with conventional ground-mounted photovoltaic systems and to identify the most sensitive parameters affecting the profitability through a Monte Carlo analysis."

Article: Farmers' perspectives on challenges and opportunities of agrivoltaics in Turkiye: An institutional perspective

Seven Agir, Pinar Derin-Gure, Bilge Senturk

Link: Farmers' perspectives on challenges and opportunities of agrivoltaics in Turkiye

Kurzbeschreibung: "[…] In this first study on Turkish farmers' perspectives on Agrivoltaics, we use in-depth semi-structured interviews to explore pioneer farmers' perceptions of the opportunities and challenges in Agrivoltaics. This is also the first study investigating farmers' perspectives with an explicit focus on how they relate to the institutional setting of agricultural land use policy, which we explore by extensive desk research and interviews with the agricultural bureaucracy. The pioneer farmers exhibit an overall positive attitude towards Agrivoltaics by identifying and valuing the synergistic potential of Agrivoltaics systems. In particular, they are perceptive about how they may use Agrivoltaics to solve local problems, including those exacerbated by input dependency and climate change, beyond an abstract opportunity dimension. Despite this solid motivational drive for Agrivoltaics, however, pioneer farmers' concerns about potential bureaucratic hassle as well as shortcomings in the current legislation indicate a weak institutional setting undermining viability of Agrivoltaics implementation. Agricultural bureaucracy's distrust of potential investors and users seem to reflect a serious concern for 'pseudo-agriculture,' caused by both low procedural capacity and lack of institutional coordination (among regulatory institutions in Energy and Agriculture). This mistrust, in return, explains farmers' negative experiences, such as red tape in receiving licenses and permits for non-dual renewable energy applications (for agricultural purposes) under current legislative framework, contributing also to their doubts about sustained government support for future dual-use applications. Understanding this institutional setting can support policy makers' decisions on how to align renewable energy investments with agricultural need and purposes."

Article: Solar parks: A review on impacts, mitigation mechanism through agrivoltaics and techno-economic analysis

Sanju John Thomas, Sheffy Thomas et al.

Link: A review on impacts, mitigation mechanism through agrivoltaics and techno-economic analysis

Kurzbeschreibung: "[…] The social impact assessment conclude that, livelihood impacts can lead to extinction of cultures, urban migrations, growth of uncontrolled peri-urban regions, the long term impacts are beyond economics. Thus social impact mitigation cost (SIMC) along with environemental impact mitigation cost (EIMC) are considered as incentives or subsidied and the levelised cost of energy (LCOE) is calculated. It is found that levelised cost of energy for the conventional ground mounted solar PV plant is 0.03 $/kWh while for agrivoltaic plant without subsidies and incentives the LCOE is 0.052 $/kWh. For the agrivoltaic plant with a subsidy of 30% the LCOE is 0.046 $/kWh and with a further green incentive billing the LCOE can be brought down to 0.041 $/ kWh."

Opinion: How to reconcile renewable energy and agricultural production in a drying world

Andreas H. Schweiger, Lisa Pataczek

Link: How to reconcile renewable energy and agricultural production in a drying world

Kurzbeschreibung: "[…] Agrivoltaics are proposed as a promising technology to reconcile food and energy needs by allowing for agricultural and electrical power production on the same area of land. However, general understanding of the potential of agrivoltaics to facilitate crop yield under changing climatic conditions is lacking. In this study we provide an overview on the effects of agrivoltaics on microclimate and crop growth and yields. We furthermore quantify the global potential of agrivoltaics to attenuate drought effects on crops and develop a conceptual framework for evaluating interactions between solar power and agricultural production under changing climatic conditions. Generally, shading by agrivoltaics will reduce yield in comparison to maximum possible yield under unshaded, well-watered conditions but can reduce interannual variation in yields caused by drought, thus, increase resilience of agricultural production. This drought attenuation potential of agrivoltaics seems to be especially promising in the drought prone regions of the world. Land use efficiency of agrivoltaic systems is directly linked the degree of crop shading which covaries with the drought attenuation potential but will ultimately be guided by political decisions on how to weight energy production vs. food security. The latter depends on economic, societal and ecological aspects related to the implementation of agrivoltaics."

Review: Decarbonisation of mobile agricultural machinery in Scotland – an evidence review

Peter Baker, Nick James et al.

Link: Decarbonisation of mobile agricultural machinery in Scotland

Kurzbeschreibung: "Agricultural machinery is estimated to contribute around 5-10% of Scottish Agriculture's greenhouse gas emissions. Agricultural land in Scotland covers 5.6 million hectares and the agriculture sector represented 19% of Scotland's emissions in 2020. The Scottish Government's Climate Change Plan update requires a 31% reduction in agricultural emissions by 2032, from 2018 levels, a pace nearly four times faster than has been achieved up to now. The decarbonisation of machinery could play a key role in Scotland's transition to net zero by 2045. However, there is a lack of reliable information on emissions from mobile agricultural machinery and the options, costs and pathways to decarbonisation. The use of mobile agricultural machinery varies considerably across Scotland, reflecting patterns of agricultural production. In this study we assess the suitability of selected low emission technologies to power mobile machinery."

