GBEP Workshop

Wood energy and carbon accounting

9 May 2023, 09:15 – 17:00 CEST (UTC+2)

FAO Headquarters, German Room C 269/C 229 (Rome) and online

Organised by GBEP

in collaboration with IEA Bioenergy

with the contribution of the UN Food and Agriculture Organisation

WORKSHOP REPORT

Workshop context

GBEP, in collaboration with IEA Bioenergy and with the technical contribution of the UN Food and Agriculture Organisation (FAO), organized a workshop on "Carbon accounting for Wood Energy". The workshop was held as a hybrid event, both in FAO headquarters and online, on 9 May 2023, back-to-back with the GBEP Annual meetings, which were held on 10 and 11 May 2023.

The workshop was organized to meet the interest expressed by GBEP Partners during the 14th Meeting of the GBEP Working Group on Capacity Building for Sustainable Bioenergy (WGCB) held online on 21st Nov 2022, highlighting the importance for Activity Group 4 "Towards sustainable wood energy development" to consider discussions on carbon accounting for woody biomass and/or estimates of woody biomass availability for bio-based fuels and for bioeconomy.

The overarching objective of the workshop was to provide a platform for discussion among various stakeholders on carbon accounting for wood energy to contribute to achieving a common vision in this area.

To facilitate the above-mentioned goal, the workshop entailed one session dedicated to ***support understanding of the various carbon accounting methodologies for wood energy***, and another session to ***showcase practical examples of how these methodologies are applied*** in practice and policies. Ultimately, ***data requirements and gaps*** were discussed.

The workshop was attended by GBEP Partners and Observers, as well as external experts.

Session 1: Carbon Accounting Methodologies for Wood Energy

The first session was moderated by Mr. Göran Berndes, Chalmers University of Technology.

Mr. Robert Matthews (Forest Research) presented on IPCC methodologies and national inventory reporting for wood energy.

IPCC methodology was born as a result of a commitment under UNFCCC signed by nearly all nations, which pledged to report greenhouse gas (GHG) emissions and removals broken down in sectors such as energy, industrial processes, agriculture, as well as land use, land use-change and forestry (LULUCF). Mr. Matthews noted the specificities of GHG inventories for this latter sector, as it requires the estimation of emissions and removals of carbon from natural processes, which is in contrast with other sectors. He summarised the methods used by the IPCC: the "stock change method", where carbon balance is equal to the change in carbon stock over a pre-defined time period. This method implies the use of models rather than actual data. Mr. Matthews also highlighted that the IPCC methodology deals with reporting rather than accounting: it only tells you what the emissions/removals are instead of being a declaration on the impacts of actions in terms of GHG emissions/removals. He also highlighted that, as of today, ***wood energy emissions are reported as part of stock changes in the LULUCF Sector*** and as zero in the energy sector; this makes emissions from wood energy indistinguishable from net carbon stock changes in forests.

Mr. Matthews described some of the complications in measuring emissions from wood energy, as IPCC measures CO_2 losses by comparing inputs for production to the output of the products. The attribution of emissions to either consumer or producer depends on the stage of the value-chain of the given biomass, and also depends on the approach or conceptual framework that is used. On this point, Mr. Matthews highlighted that ***understanding who 'owns' emissions will become increasingly important as emissions from bioenergy are captured through BECCS***.

He went on to discuss some of the limitations of the IPCC methodology, noting that changing carbon stocks in forests are not necessarily indicative due to natural developments of the forest, or its 'age distribution', which requires looking at the trajectory the carbon stock would have had in absence of intervention.

All in all, Mr. Matthews concluded that GHG inventories (GHGIs) may address several questions including total annual net GHG emissions by sources as well as those a country is responsible for, but ***GHGIs cannot quantify the total annual net GHG emissions directly resulting from the production and consumption of wood energy by a country***.

Ms. Ashley Steel (FAO) gave a presentation on product statistics, estimating wood fuel production and the Global Forest Goals.

