Sustainable Landscape Management for Bioenergy and the Bioeconomy

Report from Joint IEA Bioenergy Task 43 & FAO Workshop

11-12th October 2018, Rome, Italy

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Sustainable Landscape Management for Bioenergy and the Bioeconomy

Joint IEA Bioenergy Task 43 & FAO Workshop, 11-12th October 2018, The FAO Headquarters, Viale delle Terme di Caracalla, Rome, Italy

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Summary

In October 2018, IEA Bioenergy Task 43 “Biomass Feedstocks for Energy Markets” and FAO organized a joint workshop “Sustainable Landscape Management for Bioenergy and the Bioeconomy”. The workshop’s leitmotiv was how to communicate bioenergy beyond the typical bioenergy stakeholders. Despite the effort of the scientific community and international organizations such as IEA Bioenergy, FAO and IRENA, bioenergy uptake is occurring at slower pace despite the sustainable biomass potential, economic feasibility and availability of mature technology. Bioenergy uptake is greatly influenced with social aspects of sustainability, both as dynamic performance of each bioenergy pathway along the social dimension of sustainable development (jobs, health, energy access, etc.) and perceptions in society on the general sustainability of bioenergy (encompassing the environmental, economic and social dimensions).

Past failures of bioenergy policy to form positive synergies with agriculture, forestry and waste, e.g. biofuels from food and feed, tend to attract much more attention of the public than dominating good practice examples, backed up with scientific evidence. General knowledge of biomass issues among policy makers, the scientific community as well as civil society associations must be improved to enable a worldwide transition to a decarbonized society.

More than 30 bioenergy experts and scientists around the world from 14 bioenergy related entities gathered to express their views how to improve the communications. Some of the highlights are:

“Bioenergy represents a major type of renewable energy. As such, it is key to supporting the UN Sustainable Development Goals (SDGs) in the context of climate change and energy security. As summarized by the IPCC 5th Assessment Report, integrated assessment modelling indicates a high risk of failing to meet long-term climate targets without bioenergy. Global assessments by REN 21, IEA and IRENA find that bioenergy accounts for three-quarters of all renewable energy use today and half of the most cost-effective options for doubling renewable energy use by 2030. Bioenergy is part of a larger bioeconomy, including agriculture, forestry and manufacturing.” [1]

“Bioenergy is multi-disciplinary in nature, so it is important to ensure that it is tackled in a multidisciplinary fashion that includes all perspectives. This workshop was a first step to approach bioenergy across institutions and disciplines, in a more cohesive way – we hope that working together we can move forward.” explained Olivier Dubois, the FAO Energy team leader.

The workshop was an occasion to better understand one another’s skills and expertise for future collaboration. The results of the work in groups were translated in this report, with a feedback of an ecological sociologist on how to narrow the knowledge gap by inclusion of the epistemic community.

> “the real enemy of knowledge is not ignorance but illusion of knowledge” D. Boorstin

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1 Introduction

This report records concerns of the bioenergy community about non-technical barriers that bioenergy is facing, mirroring the increasing need for bioenergy within the climate mitigation plans with the growing need for biomass for bioeconomy against the unpopular headlines in the mainstream media. It investigates how to communicate a complex scientific message on bioenergy outside the bioenergy scientific bubble. Bioenergy has its role in succeeding the Paris Agreement goals at a point where humankind cannot afford to neglect any known asset that can both absorb atmospheric carbon and retain the fossil carbon out of atmosphere.

Despite the effort of the scientific community and research behind universities and research institutions, and international organizations such as IEA Bioenergy, FAO and IRENA, bioenergy uptake is at slower pace not because of the biomass availability or technological aspects but greatly assigned to the social aspects of sustainability, even if the market conditions favour bioenergy. While some markets face multiple factors such as low fossil energy prices, lack of reliable infrastructure and quality supply of biomass, bioenergy relies on human factor more than any other (renewable) energy source: both in terms of delivering and consuming bioenergy. Biomass policies, especially in terms of promoting biofuels from food and feed feedstock, have failed to gain desired effects in terms of expected GHG emission savings and sustainability criteria [2], [3]. It seems that a general knowledge on biomass within policy making bodies, broader scientific community as well as civil society associations is missing to create a set of concerted biomass policies.

For that purpose, IEA Bioenergy Task 43 and FAO Bioenergy Division organized a joint workshop where more than 30 representatives of 14 different stakeholders from the whole biomass supply chain were invited to discuss how to streamline the message from a journal paper and technical report to the real environment.

IEA Bioenergy Task 43 is deeply involved in identifying attractive examples of landscape management and design for bioenergy and the bio-economy. The goal of this initiative is to compile world-wide innovative examples as a means of showcasing how the production of biomass for bioenergy can generate positive impacts on agriculture and forestry landscapes. These examples are also meant to serve as sources of inspiration that other biomass producers can use to enhance the sustainability of their own activities. A collection of world examples gathered at two events: (Sydney, Australia, 2017; and Rome, Italy, 2018) is published in a separate Report under IEA Bioenergy Task 43: "Sustainable Landscape Management for Bioenergy and the Bioeconomy". The first event handpicked contributions that were demonstrating good examples and stimulated a discussion on how these can be relevant for developing attractive systems in the Oceanian context. The latter event in Rome, took a step forward towards new roles of biomass feedstock within a concept of bioeconomy. The innovative examples selected for this workshop show how biomass can be produced together with food in sustainably managed landscapes with a joint support of FAO Bioenergy Division.

The joint workshop aimed at providing a platform for a dialogue between stakeholders along biomass supply chain where invited representatives from policy making groups (alphabetically presented in the Annex), together with IEA Bioenergy Task 43 and FAO contributors, would exchange their perspectives on the showcase examples. All presentations can be downloaded from IEA Bioenergy Task 43 website.

2 Biomass in the eyes of the energy – the unheard story

In energy sector, biomass is any organic matter, i.e. biological material, available on a renewable basis suitable for energy conversions to produce useful energy forms. It includes feedstock derived from animals or plants, such as wood and agricultural crops, and organic waste from municipal and industrial sources [4]. Biomass supply for energy frequently comes from co-productive systems, unless energy dedicated plantation, in a form of residue or byproduct or waste from some primary economic activity that brings more added value to biomass utilization. Energy sector is dominated by economies of scale, with large volumes and low unit price where market forces reduce options for biomass supply for energy markets.

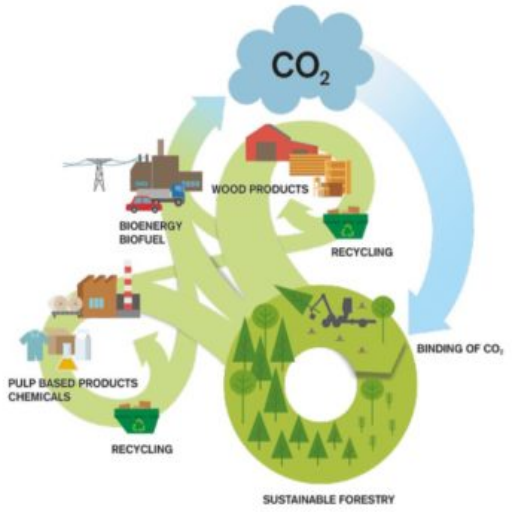


Figure 1: Forest bioenergy systems are often components in value chains or production processes that also produce material products, such as sawnwood, pulp, paper, and chemicals [24]

The fact that market economy plays important role in biomass supply is not communicated in a proper way to the outside community – the message that only biomass that cannot reach better value added at the market will be streamlined towards its use for bioenergy. This fact is called cascading use of biomass where example of cascading wood is presented below.

Figure 2: Cascading wood use – in time, value and function [21]

Cascading use of biomass should be reflected in bioenergy policy. Biomass is an internationally traded good where market distortions introduced by biomass (for bioenergy) policy can have a global effect.

Market interventions can easily disturb the priority of storing carbon in longer-lived wood products over bioenergy. Cascading use of biomass allows maximizing value added along the wood asset where low-quality wood or residues increase competitiveness of wood processing industry. The same concept can be applied on agriculture where agri-residues find value at the bioeconomy market while grain, for example, still has its traditional place in the food industry. For example, in the EU

only 22% of wood removals are for energy purposes [5] in the time when biomass is the main source (60%) of renewable energy in the EU [6]. Out of that share, 75% of biomass is used for heating and cooling, including traditional heating with wood logs [6]. Direct biomass imports to the EU make 4% [6].Even within bioenergy sector itself, diverse levels of value added are gained with the same feedstock used in different energy conversion pathways or when making the same end use energy type from different feedstock. It is complicated but while bioenergy community is trying to disentangle the complexity of biomass for bioenergy, the message that the outer community receives is that woods are cut or the land is occupied due to the increased bioenergy demand which comes as the last, and not the first, in the cascade.

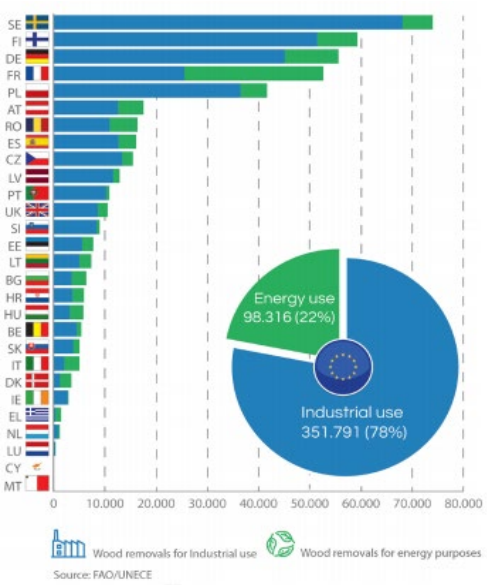


Figure 3: EU-28 wood removals according to the end use (in 2015, thousands m^3 underbark, %) [5]

Bioenergy is a renewable energy generated from the conversion of solid, liquid and gaseous products derived from biomass. The figure below indicates the heterogeneity of feedstock (biomass), production processes and various solid, liquid and gaseous biofuels to be used in all energy sub-sectors: heating, electricity generation, and for production of transport fuels. The complexity of various conversion paths and heterogeneity of biomass sources makes the remark that bioenergy is either good or bad a generic overstatement. This complexity of bioenergy clusters epistemic communities around specific bioenergy feature (e.g. GHG emissions, land use…) or bioenergy pathway (biogas, biofuel, combustion…) which is confusing for wider public and policy- makers.

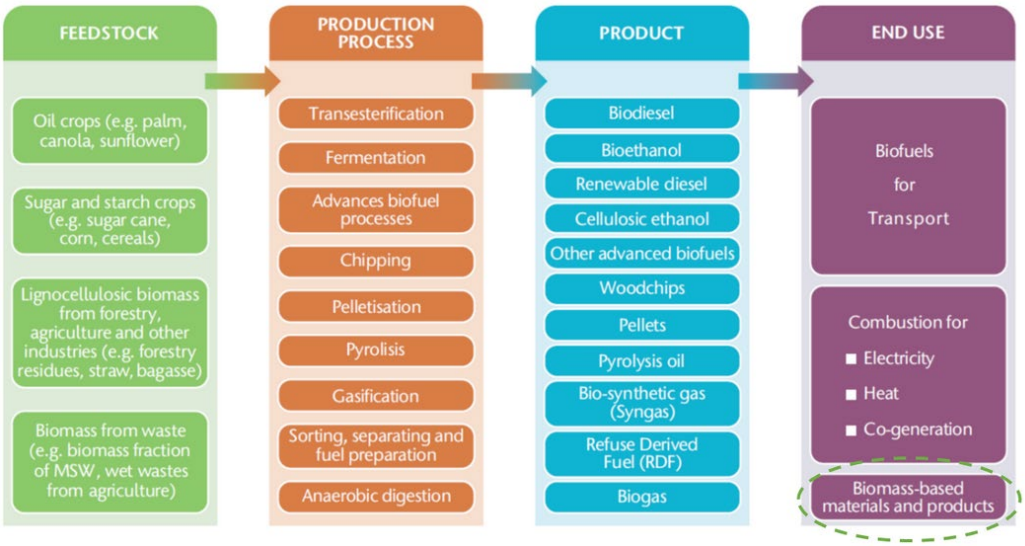


Figure 4: Biomass to bioenergy pathways in the IEA Bioenergy Roadmap (2017) [7]

"Bioenergy is multifaceted. Specific bioenergy options (such as biofuels produced from edible vs. non-edible feedstocks) are not good or bad per se; sustainability impacts are context specific and depend on the location and management of feedstock production systems. Fortunately, significant knowledge and competence are available to govern bioenergy expansion to harness opportunities and minimize risks of negative impacts [1]"

Bioenergy is an integral part of the bioeconomy, a part with bulk volumes and less value per unit of volume than biomass for chemicals and materials, food and health. Bioeconomy supports cascade use of bioresources, transformed into bioeconomy pyramid (Figure 5).