Article: Drawing transformation pathways for making use of joint effects of food and energy production with biodiversity agriphotovoltaics and electrified agricultural machinery

Anne-Kathrin Schneider, Felix Klabunde et al.

Link: Drawing transformation pathways for making use of joint effects of food and energy production

Kurzbeschreibung: "[...] In this interdisciplinary study, we show the opportunities and limits of joint synergies from the nexus of food production, energy production, energy consumption, biodiversity protection and social acceptance of renewable energies in a scenario. Biodiversity agriphotovoltaics, i.e. agriphotovoltaics in combination with biodiversity protection measures, such as flower strips, can make a valuable contribution to promoting biotope connectivity in addition to significant energy production. We show this in a GIS-based regional assessment for Lower Saxony in northern Germany. This rough spatial assessment is followed by a modelling of energy production and consumption during the cultivation of a characteristic agricultural field in the loess region of Lower Saxony. Our focus here is on the possibilities of using cable electricity or battery storage for carrying out the cultivation. In an accompanying survey of farmers regarding the use of agriphotovoltaics, we collected and evaluated their prior knowledge, experiences, and attitudes towards this technology. Finally, we show which advantages agriphotovoltaics and electrified agricultural machinery can also have for the sustainable transformation of agriculture and which challenges exist for a truly sustainable use of these technologies."

Paper: Electrification of the agricultural sector in Norway in an effort to phase out fossil fuel consumption

Ville Olkkonen, Arne Lind et al.

Link: Electrification of the agricultural sector in Norway

Kurzbeschreibung: [...] This paper focuses on the effects of phasing-out fossil fuel consumption in on-field tractor operations with electrification by introducing battery-electric and/or fuel cell tractors and on-site renewable energy generation and storage. The results show that electrification of on-field tractor operations can be a techno-economically feasible pathway to reduce tractor energy-use-related CO2 emissions in the agricultural sector. Annual CO2 emissions are observed to reduce by 69% in 2030 and 97% in 2050. However, the CO2 reduction potential can vary significantly based on the farm type. In this regard, the analysis revealed high sensitivity to manufacturing costs of zero-emission tractors (ZETs), which in combination with a low utilization rate can render the investment to ZETs unprofitable. Moreover, electrification increases electricity consumption, especially peak electricity demand in the agricultural sector. This effect can be reduced with on-site renewable energy generation and energy storage systems.

Article: Will farmers go electric? How Dutch environmental regulation affects tractor purchase motivations and preferences#

Jaap Sok, Jort Hoestra

Link: Will farmers go electric? How Dutch environmental regulation affects tractor purchase motivations and preferences

Kurzbeschreibung: Farm machinery management can contribute to European agricultural, energy and environmental policy objectives of climate change mitigation and fossil fuel independence by investing in tractor electrification. However, many farmers in the Netherlands (and beyond) have expressed concerns about the future profitability and ability to produce at reasonable costs. The Netherlands is also in a so-called ‘nitrogen crisis’, which further causes policy uncertainty about the introduction of more environmental regulations for nitrogen abatement. We conducted a best-worst scaling survey experiment to elicit preferences for electric tractor attributes and measured attitudes towards environmental regulation using motivational posture theory. The ranking of and correlations across estimated preferences and the purchase intention show that the 156 dairy and arable farmers surveyed evaluated an investment in an electric tractor as not feasible. Another conclusion is that the breakthrough of electric tractors is affected by negative anticipated emotions and feelings concerning the current environmental policy and regulatory context.

Kommende Veranstaltungen

11.-12.09.2023 Tagung „Biogas in der Landwirtschaft – Stand und Perspektiven“

Bonn und online

Kurzbeschreibung: „Um die Rahmenbedingungen zu diskutieren und innovative Lösungsansätze aufzuzeigen, laden das Kuratorium für Technik und Bauwesen in der Landwirtschaft e. V. (KTBL) und die Fachagentur Nachwachsende Rohstoffe e. V. (FNR) am 11. und 12. September 2023 zum 8. Kongress der Veranstaltungsreihe „Biogas in der Landwirtschaft – Stand und Perspektiven“ (...). Themen der Veranstaltung sind neben den aktuellen rechtlichen Rahmenbedingungen und Herausforderungen die Zukunftsperspektiven und neue Technologien. Vorträge unter anderem zu den neuesten Erkenntnissen aus den Bereichen Prozessoptimierung, Substrate und deren Alternativen, Biomethan und Flexibilisierung vervollständigen das Programm.“

21.09.2023 ÖBIKA-Biochar-Day

Tulln, Österreich

„Österreichischer Verein für Biomasse-Karbonisierung veranstaltet einen Biochar-Day. Weitere Informationen werden auf der Webseite bekannt gegeben.”