Ms. Steel explained FAO's statistics on forestry products, including imports, exports and CO_2 removals associated with roundwood, sawnwood, wood charcoal and more. Data are collected through questionnaires and published on FAOSTAT after validation, and CO_2 emissions are estimated looking at products' substitution effects in terms of carbon footprint. Wood energy encompasses many dynamics, from household fuelwood collection, to trading charcoal in informal markets, or even illegal deforestation. Ms. Steel introduced the Global Forest Goals and the global core set of forest-related indicators (GCS) that address topics identified in high-level

political commitments on forests and high-level forum discourse. Core Indicator 10 follows the logic of SDG 7.2 and measures the share of wood-based energy in total final energy consumption. She compared it with the GBEP Indicator 3 that measures annual harvest of wood resources by volume and as a percentage of net growth or sustained yield, and the percentage of the annual harvest used for bioenergy.

The measurement of core indicator 10 comes with ***challenges including availability and quality of wood energy data, and the need to integrate forestry and energy statistics***. An expert working group was established for wood fuel modelling, looking at data on needs, poverty, availability, impacts, alternatives and wood fuel stock change in terms of wood energy use, demand and final wood fuel production.

Still, ***filling data gaps remains a huge effort*** and requires participation by hundreds of countries. To tackle such challenges, recommendations include better collaboration across offices, ministries, industry and academia, the creation of predictive models as well as ***the initiation of a task force on wood energy data***.

Ms. Annette Cowie (University of New England) presented on life cycle analysis (LCA) approaches to carbon accounting.

LCA models measure selected environmental impacts form cradle to grave, from production to disposal. A number of standards for LCAs exist, an example being the UNEP Life Cycle Initiative's Global Guidance for Life Cycle Impact Assessment Indicators and Methods (GLAM). LCAs deal with many aspects over and above CO_2 stocks; the analysis compares impacts as a result of a product's life cycle with baseline values, for example when forests are untouched or biomass is not used for bioenergy production. She noted that these reference systems and also spatial scale are extremely important. Differences in analytical choices and purposes can lead to very different results.

Ms Cowie went on to discuss methods for LCA. Differences in analytical choices and purposes (e.g. system boundary, reference, climate forcers, etc.) can lead to very different results. However, she explained that, although several tools exist for GHG calculations, when assumptions are harmonized, models show very similar results. She explained that differences in GHGs are quantified in terms of mass but also lifetime in the atmosphere, which poses a challenge for their aggregation. The convention is to use GWP100 to quantify the warming effect. This can be complemented by the Global Temperature Change at 100 years (GTP100) to measure temperatures and the Lashoff approach for timing effects.

All in all, Ms Cowie summarised by showing some studies that have demonstrated that ***bioenergy can support the renewable energy transition***. For example, in Australia it has been shown that even small amounts of bioenergy in the energy mix may not only support 100 percent renewable electricity generation but also reduce the domestic price of electricity. Most recent research attempts to link integrated assessment models to life cycle assessments.

Ms Cowie summarised by providing general conclusions from the literature on where the greatest climate benefits from bioenergy are achieved, when: biomass from residues or energy crops integrated with agriculture/forestry are used; there is efficient conversion to products; GHG-

intensive fuels and co-products are displaced as part of energy system decarbonisation; demand incentivizes forest expansion; CO_2 is captured and stored durably.

During the **moderated discussion** several topics were raised, such as the need to provide simple and practical assistance to companies in making the right choices rather leading them to perform quantitative analyses through narrow-focused LCAs. Similarly, ***simple frameworks may enable operators to efficiently account for and disclose their performances in mitigating emissions***. It was stressed that voluntary and mandatory carbon markets should be regulated and governed through agreed-upon international standards, also aiming at increasing transparency.

Mr. Nicklas Forsell, (IIASA) gave a presentation on forest sector modelling.

As part of the presentation, Mr. Forsell introduced IIASA's joint project with the Integrated Biosphere Futures (IBF) Research Group and the Biodiversity and Natural Resources (BNR) Program. The main aim of the project was to apply detailed forest sector models to assess the global and regional developments for the forest sector and implications of climate policies and biomass market developments.