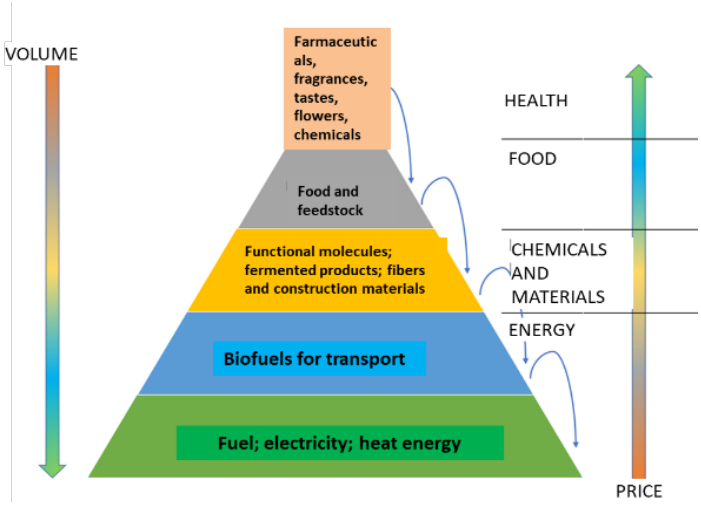


Figure 5: Bioeconomy pyramid, [22]

In Europe bioeconomy is viewed as a "response to key environmental challenges the world is facing already today. It is meant to reduce the dependence on natural resources, transform manufacturing, promote sustainable production of renewable resources from land, fisheries and aquaculture and their conversion into food, feed, fibre, bio-based products and bio-energy, while growing new jobs and industries." [8]

3 Expectations from bioenergy in the climate change actions

Bioenergy can play an important and constructive role in achieving the agreed UN Sustainable Development Goals (SDGs) and implementing the Paris Agreement on Climate Change, thereby advancing climate goals, food security, better land use, and sustainable energy for all:

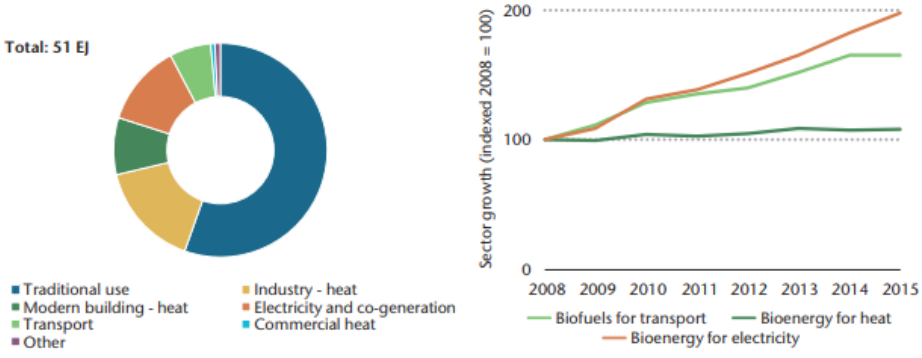
- SDG-13: take urgent action to combat climate change and its impacts,
- SDG-7: ensure access to affordable, reliable, sustainable and modern energy for all,
- SDG-2: end hunger, achieve food security and improved nutrition and promote sustainable agriculture,
- SDG-15: protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Higher ambitions for sustainable energy systems are not being translated into action [9]. In Energy Technology Perspectives (ETP) 2017, IEA highlights today's critical challenge: to ensure the momentum of the energy sector transformation and speed its progress. The ratification of the Paris Agreement and calls to implement the UN's SDGs show strong global support to address climate change and other environmental concerns. Rapid and clear signals aligned with long-term objectives will be needed to steer the energy sector towards sustainability.

Bioenergy holds the largest part of the energy from the renewable energy sources, with about 9% of the world total primary energy supply (IEA, 2018). Yet, more than a half of that energy is

attributed to traditional biomass consumption in terms of traditional wood logs, branches or charcoal for heating and cooking (Figure 6 left) with basic technologies, such as a three-stone fire, often with no or poorly operating chimneys. The aim within this segment to reduce negative repercussions of deforestation and health issues related to poor biomass combustion in developing countries.

Modern biomass solid fuels: wood chips, pellets and briquettes are burned in highly efficient stoves and boilers that increase end-use energy but also allow long term sustainability and increased living standards of their beneficiaries. Converting already harvested/collected biomass to modern biomass solid fuels and replacing inefficient stoves allows expanding the bioenergy sector with simple energy efficiency measures.



Notes: EJ = exajoule.

Sources: IEA (2017d), *World Energy Statistics and Balances 2017*, www.iea.org/statistics/; IEA (2017c), *Market Report Series: Renewables 2017*; IEA (2017e), *World Energy Outlook 2017*.

Figure 7: Consumption of biomass and waste resources by end use in 2015 (left) and modern bioenergy growth by sector, 2008-15 (right)

The current trajectory falls short, reflecting the world's current ambitions are not consistent with achieving global climate mitigation objectives. More ambitious decarbonization requires increased effort and sustained political commitment. The 2°C Scenario (2DS) and the Beyond 2°C Scenario (B2DS) each sets out a rapid decarbonization pathway in line with international policy goals. The 2DS has been the main climate scenario in the ETP series for many years, and it has been widely used by policy makers and business stakeholders to assess their climate strategies. For the first time, the B2DS looks at how far known clean energy technologies could go if pushed to their practical limits, in line with countries' more ambitious aspirations in the Paris Agreement.

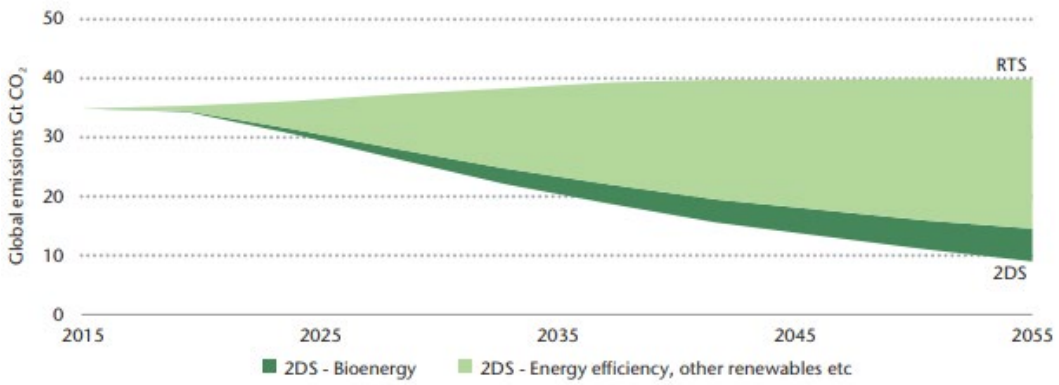
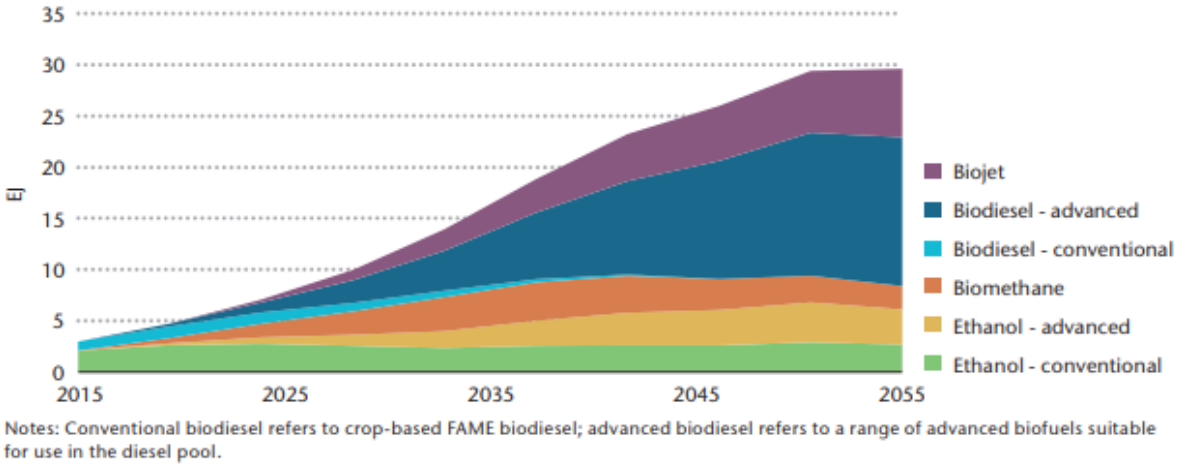


Figure 6: Contribution of bioenergy to emissions reductions in 2DS [19]

A double increase in electricity production from bioenergy within a decade (Figure 6 right) is greatly related to the positive legislative framework and different incentive schemes to produce bioenergy from cogeneration plants, particularly the EU. Biomass will remain to generate electricity but to a lesser share as the prospects are placed on fuel-less renewable electricity technologies – solar and wind.

Biofuels for transport did not meet the expectations so far: firstly, food and feed feedstock biofuels (so called 1 generation or 1G) did not achieve expected GHG emissions savings and secondly, advanced biofuels that rely on secondary biomass sources (agro-waste, biowaste, non-food energy crops…) delayed its commercial maturity. Only biogas, in a purified and compressed from as compressed biomethane (CBM) is readily available biofuel that achieves GHG emission savings, not only from substitution effect with fossil fuels but also with fossil-based fertilizers and agro-chemicals. A good example to follow is a concept developed by CIB – Consorzio Italiano Biogas e Gassificazione: BiogasDoneRight [10].

While heat energy will remain the dominant end-use of biomass, the future expectations of bioenergy are placed on biofuels to decarbonize transport sector. The energy content of biofuels in 2055 is to increase at least 5 times the share of 2015.



Notes: Conventional biodiesel refers to crop-based FAME biodiesel; advanced biodiesel refers to a range of advanced biofuels suitable for use in the diesel pool.

Figure 8: Biofuels final transport energy demand by fuel type in the 2DS, 2060 (IEA, 2017) [19]

Bioenergy has its place within the bundle of global decarbonization measures and agrees with the Paris Agreement reiterations on the "need to promote universal access to sustainable energy" while calling for "action to conserve and enhance … sinks and reservoirs of GHG gases" and for "reducing emissions from deforestation and forest degradation."

What is good about bioenergy is that it can be grown. Bioenergy has ability not only to keep the fossil carbon below the surface (substitution effect) but also to absorb atmospheric carbon in the plant and soil. This is the decarbonization concept of society based on bioeconomy of which bioenergy is an integral and the bulkiest part. Yet, the bioenergy bulkiness allows significant GHG emission savings potential. The reasoning behind is the fact that energy sector is making 72% of the total GHG emissions worldwide, and 15% the transport sector within (Figure 9).

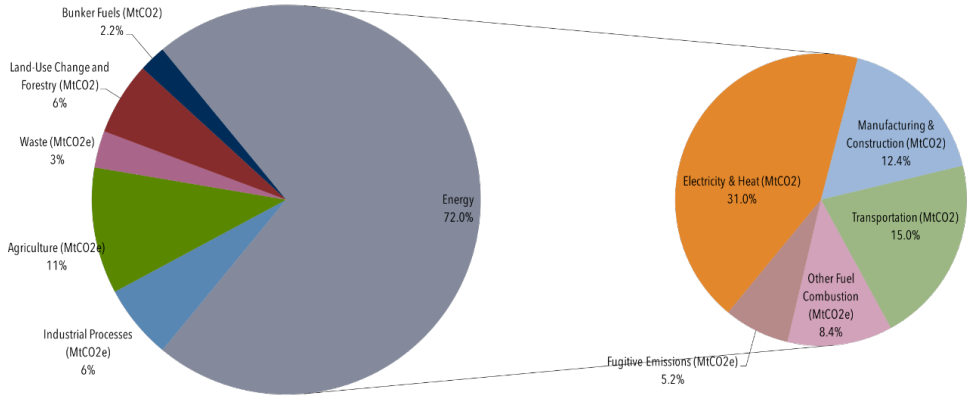


Figure 9: Global Manmade Greenhouse Gas Emissions by Sector, 2013 [23]

The overall aim is to decrease GHG emissions where bioenergy is not proposed for production of bioenergy per se, but for the applications that are the best fit to combat the climate changes. For instance, transport sector decarbonization pathway is a mixture of energy efficiency measures and directing commuters from driving personal cars to multi/intermodal transport. Biofuels come as a piece of a larger puzzle, not as a single measure along other alternative fuels options. Despite the effort within bioenergy community, the message of necessity not only to have bioenergy in the energy balances but the necessity to increase its production of biomass for bioenergy within bioeconomy is not reaching out the peer colleagues – scientists, let alone public which, consequently, make politicians hinder on bioenergy topics.

Biomass is complex and involves substantial number of stakeholders to establish a supply chain from the biomass source to energy conversion (Figure 10). Biomass uptake requires people's engagement.