17.-22.09.2023 Bio-Char III: Production, Characterization and Applications - an ECI Conference Series

Tomar, Portugal

“This proposed Conference is the third of the series, following the very successful Bio-Char I (Alba, Italy, 2017) and Bio-Char II (Cetraro, Italy, 2019).

The interest in bio-char has been booming all over the world. A number of companies have jumped into production and the user community is looking for carbon-negative applications. As a result, it is imperative to review the existing knowledge as well as to stimulate research and development activities to bring clarity to this field, ranging from feedstock selection and properties, to production and upgrading processes, from identification of applications to economics, from characterization to products standardization and policies and carbon dioxide offset credits.

The conference aims to create a forum where the current knowledge as well as the future directions are openly reviewed and discussed.

7.-9.11.2023 2nd Annual AgriVoltaics Europe

Amsterdam, Niederlande

"Netzwerktreffen von Vertretern großer Energieversorger, Politik und Herstellern zum Thema Agri-PV"

13.-14.11.2023 German Biochar Forum

Berlin, Deutschland

"Das German Biochar Forum ist die größte BCR-Fachveranstaltung im deutschsprachigen Raum. Es ist ein Treffen für die Branche, aber auch für Politiker:innen und Vertreter:innen von Kommunen, die bisher noch wenig mit dem Thema zu tun hatten.

2023 in Berlin bringen wir mit führenden Wissenschafter:innen und Expert:innen BCR auf die politische Bühne: Lernen Sie ausgewählte best practice-Beispiele kennen. Diskutieren Sie in Workshops über Herausforderungen und Lösungsansätze. Stellen Sie bei Podiumsdiskussionen Ihre Fragen an Politiker:innen, Wissenschaftler:innen und Unternehmer:innen. Kurz: Seien Sie dabei, wenn wir dem Klimaschutz und einem neuen Industriezweig „BCR - Made in Germany" den Weg ebnen."

28.-29.11.2023 AgriVoltaics Industry Forum Europe 2023

Straßburg, Frankreich

"Whether you are an R&D professional, an industry expert, a policy maker, a farmer, an consulting engineer, a researcher, or simply curious about the exciting possibilities of agrivoltaics, we invite you to join us in Strasbourg for this groundbreaking event. Together, we can explore the many ways in which this emerging field can help us build a more sustainable future.

AgriVoltaics IFE23 will feature a diverse range of invited talks, covering economic, agricultural, and regulatory aspects of agrivoltaics. Attendees will learn about best practices and business innovation in this rapidly growing field, as well as the key elements of application and integration in agriculture and farming. In addition to the informative talks, the forum will also host a dedicated exhibition, providing attendees with the opportunity to connect with leaders and innovators in the industry."

Sonstige Neuigkeiten

Veröffentlichungen des Bundesministeriums für Ernährung und Landwirtschaft zu Agri-Photovoltaik

„Die Bundesregierung bringt nun weitere zentrale Maßnahmen auf den Weg, um die Ausbauziele für erneuerbare Energien zu erreichen. Mit dem Solarpaket der Bundesregierung werden zentrale Maßnahmen der PV-Strategie von Mai 2023 umgesetzt. Das umfangreiche Maßnahmenpaket leistet einen wesentlichen Beitrag zur Erreichung der Energiewende und Klimaschutzziele."

Zum Artikel: „Agri-Photovoltaik"

Zum Pressepapier: „Gemeinsames Pressepapier BMWK, BMUV, BMEL: Flächen für die Photovoltaik Synergien für Landwirtschaft, Energie-wirtschaft und Naturschutz"

Globale Marktanalyse zu Biochar von "Expert Market Research"

Global Biochar Market

By Technology: Pyrolysis, Gasification, Others; By Application: Agriculture, Household, Others; By Region; Historical Market and Forecast (2018-2028); Market Dynamics: SWOT Analysis, Porter's Five Forces Analysis; Value Chain Analysis; Competitive Landscape; Industry Events and Developments

Link zur Webseite von Expert Market Research

Gefördert durch:

Bundesministerium für Wirtschaft und Klimaschutz

Aufgrund eines Beschlusses des Deutschen Bundestages

Verantwortung für Newslettererstellung:

Institut für ökologische Wirtschaftsforschung (IÖW) GmbH, gemeinnützig

Potsdamer Str. 105
D-10785 Berlin
Tel. +49-30-884594-0
Fax +49-30-8825439

www.ioew.de

Kontakt:

Rosalin Blessing

Email: rosalin.blessing@ioew.de

Hannes Bluhm

Tel. +49-30-884594-44
Email: hannes.bluhm@ioew.de

i|ö|w INSTITUT FÜR ÖKOLOGISCHE WIRTSCHAFTSFORSCHUNG