Mr. Forsell illustrated the importance of modelling management decisions in existing forests in response to changing demands for land resources, wood products and carbon. The scenario assumptions employed for the model simulations spanned Shared Socioeconomic Pathways (SSP); Forest Sector Pathway (FSPs) narratives; and Relative Concentration Pathways (RCP). Key forest indicators on global developments showed that ***market demand growth for forest biomass, both traditional as well as modern, and strong climate policy incentives can increase forest areas and forest carbon stocks***. In addition, compared to SSPs, RCPs have a greater impact on global forest development, while SSPs greatly influence roundwood harvest and RCPs strongly influence total wood harvest. Finally, changes in global forest carbon stocks are positively correlated with changes in forest area and timber price, but less so with total wood and industrial roundwood harvests.

Mr. David Styles (School of Natural Sciences, Bangor University, UK) presented a country case study of commercial afforestation in the UK.

Afforestation is an important component of countries' NDCs, and in the UK Committee on Climate Change scenarios. However, ***the effects of commercial forestry (including harvesting and wood use) are contentious***, and highly dependent on, inter alia, the starting point, time horizon and system boundaries of LCA approaches as well as on the counterfactual compared to reference systems.

The study inspected several illustrative scenarios with different forests, harvested wood value chains and future contexts, with a hierarchical use of carbon flows, an expanded boundary LCA and dynamic substitution "credits" (BECCS). The ***illustrative scenarios indicated robust mitigation efficacy of commercial forestry***, where not having CCS would only result in few emission reductions, mainly due to ineffective CCS. Planting trees now provides options. Mr. Styles noted

that conservation forestry is crucial but commercial forestry can drive robust and flexible decarbonisation under different future scenarios. In Ireland, achieving Net Zero implies an urgent need to explore continued planting trajectories (with wind down), as well as fuel wood value chains including CCS.

He concluded that past trajectories provide limited insight to a necessarily transformed future. He then suggested that foresight analysis, IAMS and prospective (consequential) LCAs are all valuable approaches.

The **moderated discussion** covered the subject of modelling the forest sector and afforestation. The necessity was highlighted to finetune assumptions on the specific context and quality of land of interest. It was underlined that properly distinguishing among commercial and non-commercial forests is a prerequisite for policymakers to translate the models into action. In terms of mitigation benefits related to specific wood uses, it was stressed that these are highly dependent on the efficiency with which the wood is processed and used, whereby benefits must also be evaluated in comparison to counterfactual energy uses and the counterfactual products.

Session 2: Applications and Policy Examples

Ms. Susanne Koeppen (IFEU) moderated session 2.

Mr. Giacomo Grassi (JRC) gave a presentation on EU policies on carbon accounting for land use, land-use change and forestry.

Mr. Grassi showed that new EU Climate Targets aim for a 55% CO_2 reduction by 2030 and climate neutrality by 2050, with agriculture being the biggest sector to tackle. Forests provide products that are beneficial to the climate but carbon sinks are declining due to increased harvest, decreased forest growth and increased natural disturbances. Revised EU regulation seeks to reverse this trend through better monitoring and streamlined carbon accounting procedures for LULUCF.

Mr. Grassi discussed the mitigation options associated with the bioeconomy, introducing a ***system perspective for understanding emissions from LULUCF, and all other sectors***. This perspective takes into consideration all trade-offs and synergies between different mitigation options across sectors. In terms of the energy sector, the Renewable Energy Directive (RED) has strengthened sustainability criteria for bioenergy to comply with cascading principles; this is to ensure that any additional wood used for bioenergy is not resulting in additional harvest that would reduce forest sinks and make the achievement of LULUCF targets more difficult. However, there are currently no legal restrictions under REDII on feedstock for bioenergy due to complications with implementation. He also highlighted that ***emissions from bioenergy are not counted at the point of biomass combustion but instead under LULUCF***, as a change in carbon stock in the GHG inventory.

In his conclusions, Mr. Grassi addressed some concerns and respective counterarguments on the climate impacts of forest bioenergy. He noted that, in the overall EU climate policy, bioenergy is not assumed to be carbon neutral, but woody biomass is considered a renewable energy

source. He stressed the ***importance of integrated modelling of scenarios with all forest sector options***. This should be combined with national-level governance, tools and incentives to encourage win-win pathways.

Mr. Michael Goldsworthy (Drax) presented the process of carbon accounting for a forest bioenergy company: the 'Daisy problem'.