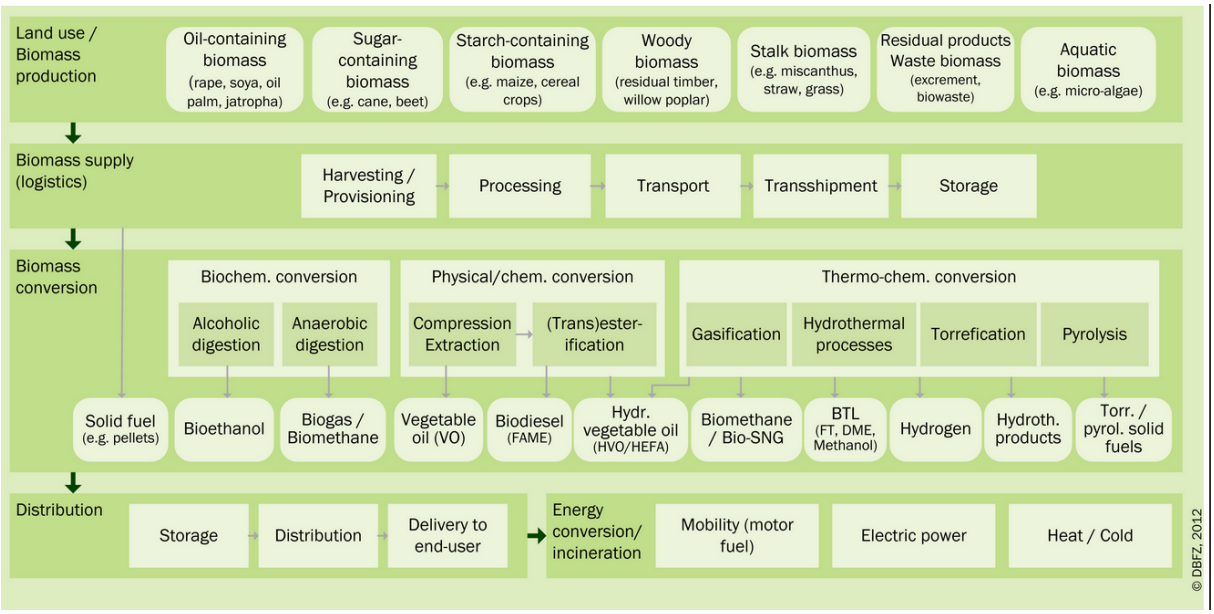


Figure 10: Systemic contribution of biomass [20]

Bioenergy indeed creates the highest multiplier effect among all the renewable energy sources, but that effect must be tempered to the positive side. On the other hand, the job demand in bioenergy supply chain makes bioenergy less competitive renewable energy source than its counterparts. EU

perceives that increasing the use of biomass in the EU can help diversify Europe's energy supply, create growth and jobs, and lower greenhouse gas emissions [11].

In 2008, the United Nations Special Rapporteur Jean Ziegler's statement on fuel vs food still echoes in media although in 2015, FAO officially changed their position and moved from food versus fuel debate to a food and fuel debate [12]. "There is no question: food comes first," highlighted J.G. da Silva, FAO Director-General at the Global Forum for Food and Agriculture in Berlin in 2015, adding: "But biofuels should not be simply seen as a threat or as a magical solution. Like anything else, they can do good or bad." Indeed, in order to have access to quality food, one has to have energy source to cook it. However, the media did not place the same attention to this statement as for the food vs. fuel debate which, although obsolete, still lingers among public consciousness.

The joint statement between IRENA, IEA Bioenergy and FAO (2017) [1] highlights some options for sustainable bioenergy expansion such as:

- identify areas best suited for bioenergy production (such as for agri-ecological zoning)
- contract farming for small-scale farmers to diversify their land use and income
- sustainable intensification and landscape planning – increasing output per unit of land while maintaining or improving ecosystems' health and productive capacity
- restoring degraded land
- reducing losses in the food chain
- processing organic residues from growing food and processing food
- forest wood with no industrial value
- sustainable forest management
- post-consumer waste…

4 Workshop format and methodology

The workshop had a proactive format, consistent of dynamic exchange of showcase presentation and work in groups to identify system frameworks and tradeoffs along different biomass supply chains in order to improve the communication with various stakeholders along a biomass supply chain. First, representatives of established associations and institutions that would voice over different stakeholders' perspectives on biomass were invited to the workshop.

The participants (alphabetically[1]: below50, BioEast Initiative, Bioenergy Europe, COPA-COGECA, EIP-AGRI, ENRD, GBEP, IINAS, SEI, SVEBIO, WBA) were asked to present their organization: vision, purpose, geographical coverage, area of activity (policy making, lobbying, representing, research…) and stakeholders' group they addressed. Within a restricted time, the participants shared their perspectives on bioenergy and suggestions on how would communicate the complexity of bioenergy to the members as well as how to limit bad practice examples. The summary of participants' contributions is presented in the Annex.

[1] Please see Annex

The next step was communicating the idea of the workshop with the Agenda[2], stressing out the issues elaborated in the previous sections of this report: the unheard story of bioenergy and the expectations of bioenergy in the climate change actions. The workshop format was a combination on presentations and work in groups that will investigate the positions of each stakeholder of the presented context of landscape management for bioenergy and bioeconomy – starting from production to energy consumption. Presentations[3] were organized according to the biomass supply chains in agriculture and forestry context.

The work in groups had a participatory approach by using the H-form format [13], where each participant had an opportunity to contribute to the discussion with a message on a post-it paper, stepping into farmers', land-owners', foresters' shoes as well as reaching a community perspective, giving pros, cons and proposals how to overcome cons.

Figure 11: Demonstration of the H-form concept and division into working groups

H-form [14] or Rugby Post form is a technique developed in 1997 by Andy Inglis while working for IUCN in Somalia to assist local people to monitor and evaluate local environmental management. Since then, it has been used in variations in other monitoring and evaluation exercises in Scotland, Wales, Austria, Northern Ireland, Egypt, England, India and Romania. The method is useful to extract ideas, facilitate discussion and collect thoughts from participants, especially on topic related to engaging with people.

IEA Bioenergy Task 43 members have delivered five questions to debate within H-form format. The concept was demonstrated on the case of "Would you use your bicycle to go to work?" and having jointly solving the issue on the screen (listed pros, cons and solutions to the cons).

[2] Please see Annex

[3] All presentations are available at the IEA Bioenergy Task 43 website: "Sustainable Landscape Management for Bioenergy and the Bioeconomy" , a joint IEA Bioenergy Task 43 & FAO Workshop, October 11-12, 2018, The FAO Headquarters, Vialedelle Terme di Caracalla, Rome, Italy. http://task43.ieabioenergy.com/publications/sustainable-landscape-management-for-bioenergy-and-the-bioeconomy/

Participants were organized in four groups. Groups were circulating from station to station where a group had to work on a specific question. Each station had a moderator and a rapporteur from IEA Bioenergy Task 43 members. The sessions were executed after a section of presentations. In total, five questions were discussed, each discussion lasting 20 minutes:

- Would the land owner/manager supply biomass for energy?
- Would an increased supply of biomass for energy affect land quality?
- Would recognition of ecosystem services affect biomass for energy production?
- What is the community perception of increased biomass production for energy?
- Can international organizations collaborate with IEA Bioenergy to affect biomass production outcomes?

First, each participant had to place a perspective on the line (positive or negative) on the topic of question from the point of stakeholders. Second, each participant had to give at least one positive and one negative reason pro or against the question and give at least one solution to each negative answer.

The final step was to write a takeaway note with the reflection on the future collaboration.

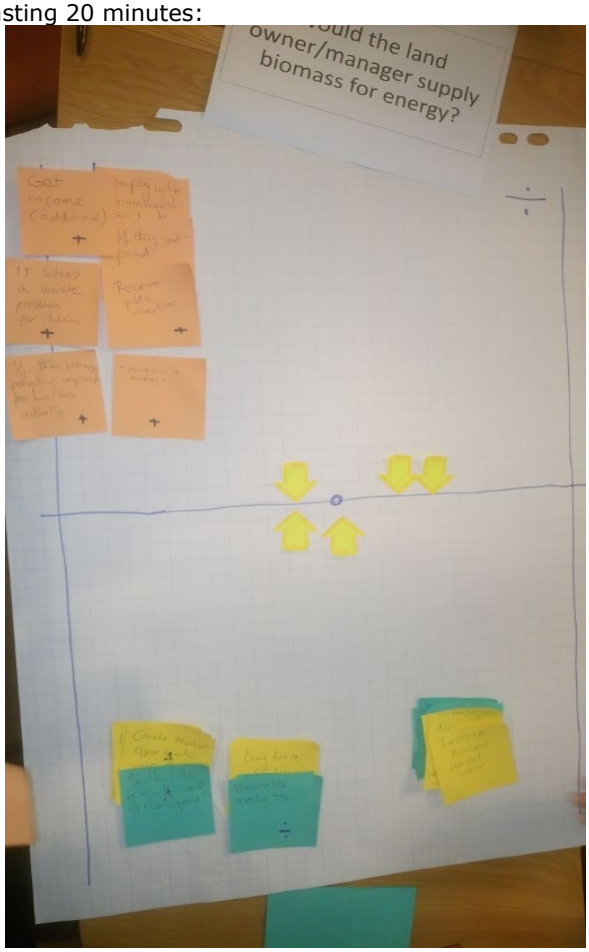


Figure 12: Perspectives and possible solutions gathered in the H-form format

5 Outcomes of the work in group

The work in groups was challenging as participants had to find a solution to each problem (negative attitude or obstacle) indicated before. The general impression of this exercise was positive as biomass experts had designated time to step into farmers' (or foresters') shoes and think of the reasons why and how to engage in a bioenergy market. The assumption was that, by figuring out what aspects of bioenergy is important from their side, it would be easier to streamline the communication from a bioenergy expert to a non-expert.

The following highlights represent indicative findings according to the statements from the group work. Complete records of statements are presented in the Annex: positive and negative attitudes as well as possible solutions to change a negative attitude to a positive one, in the manner as they were written on a post-it paper.

5.1. WOULD THE LANDOWNER/MANAGER SUPPLY BIOMASS FOR ENERGY?

Figure 13: Would the landowner/manager supply biomass for energy? station (moderated by Mark Brown and Niclas Scott Bentsen)

The participants assigned positive attitudes from the perspective of the landowner or land-manager to supply biomass for energy in both agriculture (58%) and forestry (83%) context with an average weight of 0.60 for both contexts. No negative concerns were considered in the forestry context while 21% gave a negative concern with an average -0.40 weight in the agriculture context.

The positive reasons were concentrated around profit (expressions such as "more profit", "additional income", "extra revenue"…) finding a

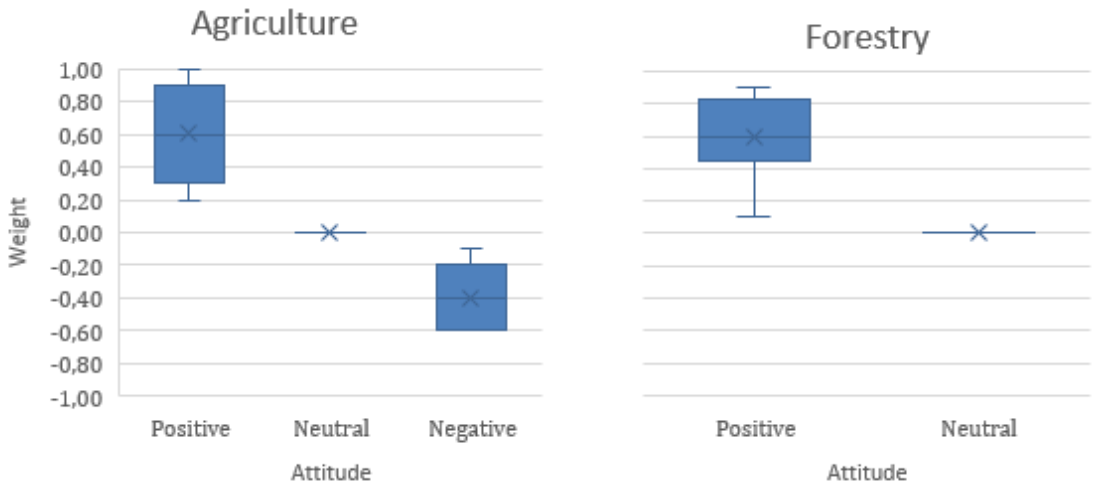


Figure 14: Views if the landowner/manager would supply biomass for energy

market for agro-residues ("farmers are paid for what they produce", "utilization of unused feedstock", "solving waste problem"…) and compliance with environmental standards with less net loss.

The negative reasons were concentrated on farmers' perceptions of having agri-residues placing on bioenergy market too complicated (too complex legislation, possible damage to the soil), with low profitability and market instability (investments too high to be justified with short term agreements) as well as farmers' reluctance to changes ("food comes first", "happy with the situation as it is").

One of the conclusions from this section would be to highlight profit aspect when communicating bioenergy to farmers, foresters and landowners. Simultaneously, one must be cautious not to raise

too high expectations as there are high odds that that the biomass suppliers at the beginning of the biomass supply chain will likely to gain the least value added along the supply chain, mirroring the existing position in the food supply chain. Organizing a biomass supply in a farmers' (foresters', landowners') friendly way, such as the least effort options, 3rd party logistics/collection/harvesting along with educating agriculture and forestry extension services on the best practice would minimize the perceived complexity and instability of the bioenergy market.

5.2. WOULD AN INCREASED SUPPLY OF BIOMASS FOR ENERGY AFFECT LAND QUALITY?

Figure 15: Would an increased supply of biomass for energy (from forest lands) affect land quality? station (moderated by Keith Kline and Virginia Dale)

Increased supply of biomass for bioenergy would affect land quality where both negative and positive weight median settles at +/-0.30 weight at agriculture context. In the forestry context, positive weight median was at 0.50 against -0.36 at the negative side. The question was considered highly ambiguous and several participants voiced concern about the question and different ways to interpret it. That reflected in high numbers recorded as "neutral": 30% and 20% at agriculture and forestry context, respectively.

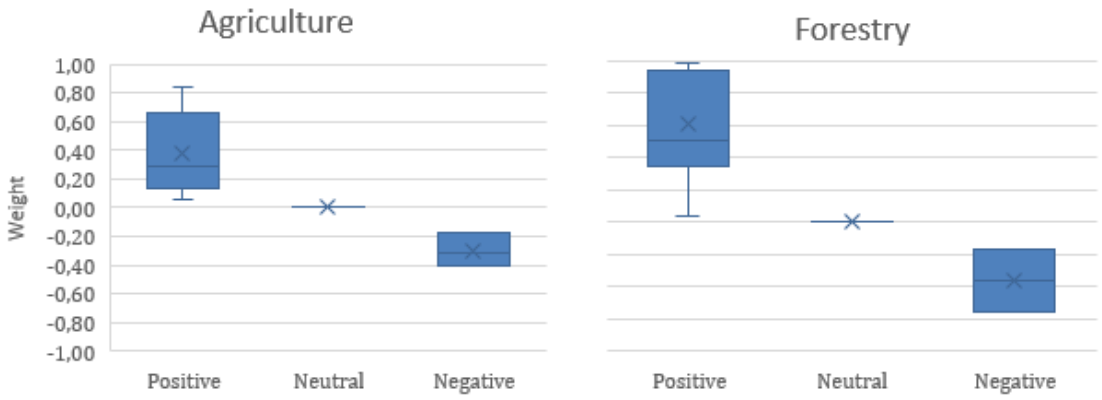


Figure 16: Views if an increased supply of biomass for energy would affect land quality

Three main messages could be driven from the groups' statements: 1) biomass for bioenergy can improve the land quality by introducing cover crops, polyculture and agro-foresty as an opposite to monocultures in traditional cropping; 2) sustainably managed forests produce more biomass and

save more GHG than unmanaged forests; 3) removing organic material would deplete the soil, regardless on the soil qualification or use. When communicating land quality, it seems that soil depletion and nutrients removal are the buzz words that need to have an adequate response from the bioenergy community. For that, education is required.

5.3. WOULD RECOGNITION OF ECOSYSTEM SERVICES AFFECT BIOMASS FOR ENERGY PRODUCTION?

Figure 18: Would recognition of ecosystem services affect biomass for energy production? station (moderated by Jörg Schweinle and Gustav Egnell)

The group work outcome leads to the conclusion that recognition of ecosystem services would not affect biomass for energy production neither in agriculture nor in forestry context. In other words, when communicating the bioenergy message, ecosystem services are not placed highly on the priority list.

In agriculture context, both positive and negative statements clustered around profit or increased farmers' income for providing ecosystem services,

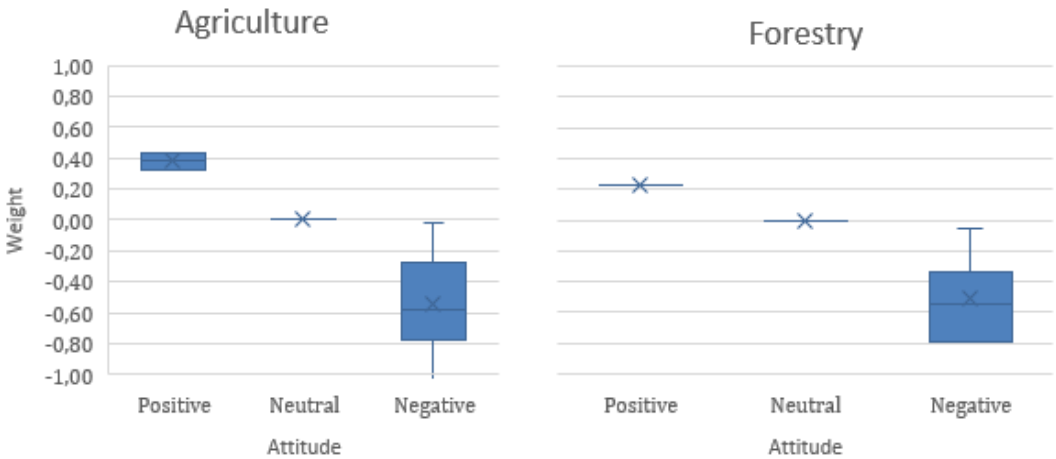


Figure 17: Views if recognition of ecosystem services would affect biomass for energy production

awareness of their existence as well as its complexity to value them. In general, it could be concluded that, if ecosystem services are to affect biomass for energy production, they had to be monetarized with a transparent evaluation system to the biomass supply stakeholders.

The reasons were that forest management for ecosystem services is needed disregarding the end

use of wood. If ecosystem services were valued, it would add value from biomass for bioenergy.

5.4. WHAT IS THE COMMUNITY PERCEPTION OF INCREASED BIOMASS PRODUCTION FOR ENERGY?

Figure 19: What is the community perception of increased biomass production for energy? station (moderated by Evelyne Thiffault and William White)

The answers indicate that bioenergy is not unambiguously perceived as solely as a positive occurrence which is further reflected in the media and publications. Although 55% of participants assigned a positive attitude towards increased biomass production, the average positive value achieved (0.31) is less than the average negative value (0.59). The whiskers of the negative attitude had wider spread and reaching to the maximum negative values (0.93) while the positive attitudes were capped at 0.54.

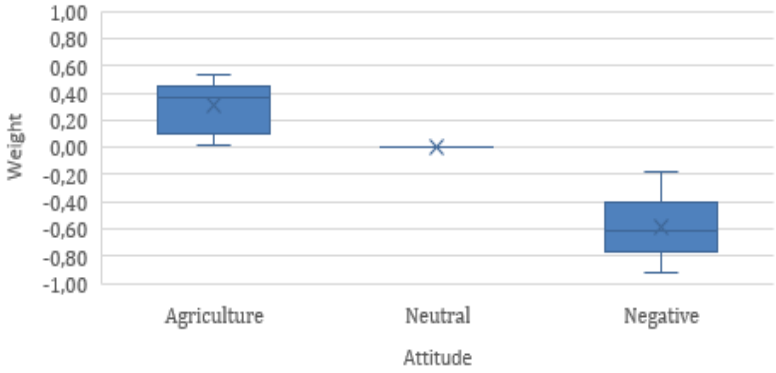


Figure 20: What is the community perception of increased biomass production for energy? attitudes

The answers indicate that bioenergy is not unambiguously perceived as solely as a positive occurrence which is further reflected in the media and publications. Although 55% of participants assigned a positive attitude towards increased biomass production, the average positive value achieved (0.31) is less than the average negative value (0.59). The whiskers of the negative attitude had wider spread and reaching to the maximum negative values (0.93) while the positive attitudes were capped at 0.54.

Positive arguments were concentrating on the economic growth, climate mitigation and environmental benefits, especially if the awareness is increased. Bioenergy could allow access to low cost energy and energy security for poor countries.

Negative arguments clustered around market barriers: competitiveness of bioenergy against fossil energy counterparts, increased competition for resources and the sustainability of an increased demand for biomass, administrative burden to a farmer to enter the market, lack of local markets… The fair share of negative arguments was clustered around the common misconception of bioenergy: food vs. fuel debate. Absence of policy that would create a connection between practice and carbon

markets could be addressed by creating a mechanism for coupling carbon storage to carbon offsets. Yet, it is important not to forget water in the water-energy-food nexus which is more difficult to address by a policy.

5.5. CAN INTERNATIONAL ORGANIZATIONS COLLABORATE WITH IEA BIOENERGY TO AFFECT BIOMASS PRODUCTION OUTCOMES?

8 participants joined the challenge where all agreed that it is “very likely” that international organization can collaborate with IEA Bioenergy to affect biomass production outcomes.

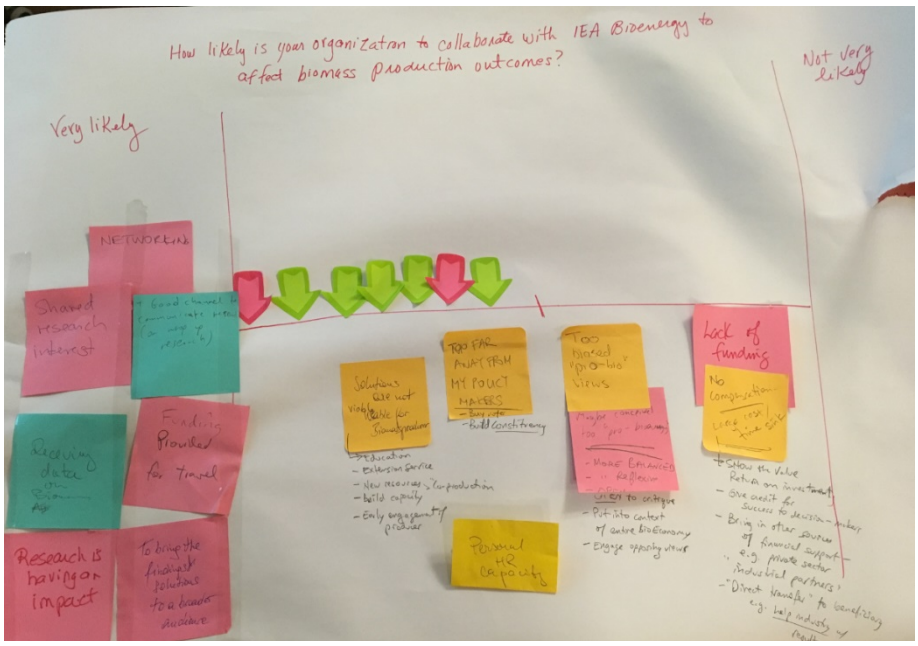


Figure 21: H-form of „Can international organizations collaborate with IEA Bioenergy to affect biomass production outcomes?“ discussion (moderated by Keith Kline and Virginia Dale)

The reasons that justified the collaboration were sharing the interest and benefiting from networking, crosspollinating projects and research and broadening the outreach.

As the methodology provokes also negative aspects of the topic in question, the reasons that would lead to unlikely collaboration were lack of funding, large commitments, lack of relevance to local conditions as well as IEA Bioenergy perceive too biased “pro-biofuels”. Solutions proposed to the latest remark were to ensure reflexive and balanced analyses and reports, invite and accept criticism as well as to put bioenergy in a context of bioeconomy. Those solutions would also affect other shortcomings for the international organisations to collaborate with IEA Bioenergy.

6. Take-away messages

This is not the first time FAO and IEA have organised a workshop together, but it was the first time that the focus has been on bioeconomy. We have all heard about the benefits of renewable energy that comes from organic material and the potential for this bioenergy globally is substantial, but it is not just about bioenergy – bioenergy must be considered within the larger bioeconomy.

The sustainability of bioenergy within the broader bioeconomy: The bioeconomy is based on the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy. It involves three elements:

1. The use of renewable biomass and efficient bioprocesses to achieve sustainable production.

2. The use of enabling and converging technologies, including biotechnology.

3. Integration between sectors such as agriculture, health and industry.

The cross-cutting nature of the bioeconomy offers an opportunity to address interconnected societal challenges such as food security, fossil-resource dependence, natural resource scarcity and climate change, while achieving sustainable economic development.

However, simply developing bioeconomy is not sustainable. The development of an economy that is based on biomass resources faces several trade-offs. It is crucial that bioeconomy development does not hamper but rather strengthens food security as a basic human need and right, while also helping to achieve several other Sustainable Development Goals (SDGs)."[4]

"After the IEA Bioenergy Meeting in Rome I was even more convinced that we can do a lot of research, a lot of modelling but if we are not able to find a way to increase demand, increase use – we have very little use of the work and modelling we have done." G. Melin, SVEBIO

Opening communication channels with stakeholders: The workshop also evoked a question if IEA Bioenergy is being perceived as biased when advocating bioenergy. Although science is not to be linked with bias, it seems unavoidable in public perception. Labelling could be avoided by being open to crosspollinated science, expertise and practical knowledge: embracing green NGOs and representatives of all stakeholders along the biomass supply chain in discussions along the development of models and policies. Invite and accept criticism and learn how the weak points and blind spots of bioenergy can be addressed by engaging with stakeholders holding opposing views. This two-way communication channels need to be established to articulate the bioenergy message in a way that is addressing issues highlighted by the larger community, not only the issues that bioenergy community finds important or takes for granted. Bioenergy sector is dynamic and facing improvements on daily basis in adapting practices, refining technologies, minimizing or eliminating the weak points by better crafted policies… Communication on those improvements that tackled the issues of concern could be a starting point.