Drax has the ambition to be carbon negative by 2030 through the use of bioenergy with carbon capture and storage (BECCS). Drax's carbon reporting history has evolved from compliance to trading schemes and reporting. Mr. Goldsworthy noted that for carbon accounting and disclosure, the numerous rules, definitions and requirements render it difficult to develop consistent assumptions. The company has now launched an LCA tool targeted to wood pellets and many steps in the lifecycle (i.e. site emissions, CCS removals, downstream/upstream supply chain emissions) have robust methodologies for their measurement but he noted that there remains no clear consensus on appropriate methodology for LCA of forest carbon.

Mr. Goldsworthy introduced the 'daisy problem' to help with understanding some of the ***problems that businesses face in terms of counterfactual modelling in LCA***. He compared wood energy to the meat industry, highlighting that we would not consider the climate impact of the meat industry based upon the assumption that it depletes the global cattle population; in the same way, Mr. Goldsworthy highlighted that bioenergy does not necessarily lead to depletion of forest carbon stocks, and ***failure to capture market and broader system dynamics for wood products will frequently lead to misleading results***. To help businesses achieve net zero targets, a voluntary carbon market is useful and may mitigate the 'daisy problem'. In response to this problem, Drax has reframed the counterfactual from 'what would otherwise happen to the fibre that we source?' to 'what happens when we place a new demand for fibre on a forest system?'. Through systems thinking, their SRTS model looks at the effect of product demand on a forest system, factoring in economic relationships that prevail in wood markets of the US South. They hope to use this approach for analysing the forest carbon impact of new investments in the future.

Mr. Alessandro Flammini (FAO) gave a presentation on quantifying GHG emissions from woodfuel used in households.

Roughly 2.8 billion people worldwide burn wood to satisfy their basic energy needs (cooking and heating). Mapping IPCC to FAOSTAT categories, the CO_2 component of deforestation attributable to unsustainable wood fuel energy use is part of AFOLU. Emissions are quantified using different data sources including non-renewable biomass (NRB) to get indication of wood harvested in excess of annual growth rate and sustainable harvesting level.

Mr Flammini gave some global data on GHG emissions from wood energy. Global CO_2 emission trends are slightly declining, mainly driven by China, with some African countries on the rise. The 10 top emitting countries account for 69% of total emissions. The share of forestry emissions is significant and increasing. However, these results are subject to high statistical uncertainty.

He gave some suggestions for ***future steps***: stratify wood fuel shares; update NRB values for key countries: quantify the true impact of agri-food systems development on deforestation; and monitor the role of bioenergy and renewables in the agrifood sector.

Ms. Suani Coelho (University of São Paulo, Brazil) presented a pilot study from Brazil on carbon accounting of charcoal production for residential use.

Ms. Coelho presented a comparison between charcoal from planted wood and from native forests. Brazil is the world's largest charcoal producer with 6 million tonnes produced in 2021. Only 10% of this goes to households (for cooking and heating), whilst the remaining 87% is destined for the industrial sector, mainly iron and steel industries. The Brazilian Nationally Determined Contribution (NDC) aims to reduce total emissions by 37% by 2025, which requires focusing on reducing emissions from traditional production and use of charcoal, mainly in the south, and predominantly used for traditional barbeque.

Ms Coelho explained that most charcoal in Brazil come from planted forests (94%), while some regions of the country are still dependent on charcoal from native sources. ***While the country has a very important protection legislation, the problem remains enforcement, which requires more work and funds***.

She shared the results of research on decarbonisation of the Brazilian steel industry using energy produced from sustainable charcoal, which is produced from wood from planted forests on previously degraded land using efficient furnace oven systems. The analysis suggests that this charcoal, produced from restoring and planting, would lead to negative carbon emissions, but she noted that it remains much less profitable compared to the production of charcoal from native forests, especially if this last option is done without requesting the restoration of deforested areas. She stressed that multiple challenges remain for the stimulation of the sector and that incentives are needed both for forest plantation and recovery of degraded areas, and for the promotion of the use of more efficient technologies. Investments in capacity building of small and medium producers were also highlighted as important.

Discussion on Challenges and Future Directions for Carbon Accounting for Wood energy

Mr. Francesco Tubiello (FAO) moderated the discussion on challenges and future directions for carbon accounting for wood energy, also highlighting the importance of laying out the next steps for a collaboration between GBEP and FAO as well as other Agencies. He stressed the role of carbon accounting methodologies to facilitate sustainable development, and the urgent ***need to fill related data gaps***. Multiple needs and requirements were raised during the discussion, such as:

- Science-based interventions for LCA backed by institutional support;
- Supplementing IPCC guidelines;
- Capacity building: simplicity in regulations
- Sustainability, whereby the GSIs represent a harmonized tool, and the agreement of these indicators represents GBEP's success; and

- To address public perception, while educating the public.

During the discussion, initiatives were invited to strive towards harmonization of data methodologies and to develop a joint apparatus of definitions to mainstream and document the impacts on the climate of the work performed by each initiative.

The significant opposition that persists towards wood bioenergy was highlighted, regardless of the strength of supporting data. It was ***underlined the need to address related misconceptions***, including by the public, while strengthening data frameworks on wood energy and carbon accounting.

The need for cooperation was noted on capacity building of policy makers and technical institutions on latest technologies, calculations and techniques for resource assessment and to transfer them to developing countries, where accounting is lacking. It was also highlighted that a joint effort should also be aimed at decreasing traditional biomass use. The issue was raised that ***bioenergy is not supported by any of the climate financing institutions, which also limits the transfer and mobilization of resources***.

It was also added that harmonization is required on LCAs: a technical and political discussion which may be hosted by an international multi-level organization and that would allow to include developing countries that do not have access to appropriate science, technology and methodologies, and thus limited access to markets and economic development.

The key role of GBEP was stressed, as the ideal initiative for inclusion of all countries, and specifically of developing economies. It was highlighted that the GBEP set of Sustainability Indicators for Bioenergy represents the successful outcomes of a long participatory process entailing dialogues and negotiations among GBEP partners towards monitoring of environmental, social and economic performances of a certain value chain. The upcoming work may build upon the tremendous and inclusive work performed by GBEP during the last 17 years and the technical and robust background of this internationally recognized initiative. The GBEP Indicators for Bioenergy constitutes a science-based, harmonized tool which is widely recognized for assessing the sustainability of all types of bioenergy pathways. ***The GBEP Indicators could be a useful tool to be considered in the development of a guideline on carbon accounting and the related work on attribution***.

The importance of simplifying highly complicated models was stressed, to allow operators to easily demonstrate the positive impacts of their activities, comparable to a balance sheet easily depicting carbon stock changes. It was noted that IPCC guidelines were not designed for the topics raised in this discussion, but that these could be easily adapted to the points of interest. The importance of clarifying where the responsibility lies for collecting data and for demonstrating compliance across the entire value-chain, and of enabling small players to participate in the process was also highlighted.

In his concluding remarks, Mr. Francesco Tubiello (FAO) underlined the necessity to expand upon the IPCC guidelines to allow for a broader work of inventory on GHGs with a supplement that aims to give additional value to the coefficients that many Members are developing on their own, for example on amount of energy used for cooking as compared to heating.

Conclusions and outlook

The workshop concluded with some take home messages that were echoed in the following GBEP Working Group on Capacity Building meeting.

It arose from the discussion that a ***variety of methodologies and metrics*** are currently used and that they are not harmonized. This is in part because the purpose of available methodologies is different. Moreover, very few of these are dedicated to wood energy, but rather they are focused on forest areas/resources, LUC and iLUC, or availability of woody biomass for wood products, and the calculation of climate impacts of wood energy therefore must be inferred.

The harmonization of methodologies is important not only for national Measuring, Reporting and Verifying (MRV) climate impacts of the wood energy sector, but also to ***support the development of international carbon markets*.** In this regard, a common understanding of who has 'ownership' of emissions (or removals, in the case of BECCS) along value chains is extremely important.

"If we don't measure, we don't manage."

Regarding ***data***, it emerged that data on wood energy are mostly missing, and many measurements of climate impacts use estimates inferred from models.

To improve accounting, these ***estimates need to be improved using actual and updated data from countries*** (i.e. data on woodfuel and charcoal production), as well as remote sensing. In turn, models need to consider context specificity in terms of natural forest processes and ways of wood energy use.

Last but not least, the importance of continuous efforts to strengthen or ***build capacity for the implementation of carbon accounting on wood energy*** was stressed.