"Collaboration is the key role on how bioenergy can benefit not only at conventional bioenergy supply sectors (agriculture, forestry, water, energy, environment) but also other economic sectors e.g. health, industry, transport." O. Dubois, FAO

Telling the unheard bioenergy story: It has been highlighted that many aspects of bioenergy remain untold or have been ineffectively communicated. While it is necessary for scientists to conduct research on aspects of bioenergy that are not of general interest among the public, it is also important for these scientists to invest adequate efforts in consistently and effectively communicating the benefits of bioenergy to increase general awareness and support.

The workshop made us all closer to streamline the message of bioenergy outside the bioenergy community bubble. Yet, there is still much to do be done to achieve that communication in limited time. The workshop conclusions were that the similar events to exchange and assimilate good practice examples are much needed among the bioenergy experts working for different organizations and on various aspects of biomass. Networking and sharing contents (e.g. studies, projects, good practices and communicate or participate at event/publication would echo the bioenergy message further. Full "take-away" messages are presented in the Annex.

[4] Statement published at the FAO website www.fao.org/energy/news/news-details/en/c/1160386/

7. A view from outside the bioenergy bubble

After the workshop, IEA Bioenergy Task 43 hired an external expert, an ecological sociologist who has not been involved in the workshop, to have a reflection on the outcomes as well as on the successfulness of communicating bioenergy.

Although IEA Bioenergy and FAO have experience in organizing joint events, this was one of the first workshops with the focus on communicating bioenergy. Involved organizations and participating actors are well-aware of the multidisciplinarity and transdisciplinarity of the bioenergy since the potentiality of bioenergy in achieving transition towards zero carbon economy requires engagement of scientific community but also the inclusion of wider public. Through interaction and knowledge sharing workshop participants made a possibility to create as "epistemic community" concerning the issues of bioenergy. Epistemic community as a concept refers to an informal network of knowledge-experts that can influence policy actors through providing expert knowledge. Since the workshop gathered experts in bioenergy from various scientific fields, supply chain and interests, it created a possibility to create epistemic community in the long-run that has a capacity to mobilize around the discourse concerning bioenergy.

Epistemic communities often deploy a set of rules in order to exchange knowledge and to address ignorance, but also to discuss values and anti-values. This kind of communities are not the only ones interested in the topics on bioenergy and with an aim to inform the wider public they often compete with similar epistemic communities. What could be beneficial for a specific epistemic community in reaching a wider audience is its internal variance of knowledge-experts and interested professionals.

From the perspective of media studies the mechanism by which public opinion and people´s attitudes toward energy and energy issues are formed are well known. Two processes are important in acquiring media attention on the issue of bioenergy. First one is *agenda setting* and *priming*, the process in which it is needed to control social attention by devoting enough time, space and significance on issues concerning bioenergy. Second process important in acquiring attention of wider audience is *framing*. Bioenergy is a complex issue with multidisciplinary scientific perspectives involved in explaining bioenergy topics. Epistemic community with its experts and their knowledge can create the interpretation frameworks and can construct narratives on the importance and potential of bioenergy. Yet, the heterogeneity of biomass feedstock, multiple conversion pathways and end-use at all energy sector markets, challenges the unity of epistemic bioenergy community. One of the ways to deal with these types of obstacles is to have in-depth discussion on the social and ecological values important for preserving the planet Earth and humankind as such. As we are quite aware of the messages coming out of scientific communities about the social and environmental risks and problems in our near future, all those that can contribute to mitigation and adaptation policies/plans/strategies to climate change and loss of biodiversity should agree on principles/values aimed at achieving sustainable planet and sustainable societies. When principles/values relevant for sustainable planet and sustainable societies are enlisted than those actors/organizations/institutions should steer their interests in line with those principles/values, thus qualifying themselves to be relevant actor in the epistemic community. Risks and problems our civilization and our planet can expect soon, calls for principles/values of strong sustainability.

Creating the narrative frame on bioenergy issues several challenges could occur. First, the topics discussed during workshops are complex and are dependent on numerous social, economic, geopolitical and technological contexts. This complexity and multilayer feature of the bioenergy creates a barrier to media and citizens to comprehend what is the potential of bioenergy, but also what are social and economic tradeoffs that some of the models of using biomass can create. Second

challenge could be for those citizens living in a materially affluent societies, where citizens do not perceive energy *per se* to be of a vital interest. For instance, around 4% of EU citizens tend to perceive issues like climate change, energy supplies and environment in general to be of a specific concern [15]. Topics like employment, economy or immigration concern 35-40% of Europeans. The research also shows that Europeans when asked about energy technology express to trust more the scientists and nongovernmental (NGO) organizations than journalists and politicians. So, creating an epistemic community consisted of scientists and representatives from NGO sector is vital in achieving and opening a communication channel towards wider public. Since energy is not on focus of citizens living in more affluent societies, scientists and NGO´s should develop a strategy how to set the agenda and in what way topics concerning bioenergy and biomass in specific should be framed.

When trying to reach wider audience with the purpose of conveying a message on certain issues, it is required to understand how the idea of communicating in public sphere functions. Various actors in public sphere publicly debate and assess each other's positions, strengths, values, motives and opinions. Ideally, public sphere could be imagined as a forum, like in ancient's times, where different views and perspectives could be aired. With guaranteed freedom of speech, the idea is to have various actors debating various ideas and with the quality of arguments and persuasion strive to gain attention and partiality. This ideal of substantial debate and reflecting public opinion is in the core of deliberative democracy. Unfortunately, this only the ideal, since public sphere is similar more to an arena where the logic of truculence is employed. Battling in public sphere where the distribution of power creates unequal positions for various actors indicates manipulation and exclusion. This often results in marginalization of important actors such as scientists, especially if their research findings could refute some of the mainstream socioeconomic logic. The example of this can be seen in various public attacks and denouncing the climate change scientists in the last five decades. Therefore, it is important to create an epistemic community enabled to actively participate in the public sphere and being ready and narratively equipped to strongly hold its position on various issues regarding bioenergy and biomass.

Energy *per se*, and for that matter bioenergy in media, has different discourses on technological aspects, matters of resources, energy politics, examples of social practices, questions of measurability and indicators. In order to shape public opinion and to influence politics and policies, framing is the most important condition. Usually matters of energy fall into a discourse on civilizational achievements and development [16], as an achievement of capitalism and neoliberal ideology. This discourse is mostly used by politicians and businesses, while technological frame is being used as a mean of delegitimizing adversaries claiming that they do not understand technology and making accusations that their vision of development is fault. Technology as a tool for an argument combined with economic reasoning is often on sided perspective with the opposing perspective of environmentalism. This is often dichotomized through the argument "jobs" or "environment" [17]. Only recently we can witness a new frame where technological and economic perspectives relate to the goals of climate policy. Within this framing lays a necessity to discuss issues and potential of bioenergy and biomass. This type of framing calls for energy transition while it is often juxtaposed with the discourse of energy security often deployed by policymakers. Necessity of energy transition in order to effectively combat climate change consequences provides the space for new technologies concerning the usage of biomass, but the framing here needs to always be attentive to positive and negative effects that new technologies could have on environment and societies.

To pose bioenergy topics into the public sphere and to have more success in shaping the public opinion and influencing the policymakers, two aspects are important. One stems from the ecological modernization theory (EMT) which proposes that environmental policy has a potential to modernize the economy, technological development and innovation [18]. The environmental policy in that

regard must stem out of the debate and cooperation which includes various organizations/epistemic communities. Scientific community needs environmental organizations and civil society organizations (also epistemic communities) to actively cooperate and create framing (narratives and discourses) on the potential of bioenergy and biomass. Topics and discussions on bioenergy engage various actors and epistemic communities that tend to understand each other or sometimes even ignore each other. Therefore, to have an influence on wider public, broader epistemic coalitions are needed among the organizations and actors concerned with bioenergy and biomass topics and issues.

8. Conclusions

The workshop outlined the necessity of a two-way communication to bring bioenergy, as a valuable climate mitigation option, out of the scientific bubble. It is true that scientists could be carried away with researching aspects of bioenergy that are of less interest to the public (e.g. ecosystem services), while assuming facts like "bioenergy comes usually from co-productive sources" or "increases income of wood-based industry" belong to the general knowledge among the population.

This report highlighted many aspects of bioenergy that are either untold or unheard properly. Here we highlight again messages that needed to be emphasized when communicating bioenergy:

- **Biomass supply for energy frequently comes from co-productive systems**, unless energy dedicated plantation, in a form of residue or by-product or waste from primary economic activity (furniture, pulp & paper, food production, cattle breeding…) that brings more added value to biomass utilization.

- **Energy sector is dominated by economies of scale**, with large volumes and low unit price where market forces reduce options for biomass supply for energy markets. In a market economy, biomass for bioenergy will be, very likely, the least option for biomass supplier.

- **Market economy plays important role in biomass supply**: only biomass that cannot reach better value added at the market will be streamlined towards its use for bioenergy.

- **Biomass is an internationally traded good where** market distortions introduced by biomass (for bioenergy or any other purpose) **policy can have a global effect**. Cascading use of biomass should be reflected in bioenergy policy.

- **Cascading use of biomass allows maximizing value added along the wood asset where low-quality wood or residues increase competitiveness of wood processing industry**. The same concept can be applied on agriculture where agri-residues find value at the bioeconomy market while grain, for example, still has its traditional place in the food industry.

- **The complexity of various conversion paths and heterogeneity of biomass sources makes the remark that bioenergy is either good or bad a generic overstatement**. This complexity of bioenergy clusters epistemic communities around specific bioenergy feature (e.g. GHG emissions, land use…) or bioenergy pathway (biogas, biofuel, combustion…) which is confusing for wider public and policy- makers.

- **Bioenergy is an integral part of the bioeconomy**. It is the only renewable energy source that can absorb atmospheric CO_2 which increases its GHG savings affect.

- **Bioenergy interacts the most with the society among all the renewable energy sources**.
- **Bioenergy is an integral part of Paris Agreement implementation**.
- **Some bioenergy settings can achieve negative GHG emissions**, such as BiogasDoneRight.
- **Some bioenergy settings can improve yields and income per hectare for farmers** with agroforestry and water-energy-food nexus shown in the examples in the Agenda.
- While heating and cooling sectors will remain the dominant sectors for bioenergy use, **the future expectations of bioenergy are placed on biofuels to decarbonize transport sector**.

Different engagement of bioenergy experts can open a two-way communication. For that communication, it is important to create an epistemic community enabled to actively participate in the public sphere and being ready and narratively equipped to strongly hold its position on various issues regarding bioenergy and biomass. Indeed, a challenge lays in forming the bioenergy epistemic community too, given the heterogeneity of biomass feedstock, conversion pathways and end-uses. It is crucial that bioenergy epistemic community agrees on imperatives that bioenergy must meet in all spheres: science, policy and practice: such as sustainability in biomass supply; cohabitation with the local community, efficiency in use and putting the GHG emissions savings effect, along the supply chain till the end-use in front, of the quantity of bioenergy produced… When communicating bioenergy, two-way communication is crucial between the scientists and public. Identifying interests on bioenergy outside of the bioenergy bubble and articulating those interests in the scientific research, policy advising, project development…could make an audience for, so far, an unheard bioenergy story.

It seems that we, the scientific community that deals with various aspects of bioenergy with an aim of halting climate changes, need to find new communication platforms in our "business-as-usual" format. The communication platforms would engage more effort in sending out the message, with an aim of educating, cultivating and informing on bioenergy issues that public finds interesting, often taken for granted by the scientists in the bioenergy bubble. The communication can also detect issues that occur in practice and weren't foreseen before. The feedback on those incidents would provoke new ideas how to improve the system and minimize area for negative practice. Some formats of engagement are listed below but not limited to the list:

1. Inviting broader scope of participants to our specific topics workshops and asking for the feedback to detect how understandable or applicable was the outcome of our research efforts;

2. Including extension service associations into bioenergy discussions (events), helping them with supplying the best practice examples but also receiving feedback from real practice examples and issues of concerns;

3. Publishing articles in open-source interdisciplinary journals (i.e. Science Daily) that are easily access by non-science community;

4. Educate our peers scientist on various aspects and interlinkages of bioenergy with other sectors and society by inviting them to have a joint research;

5. Educate investigating journalists that do not have access to scientific papers by publishing

briefs, visually attractive, free of charge infographics;

6. Translating a 2pager report to a journalist style and sending over to the stakeholders or even publish it on portals dedicated for educators, such as Scitable by Nature Education[5];

7. Webinars to be used in teaching programmes – most of our IEA Bioenergy members are highly appreciated professors from respectable world-wide universities. Include webinars in teaching classes;

8. Appearing more on popular scientific shows that target general population and children;

9. Map overlapping issues with NGOs that are willing to create an epistemic community on bioenergy;

10. Detect different roles of scientists, industry, government, etc. have in defining / shaping the message and then relaying it;

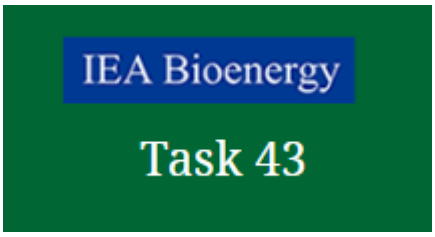
11. Bringing local good practice examples closer to the public and decision-makers. A first-hand experience is effective tool of knowledge spreading. It is important to stay true as a bias or false advocacy could do more harm than good.

The time to engage is limited as radical actions are needed to halt the climate change and biomass for bioenergy has its dedicated role.

[5] https://www.nature.com/scitable

Annex

About the hosts:



http://task43.ieabioenergy.com/

IEA Bioenergy is an organization set up in 1978 by the International Energy Agency (IEA) with the aim of improving cooperation and information exchange between countries that have national programmes in bioenergy research, development and deployment. 24 countries plus the European Commission participate in IEA Bioenergy's 12 ongoing tasks in 2016-2018 triennium.

IEA Bioenergy Task 43 Biomass Feedstocks for Energy Markets promotes sound bioenergy development that is driven by well-informed decisions in business, governments and elsewhere. This will be achieved by providing to relevant actors timely and topical analyses, syntheses and conclusions on all fields related to biomass feedstock, including biomass markets and the socioeconomic and environmental consequences of feedstock production. It operates on the researcher efforts and needs from 12 participating countries: Australia, Belgium, Canada, Croatia, Denmark, Finland, Germany, Ireland, Netherlands, Norway, Sweden and the USA. The area of their expertise varies from agro-economics to forestry and physic science. Some are more orientated towards research, some towards policy making and some towards industry.

At this workshop, the following institutions of the biomass experts represented IEA Bioenergy Task 43 (alphabetically):

https://www.chalmers.se/en/departments/see/Pages/default.aspx

http://www.eihp.hr/?lang=en

https://www.ornl.gov/division/esd/ssss

https://www.thuenen.de/en/wf/

https://www.slu.se/en/departments/crop-production-ecology/research1/cultivation-of-deciduous-trees-/

https://ign.ku.dk/english/

https://www.ffgg.ulaval.ca/

https://www.usc.edu.au/research-and-innovation/research-partnerships/australian-forest-operations-research-alliance-afora

http://www.fao.org/energy/bioenergy/en/

FAO is a specialized agency of the United Nations that leads international efforts to defeat hunger.

Our goal is to achieve food security for all and make sure that people have regular access to enough high-quality food to lead active, healthy lives. With over 194 member states, FAO works in over 130 countries worldwide. We believe that everyone can play a part in ending hunger.

FAO's work on energy involves enhancing knowledge and supporting member countries to move towards using energy-smart agrifood systems through five areas of work. The energy-smart approach refers to methods and technologies that optimize the use of efficient and sustainable energy in different settings. Energy is needed at every stage of this chain. Energy-smart agrifood systems can also be used to produce energy and therefore offer a way to take better advantage of the dual relationship between energy and food.

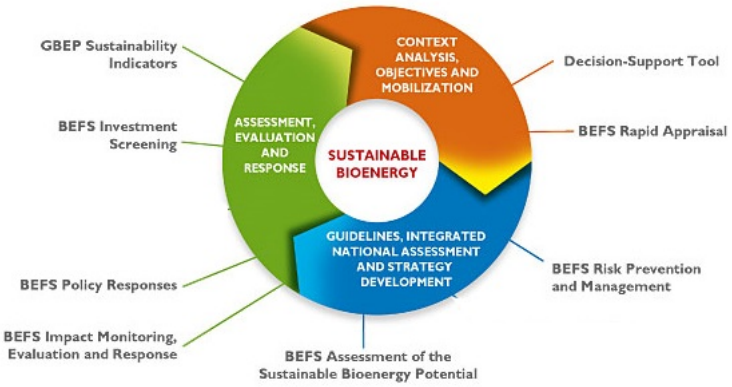
The Energy-Smart Food Programme directly contributes to FAO's Strategic Programmes:

- Energy needed to ensure food security
- Technologies related to climate-smart agriculture
- Addresses energy poverty in rural development
- Directly contributes to the development of green and inclusive food value chains
- Contributes to safe access to sustainable energy in emergency/rehabilitation settings.

The links between bioenergy and food security are complex. Making bioenergy development sustainable becomes even more challenging when trying to capture its potential benefits on rural development, climate and energy security. An integrated approach is required to address these links and promote both "food and fuel", and ensure that bioenergy contributes to sustainable development. This approach requires:

- **In-depth understanding** of the situation and of the related opportunities, risks, synergies and trade-offs.
- An **enabling policy and institutional environment**, with sound and flexible policies and effective means to implement these.
- **Implementation of good practices** by investors and producers in order to reduce risks and increase opportunities; and appropriate policy instruments to promote these good practices.
- Proper **impact monitoring, evaluation and response**.

In order to promote this sound and integrated approach, FAO, in collaboration with partners, has developed the FAO Support Package to Decision-Making for Sustainable Bioenergy. This support package includes different elements which can be used independently or together at different stages within the decision making and monitoring processes of bioenergy development.



Decision Support Tool (DST): The UN-Energy DST for sustainable bioenergy, prepared jointly by FAO and UNEP, proposes step-wise guidance for both strategy formulation and investment decision-making processes, and offers a repository of technical resources and links to existing tools, guidelines and information resources. The DST can be seen as providing a comprehensive framework under which the other elements of the FAO support package fit.

Bioenergy and Food Security (BEFS) Approach supports countries in developing evidence based policies derived from country level information and across institutional dialogue involving relevant stakeholders. More specifically, the BEFS Approach consists of a *multidisciplinary and integrated* set of *tools* and *guidance* that can support countries throughout the bioenergy policy development and implementation process.

Global Bioenergy Partnership (GBEP) Bioenergy Sustainability Indicators: the 24 GBEP Bioenergy Sustainability Indicators were developed with FAO and agreed upon in 2011 by 23 countries and 13 international organizations (with the involvement of a further 22 countries and 10 international organizations as observers) to provide a comprehensive yet practical means of evaluating the impacts of bioenergy production and use in a country. As of today, the GBEP sustainability indicators for bioenergy had been implemented in more than a dozen countries. From 2011 to 2014, FAO pilot tested the indicators in Colombia and Indonesia, while from 2016 to 2018 FAO implemented the GBEP indicators in Paraguay and Viet Nam with a view to monitor the environmental, social and economic impacts of their national bioenergy production and use. Both projects were supported by the Government of Germany.

Integrated Food-Energy Systems is a diversified agricultural production farming system that incorporates agro-biodiversity and builds on the principles of sustainable production intensification. IFES can be small-scale operations managed at village/household level or large-scale operations designed for commercial activities. IFES can optimize land use through a combination of food and energy crops and/or optimize biomass use through its a cascading sequence to produce both food and energy. Depending on the circumstances, the generation of solar, thermal, geothermal, wind and/or hydro energy can be an integral part of the system.

FAO has developed an analytical framework to assess the sustainability and the possibility to replicate the IFES. This tool was used in Vietnam in 2015, and in Mozambique and Ghana in 2016-2017.

Invited participants (listed alphabetically):

https://www.wbcsd.org/Programs/Climate-and-Energy/Climate/Transforming-Heavy-Transport/below50

below50 **is a unique global collaboration that seeks to de-carbonise transportation by growing the use of sustainable fuels that reduce CO2 emissions by greater than 50% as compared to conventional fossil fuels.** below50 is up-scaling the production and use of these fuels by:

•Driving a global campaign that communicates the availability and benefits of below50 fuels;

•Creating regional hubs to tailor the below50 campaign to regional and national contexts;

•Creating inter-sectoral business-to-business (B2B) opportunities across the below50 fuel value chain to increase the number and diversity of companies choosing below50 fuels; and

•Removing legislative and financial barriers to sourcing below50 fuels.

It is a programme of WBCSD - a global, CEO-led organization of over 200 leading businesses working together to accelerate the transition to a sustainable world.

below50 is technology agnostic and supports to production and use of all fuels that reduce GHG emissions. We strongly encourage the sustainable production and use of biomass based fuels for hard to electrify sectors like aviation, heavy trucking and maritime.

below50 members that are both producers and fuel users see biofuels as a strong positive contributor to the goals of the Paris Agreement and the SDGs. Downstream users, like airlines, mining companies, and shipping companies often have little appreciation for the subtleties of biofuel sustainability. Some are interested in the subtleties others take a "certify it so that I can use it" approach. A major challenge that we face is recruiting potential users that are unfamiliar with biofuels. The have a lot of negative preconceptions and view biofuels suspiciously often over issues like the relationship between food and fuel.

Given the below50 seeks to create B2B off-take agreements in which we connect fuel producers to fuel users we have to do a lot of education for fuel off-takers about both the sustainability aspects of low carbon fuels and the technical/chemical aspects of low carbon fuels. The existence of drop-in fuels like renewable diesel and renewable jet is news to nearly all stakeholders outside of the renewable fuels sector. To date we have worked with producers to collect their information and communicate it to off-takers. Most of our outreach has been 1-to-1. Interestingly, there was considerable interest in de-carbonizing transport at the California Global Climate Action Summit.

"I often highlight bad examples as they occurred in the past and fuel producers have learned from those mistakes. In fact, most bad examples (other than Indonesian Palm Oil Biodiesel, which is a category of manmade disaster unto itself), were isolated incidents that are essentially impossible to repeat, such as attempts at industrial scale jatropha use in Africa and India", Gerard J. Ostheimer, Ph.D. Co-Founder and Senior Advisor to below50

http://www.bioeast.eu/

BioEast Initiative**: Central-Eastern European Initiative for Knowledge-based Agriculture, Aquaculture and Forestry in the Bioeconomy offers a platform to 11 Central and Eastern European (CEE) countries for a shared strategic research and innovation framework for working towards the development of a sustainable bioeconomy. Members of the BioEast Initiative are mostly Ministries of Agriculture from 11 CEE countries, supported with a topic related science/research institution.**

Bioenergy is within the top 5 research priorities of the BioEast macro-region, emerging through the Thematic Working Group Bioenergy and New Value Added Materials (TWG Bioenergy) whose mission is to contribute to the development of cost-competitive, innovative world-class bioenergy and related new value-added products, to allow integration of old and creation of new bioenergy projects integrated to strengthen a healthy European low carbon industry and to accelerate the sustainable deployment of bioenergy in the European Union through a process of guidance, prioritization and promotion of research, technology development and demonstration.

As such, bioenergy is interlinked with other 4 thematic working groups: Sustainable Yields Agroecological Intensification; Forestry; Fresh water bioeconomy and Food Systems.

TWG Bioenergy introduces a new perspective on bioenergy with raising the awareness that demand for biomass for bioenergy comes from energy sector but biomass supply is in the agriculture. As energy sector is a sector of large scales, biomass demand will affect agricultural markets. Yet, the outcomes, scope and value added of those market changes will depend on the policies. Here is the focus to increase farmers' competitiveness with bioenergy. Another aspect is that biomass production costs are less than in the other parts of the EU which gives an opportunity for BioEast macro-region to become a biomass-hub, especially for biofuels for transport.

Bioenergy is not well communicated in the BioEast countries and has potentially negative perception given the experiences from past policies in some countries. The communication between political stakeholders (ministries responsible for agriculture, energy and environmental protection) to implement concerted bioenergy related policies is still not there yet. One of the missions of the BioEast Initiative is to establish inter-ministerial groups.

Bad practice examples were present in the CEE as an effect of a narrow renewable energy legislative framework set in some individual countries. Yet, RED II minimizes the opportunity for sustaining such practice by shifting the focus from bioenergy produced to mandated GHG emissions saved for each specific biofuel setting. As such, much controversial biogas plants on maize silage that were selling renewable electricity to the grid at a privileged price while wasting the heat from the cogeneration unit, hopefully belong to the past.

https://bioenergyeurope.org/

Bioenergy Europe **is the voice of European bioenergy. It aims to develop a sustainable bioenergy market based on fair business conditions. Founded in 1990, Bioenergy Europe is a non-profit, Brussels-based international organisation bringing together more than 40 associations and 90 companies, as well as academia and research institutes.**

Bioenergy Europe is confident that bioenergy will play a key role in the low carbon economy is all sectors of electricity, heat and transport, thanks to its inherent advantages of versatility and

dispatchability. It also brings key advantages for rural economy and job creation. The association is arguing in favor of a harmonized sustainability framework to differentiate from unsustainable fossil fuels, to reduce investment risks and to gain public acceptance.

https://copa-cogeca.eu/Menu.aspx

COPA-Cogeca **represents 23 million European farmers and family members and 22, 000 European agricultural cooperatives; purpose is giving all European farmers and agricultural cooperatives one strong voice and lobby for their interests as well as representation and policy making in all areas farmers and foresters are concerned.**

Bioenergy is a big topic in COPA-Cogeca, particularly feedstock production for biofuels (e.g. rapeseed, rapeseed oil, wheat) and solid biofuels from wood. Especially within the framework for "renewable energy – RED II", Bioeconomy and also "clean planet 2050" biomass, liquid and solid biofuels as well as bioenergy and renewable feedstock play a major role for decarbonisation of economy. Farmers and foresters ensure the whole feedstock supply with biomass for material and energetic use.

Bioenergy is perceived by our members very positively and as an opportunity to diverse the earnings from agriculture and forestry and possibly gain additional earnings by using new or additional feedstock and raw material (e.g. branches, low quality trees (bark beetle) etc.).

Communication to our members is on different ways – by meetings of member-representatives, via mail, brochures, internet and Email. Anyway, we try to keep the messages even to complex topics very short and simple. Therefore, we split topics into several subitems and then point the advantages but also the issues for the farmers/foresters out.

In my opinion this is a topic for the Member states and third countries. We don´t promote bad practices examples and communicate any wrong development in our point of view.

https://ec.europa.eu/eip/agriculture/en

https://ec.europa.eu/eip/agriculture/en/focus-groups/enhancing-production-and-use-renewable-energy-farm

The European Innovation Partnership for Agricultural productivity and Sustainability **has been launched in 2012 to contribute to the EU's strategy 'Europe 2020' for smart, sustainable and inclusive growth. This strategy sets the strengthening of research and innovation as one of its 5 main objectives and supports a new interactive approach to innovation: European Innovation Partnerships.**

Coordinating agricultural research across the European Research Area, the Standing Committee for Agricultural Research (SCAR), which consists of representatives from Member States and Candidate and Associated Countries, has engaged in assisting the EIP through the development of innovative Horizon 2020 instruments. It is providing advice via a dedicated working group on Agricultural Knowledge and Innovation Systems (AKIS).

There are several focus groups that tackle biomass for bioenergy (Forest Biomass, Agroforestry:

woody vegetation etc.) the Focus group *Enhancing production and use of renewable energy on the farm* is focusing on biomass for bioenergy, among other options for farmers to produce renewable energy via tasks:

- Identify the main practical challenges and opportunities posed by the production and use of renewable energy at farm level.
- Identify main practical barriers to sourcing of materials (forest biomass, agricultural biomass - with potential focus on agricultural residues - solar, geothermal and wind), transportation and collection (e.g. on farm, to local biogas plants etc.), transformation to energy, and distribution to farms and on farms as well as to public grids.
- Identify new and best practices and tools that can be applied at farm level to increase both the production and self-consumption of renewable energy in a cost-efficient manner, while ensuring that renewable energy sourcing meets the sustainability criteria.
- Examine the trade-offs between all types of on-farm energy production and alternative uses (food, feed, other non-food).
- Analyse possible synergies between use of various energy sources (agriculture, forest, solar, wind) and demand on farm level (constant and stable supply).
- Propose potential innovative actions to stimulate the knowledge and use of management practices and strategies for improving uptake of renewable energy and provide inspiration and ideas for Operational Groups and other innovative projects.
- Develop collective selling approaches for farm-produced energy – links to economic opportunities for territorial developments and networking activities for dissemination of these approaches.
- Identify remaining research, innovation, advisory and other needs coming from farm level to improve the use as well as the production of renewable energy on farm holdings.

Provide examples of practices and tools that are already applied, including through better stakeholder involvement and synergies with other sectors such as tourism.

European Network for Rural Development

https://enrd.ec.europa.eu/home-page_en

The European Network for Rural Development **facilitates the exchange of information between all EU Member States on how EU-funded Rural Development policy, programmes, projects and other initiatives are working in practice and how they can be improved to achieve more.**

Bioenergy, as a part of the broader bioeconomy, can contribute to achieving the objectives of the Rural Development Policy, in particular linked to increasing farm viability, economic development in rural areas, and building a resource-efficient, climate-resilient economy. We see bioenergy as a component of greening the rural economy and as a way of adding value to agricultural and forest by-products and waste. ENRD collects and shares good practices of local bioenergy production in rural areas and related business models, to demonstrate how rural actors can contribute to the transition to zero-carbon economy while diversifying their incomes. Locally produced bioenergy reduces the dependency of farms and rural communities of imported energy and generates local income, retaining more money within the local economy. Several measures of the Rural Development Programmes financed under the EU Common Agricultural Policy can be used to promote sustainable rural bioenergy production.

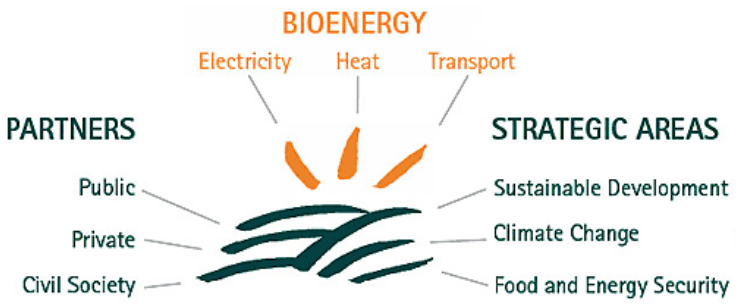
Bioenergy is not a stand-alone solution but should be a component in a broader approach to make our production and consumption patterns more sustainable. Its sustainability should be looked at in the bigger picture. This implies that biomass used for bioenergy is produced sustainably – for

example, without adding pressure to land use or biodiversity, in line with good agricultural or forestry practices – and that the by-products of bioenergy production itself, such as digestate generated by biogas production, is further treated and used following sustainable (agricultural) practices. Best practices in bioenergy show that such systemic approaches can provide solutions to several economic, social and environmental challenges at once.

http://www.globalbioenergy.org/

Global Bioenergy Partnership **was founded in 2006 on the idea that bioenergy can significantly contribute to energy access and security, climate change mitigation, food security, and ultimately sustainable development. The last decade has marked considerable growth for the organization, now counting with more than 70 members and an expanded number of activities in different countries.**

GBEP brings together public, private and civil society stakeholders in a joint commitment to promote bioenergy for sustainable development.



The Partnership focuses its activities in three strategic areas: Sustainable Development - Climate Change - Food and Energy Security.

http://iinas.org/news.html

The International Institute for Sustainability Analysis and Strategy **(IINAS) is an independent transdisciplinary research organization based in Darmstadt (Germany) which started operating in April 2012.**

Key current IINAS biomass projects:

- Scientific support to the Global Bioenergy Partnership (**GBEP**)
- Sustainable bioenergy deployment and sustainability governance of the bioeconomy: contributions to **IEA Bioenergy Task 40** (Deployment of biobased value chains) and **IEA Bioenergy Task 45** (Climate and sustainability effects of bioenergy within the broader bioeconomy)
- Forest Landscape Restoration (FLR) and bioenergy: **FLR-bio dialogues**
- **Sustainable palm oil?**

https://www.irena.org/

International Renewable Energy Agency **promotes all forms of renewable energy (solar, wind, hydro, geothermal, ocean and bio) on behalf of its 160 member countries.**

Perspective: Bioenergy is essential to meeting sustainability goals for energy and climate. It should be sourced sustainably, from feedstocks surplus to food requirements, in ways that do not induce land use change that result in release of carbon dioxide.

Perception: Countries and their citizens have a range of views. Countries with significant biofuel production and/or consumption have a largely positive view. But there is a residual perception that bioenergy conflicts with food security and environmental goals.

Communicating Complexity: We would hope to show that bioenergy sources from sustainable pockets of potential does not have to conflict with food security and environmental goals.

These are widely acknowledged to include residues from agriculture and forestry. But they also include energy crops grown on land made available by raising food yields and reducing food waste and losses, which is less widely understood.

Limiting Bad Practices: We would hope to focus attention on good practices – for example those which enhance food yields and reduce food waste and losses, or allow a greater shear of residues to be collected without harming biodiversity in farms and forests. We have also produced a compendium of good practices for Sub-Saharan Africa:

https://www.irena.org/publications/2019/Jan/Sustainable-Rural-Bioenergy-Solutions-in-Sub-Saharan-Africa-A-collection-of-good-practices

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Transparent supply chains for sustainable economies **(Trase) is a transparency platform that enables governments, companies and others better understand and address the environmental impacts linked to supply chains.**

https://www.sei.org/projects-and-tools/tools/trase/

Established by Stockholm Environment Institute.

Agricultural expansion to produce commodities such as soy, palm oil, timber, and beef is driving two thirds of tropical deforestation worldwide. Forests are cleared to make way for farm land, destroying valuable wildlife habitat, affecting the livelihoods of local communities, and exacerbating climate change.

Trase seeks to transform our understanding of agricultural commodity supply chains by increasing transparency, revealing the links to environmental and social risks in tropical forest regions, and creating opportunities to improve the sustainability of how these commodities are produced, traded and consumed.

Recognising the value of forests and other tropical ecosystems, some governments, companies and investors have made ambitious commitments to achieve deforestation-free supply chains – some by as early as 2020. But the complexity and opacity of supply chains are major barriers to delivering on these – if the buyers don't know where their supply chains start or end, who is involved in them, or whether they are exposed to risks as a result, how can they take action to ensure they are sustainable?

Trase addresses this problem, using publicly available data to map the links between consumer countries via trading companies to the places of production in unprecedented detail. Trase can show how commodity exports are linked to agricultural conditions – including specific environmental and social risks – in the places where they are produced, allowing companies, governments and others to understand the risks and identify opportunities for more sustainable production.

Trase provides data at scale, free-of-charge, comprehensively mapping supply chains for key

commodities from entire countries and regions. By 2021, Trase aims to map the trade of over 70% of total production in major forest risk commodities, catalysing a transformation in supply chain sustainability.

The vision of Trase is to provide, by 2021, the go-to public supply chain information system for companies, governments, investors and other actors seeking to transition towards more sustainable production, trade and consumption for the world´s major forest-risk agricultural commodities.

Trase aims to cover over 70% of the total traded volume of major forest risk commodities, including soy, beef, palm oil, timber, pulp and paper, coffee, cocoa and aquaculture. The initial focus of Trase is on Latin American soy, followed by beef in Argentina, Brazil and Paraguay, palm oil in Indonesia and Colombia and coffee in Colombia. Additional countries and commodities will be added as the platform develops.

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https://www.svebio.se/en/

Svebio **is a commercial environmental organization for companies and individuals. We believe in renewable energy, entrepreneurship and a free market economy. Our vision is a 100% renewable energy system, where the different renewable energy sources interact. Bioenergy will play a central role and we want to increase the use of bioenergy in an economically and environmentally optimal way.**

Currently, Svebio has more than 220 members.

Bioenergy is the leading energy source in Sweden today. The Swedish energy system has gone through a major transformation. In the 1970s oil was totally dominating. Today, oil is almost entirely a transport fuel, whereas bioenergy has taken over in district heating, and plays a major role in industry and in electricity production.

The use of bioenergy in Sweden has increased from 40 TWh/year in the 1970s to around 140 TWh today. In 2009, bioenergy surpassed oil as the leading energy source for the Swedish energy consumption. The same year, the total use of bioenergy was more than the use of electricity from hydropower and nuclear power together.

Biomass has a dominant position in the Swedish heat market, to a large part as fuel in district heating. Biomass is also the main energy source in energy intensive forest-based industries. Bio-electricity, biopower, accounts for 7–9 percent of Sweden's power production, and biofuels are making inroads into transport fuels. Bioenergy is characterised by diversity, and by expansion in all markets.

Increased bioenergy use is the main reason that Sweden managed to decrease greenhouse gas emissions by 25 percent between 1990 and 2014, while GNP increased by 60 percent. Bioenergy use more than doubled during the period.

The primary reason for the tremendous growth of the bioenergy sector in Sweden is broad political support and the use of strong general incentives like the Swedish carbon dioxide tax (introduced in 1991) the green electricity certificates (introduced in 2003), and tax exemption for biofuels for transport, as well as direct investment supports.

The bioenergy success story also rests on the long-standing Swedish tradition of using the natural resources in our forests, whilst simultaneously protecting and developing these resources. The total

stock of wood in the Swedish forests, and stored carbon, has increased year by year, despite the rapidly increasing use of biomass for energy.

https://worldbioenergy.org/

World Bioenergy Association **is a global organisation with a mission to promote the sustainable development of bioenergy on an international level and to support the business environment for bioenergy. Our members include private sector, researchers and civil society and the total membership is more than 250 members from more than 60 countries. The WBA Secretariat is based in Stockholm, Sweden. Our activities include knowledge transfer, data, technology transfer platforms, networking and research**

We perceive bioenergy as the world's largest renewable energy source. It currently contributes approx. 13% of the world's energy consumption and will continue to play a dominant role in the future energy mix. Sustainable utilization of biomass reduces energy imports, develops local economies, provides jobs and improves the social conditions.

WBA members include equipment manufacturers, biofuel producers, pellet producers, researchers, international organisations etc. working in forestry, agriculture and waste to energy sectors. The members promote bioenergy locally and internationally and utilise the WBA platform to engage, network and exchange best practices.

WBA is in constant contact with our members and provides a platform via our annual meetings and international forums for exchange of ideas, publishing factsheets, newsletters and policy papers to promote fact based understanding of the sector and respond to individual member queries simultaneously.

Information exchange is the best way to limit unsustainable use of biomass. There are numerous excellent examples where bioenergy has created jobs, protected forestry/agricultural land, reduced economic burden and improved lives. WBA with its network of members along with cooperation with international agencies is in the best position to act as a clearing house for exchange of knowledge and understanding of sustainable bioenergy development.

PARTICIPANTS LIST

FAO	Olivier Dubois	BioEast	Barna Kovacs
FAO	Irini Maltsoglou	SE4ALL/below50	Gerard Ostheimer
FAO	Marco Colangeli	IEA Bioenergy	Floor van der Hilst
FAO	Jonathan Moncada Botero	SEI-TRASE	Mairon Bastos Lima
FAO	Anne Bogdanski	IEA Bioenergy	Göran Berndes
FAO	Florent Eveillé	IEA Bioenergy	Ioannis Dimitriou
FAO	Marta Gomez	IEA Bioenergy	Biljana Kulisic
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WBA	Gustav Melin	GSE	Elisa Stellato
EIP-AGRI	Sergiu Didicescu	GBEP	Constant Miller

AGENDA

13:00 – 13:20	**Registration and introduction**
	FAO: welcome Dimitriou: Welcome to IEA Bioenergy Task 43 workshop
13:20 – 13:40	Dubois: The Energy-Smart Food for People and Climate Programme (ESF Programme) Berndes: WP1 Landscape management and design for bioenergy and the bioeconomy Kulisic: Sustainable Landscape Management for Bioenergy and the Bioeconomy workshop format
13:40 - 14:30	Introduction of stakeholders (3' per stakeholder) *Introduction will be moderated by Kulisic showing a power point slide with a name and affiliation of a stakeholder. The stakeholder will have 3 minutes to share the view and focus on biomass in bio-based economy from the activities within their affiliation.*
14:30 – 14:45	Coffee/tea break
14:45 – 16:30	**Section 1 (45' presentations; <60'work in groups)**
	FAO (Maltsoglou I.): Bioenergy Potential from Crop and Livestock Residues in Egypt and Turkey – through the BEFS RA methodology Bentsen N.S.: Grass based biorefinery systems producing biofuels/biomaterials/feed Kline K.& Negri C.: Implementing bioenergy at the landscape level to reduce land use impacts and improve resource use efficiency? Moderated discussion

[6] Before AEBIOM

	Work in groups will investigate the positions of each stakeholder of the presented landscape management for bioenergy and bioeconomy – starting from production to energy consumption. *Participants will be organized in groups. For each group, a moderator and a rapporteur are assigned from IEA Bioenergy experts. After solving the task in H form, the groups are moving in a carrousel style from table to table, clock-wise.* *After the bell, the work stops, stakeholders move to the next table while the moderator and the rapporteur prepare a new sheet of H form with the same question for the group to come.*
16:30 – 16:45	Coffee/tea break
16:45 – 18:30	**Section 2 (45' presentations; <60'work in groups)**
	Skeer J & Armitage Ch. (IRENA&ICRAF): A set of integrated practices: a multi-faceted market-led approach to improving food and energy security and adaptation to climate change, which incorporates alley cropping of *Gliricidia sepium* into small-scale maize farming systems in Zambia FAO (Dubois O.): Water-energy-food nexus in bioenergy-landscapes Bezzi G. et al: Biogas done right Moderated discussion as in Section 1
DAY 2: 12 Oct 2018	
09:00 – 10:00	Reporting back of the Sections 1&2 and introduction to the Day 2 *Rapporteurs of different groups will report by showing on a slide the fairness position of a stakeholder in question, organizing the fairness, unfairness and solution in 3 columns – detecting frequency, outliers, pattern – 5' per stakeholder.*
10:00 – 10:15	Coffee/tea break
10:15 – 12:00	**Section 3 (45' presentations; <60'work in groups)**
	Dale V. et al: Cellulosic-based biofuels are strengthening rural investment and development in the United States FAO (Colangeli M.): Web-based sustainability assessment tools for Bioenergy projects on underutilized lands in Europe Thiffault E. et al: Opportunities for making use of unloved wood Moderated discussion as before in Section 1 and 2
12:00 – 13:00	Lunch break
13:00 – 15:00	Section 4 Where to move from here?
	Reporting back of the Section 3 (10') Plans forward – FAO (O. Dubois) (15') Plans forward – new triennium of IEA Bioenergy (M. Brown & G. Berndes) (15' + 15') Stakeholders' ideas on collaboration opportunities (3' each) (60') Wrap up (I. Dimitriou & O. Dubois) (5')

DETAILED OUTCOMES OF THE WORK IN GROUPS

The following tables represent transcripts of the writing statements during the H-form. Both positive and negative attitudes were clustered around the main issue and followed with the original statements. The column "aspects to be covered in communication" is added as an indicative conclusion to a negative attitude. However, the conclusions will be different given the context where the negative attitude occurs.

The rapporteurs had different format of recording the outcomes and there were minimum interventions in it.

Table 1: Positive attitudes: Would the land owner/manager supply biomass for energy?– agriculture context

(Increased) farms' income: 1. Secure, reliable, profitable markets 2. If farmers get paid, they will deliver all that is possible and profitable 3. If good profitability 4. Most profitable use 5. Additional income 6. If paid farmers will expand farming from Nile area and out into the desert 7. They get paid for what they produce 8. Improve profitability 9. They make money 10. Policy incentives in Europe means higher income 11. Extra revenue from sale of biomass 12. Profit 13. Profitable production and valorisation of by products 14. Earning additional money 15. If additional source of revenue 16. Get additional income 17. Economic reasons 18. Diversity of markets 19. Receive public incentives 20. If they get paid
Problem solving (e.g. waste, excess biomass): 1. If obliged to find solutions to a problem 2. Use unused feedstock 3. It solves a waste problem for them
Social issues: 1. Socially responsible choice 2. If they bring positive impact from his/her activity 3. Comply with environmental standards with less net loss

Table 2: Negative attitudes with possible solutions: Would the land owner/manager supply biomass for energy?– agriculture context

Negative attitude	Possible solutions	Aspects to be covered in communication
Not seeing the gain/benefit for the effort: 1. No profit	Improve return/fair trade to landowner Peer ambassadors to spread	Increase knowledge techniques on harvesting agri-residues to farmers

2. If price is low and it is not profitable farmers will not deliver biomass 3. Not profitable 4. If bad profitability 5. The deal is not good enough, has better uses for his land 6. If contracts are short term it will not be profitable to invest in collection/producing biomass 7. If investment is too high	knowledge Investing in education of new farmers Create market opportunity Pre-treatment on farm to increase value before transport Increase biomass market value New innovative integrated technology to collect biomass with main crop Improve value of biomass Monetize other values (carbon) Economy of scale/cooperatives Cooperative to distribute cost Leverage of existing transport systems Subsidy Link farmer to energy market Grants Reduce subsidy on food/feed crops Favourable loan conditions	Demonstrate options and practice to increase the value of biomass on farm (new technology, new practice…) Foster farmers' decision to join actions (economies of scales, distribute costs, leverage biomass supply…) Allow attractive financing scheme for the investment needed
Lack of biomass market/market immaturity: 1. No time to collect the biomass and nobody else offers to do it 2. If lack of stable demand by reliable users 3. Uncertain markets. Farmers often are quite risk averse 4. Unstable markets 5. Long term uncertainty of markets 6. Unsure about buyers, who in turn are unsure about security of supply	Improve access to skilled labour and services Specialized contractors or coops Brokers to consolidate supply Cooperate model to manage supply chain Contractor or cooperative logistics provider Manage market demand/supply connections Political support + vision Stable policy Long term contract Increase demand Hop and spoke systems Logistics support/cooperatives Stable policy Positive stable policy Long term contracts (bankable) Long term off take agreement Investment support for start-ups	Stable policy with vision would allow time for biomass market uptake Present examples of biomass logistics/biomass supply chain for agri-residues, harvested energy crops, byproducts (manure) Secure long-term agreements, correlated with the investments (equipment, storage, biomass upgrading, logistics…) needed Transparent pricing models Biomass supply knots/hubs

	Long term service agreement incl. transport	
Reluctance to change/food priority: 1. It is hard to change agricultural practices, incentives would have to be strong 2. Happy with current situation 3. Resistance on changing traditional uses of biomass 4. Food production is main income 5. Have to produce food first	Demonstration of best practices and benefits Demonstrate that complimentary cropping is more productive with biomass. Study tour	Study tours to demonstrate best practices and existing benefits, preferably presented by their peer farmer.
Complexity: 1. Too complicated 2. Too complicated 3. Too difficult to manage and understand legislation	Improve supportive legislation and policy	Improve supportive legislation and policy
Competition: 1. Landowner no longer able to use biomass for other uses 2. He has better offers/higher price for feedstock from other bioeconomy sector	Chose crops with multimarket options	If a farmer had already found a market to add value for biomass suitable for energy conversions too, it's a market economy.
Environmental concerns: 1. Land quality damage	Implement landscape management principles Best practice guidelines for crop selection and management	Implement landscape management principles Best practice guidelines for crop selection and management

Table 3: Positive attitudes: Would the land owner/manager supply biomass for energy?– Forestry context

(Increased) foresters' income: 1. If there is significant price incentive 2. New income motivates silvicultural measures to displace declining uses, e.g. pulp 3. Biomass use for energy from thinning strengthens future trees and generates more revenue 4. Profit

5. Yes, if right price 6. Profitable opportunity 7. Provides that it is lucrative and that farmers will supply biomass for energy 8. (EUR) 9. More revenue
Market maturity: 1. Additional downstream market 2. If there is a functioning service chain to collect it 3. If the farmer gets paid he will deliver, if there is something to supply 4. If logistics are made easy
Environmental issues: 1. Clear reason for replanting
Social issues: 1. Maturity of the forest industry. Most likely to trust forestry management systems and initiatives

Table 4: Negative attitudes with possible solutions: Would the land owner/manager supply biomass for energy?– Forestry context

Negative attitude	Possible solutions	Aspects to be covered in communication
Immature biomass market/Not seeing the gain/benefit for the effort: 1. Unknown value added 2. If the price is not fair 3. Too much hassle for little economic return 4. Why bother given such marginal use 5. No reasonable prices are paid for low quality wood 6. Long term market uncertainties will discourage landowners to supply biomass for energy 7. If demand is short term, investments may not be done for increased delivery 8. If there is no market and low prices farmers will not supply 9. Probable CO2 tax	Supportive policy Price incentives Increased value Education Increased value for biomass Long term contracts Long term off take agreements Diversify markets Better tax policy Ensure carbon neutrality in ETS Stable markets for biomass Long term off take agreements Increased cost of fossil fuel, carbon tax More transparent market access, right product to right use Increase demand to increase price	Stable policy with vision would allow time for biomass market uptake Monetarize CO2 tax contributions to increase the market value of biomass Secure long-term agreements, correlated with the investments (equipment, storage, biomass upgrading, logistics…) needed Transparent pricing models Biomass supply knots/hubs

contribution		
Competition: 1. No, if there is a competing market 2. Other uses may be more interesting (higher value)	Improve landscape planning	If a farmer had already found a market to add value for biomass suitable for energy conversions too, it's a market economy.
Social issue: 1. Afraid of bad image 2. Lack of knowledge	Education	Education
Legislation too complex: 1. Complicated sustainability criteria	Certification Service provider to manage sustainability Investments or modular approaches to sustainability Consolidate different sustainability schemes, increase consistency Incentives	Simplify / enable forester to comply with the sustainability criteria
Environmental concerns: 1. Removal of nutrients (soil quality)	Cooperatives to build expertise Training for managers Better knowledge on soil conditions and how much can be extracted Access to bio fertilizer Best practices to retain small nutrient rich material Harvest practice to allow needle/leaf fall	Highlight the nutrition circle when communicating, with the bioenergy plant (related to the technology in question) being the part of the cycle

Table 5: Statements if an incresed supply of biomass for energy would affect land quality? -forestry context

It will affect land quality to the better side: 1. Yes, applying better practices for forest management. 2. Planting trees through nature-based forest increases land quality. 3. Managed forests (for lumber & other products) produce residues while offering C to soil by remaining biomass 4. More demand for forest products – more forests – better land quality. 5. Increased profit for stakeholders. 6. Managed forests produce more wood and save more GHG 7. When we remove biomass, growth will increase in the long run recirculation of nutrients will be needed. 8. Better forest management.
It will affect land quality to the worse side:

1. Likely to affect soil quality if the increased supply is sourced from debris and dead wood without sustainable management practice.
2. Faster removal of trees affects land quality
3. The more organic matter you remove the worse the impact
4. Removing material will lead to poor soil.
5. Too much carbon removals.
6. Visual perception – tourists' perception is negative.

Table 6: Negative attitudes with possible solutions: Would supply of biomass for energy affect land quality?– Forestry context

Negative attitude	Possible solutions
Soil depletion	Long term sustainable forest management for all end-uses Including ecosystem services and sustainable practices.
Forests are already managed poorly. Can't get worse	Educate about benefits of active forest management that is a part of a typical forestry practice. Better management More collection of unloved wood (slash especially) More intensive forest growth – C in soil!
Not likely because change always occurs anyway	Manage to address changes (be proactive) Grow biomass (trees) on degraded/saturated land – new forest! Land restauration!
Much biomass from forests already available and not used	Cascading bioeconomy
Unsustainable practices being used	Not likely because biomass supply is hugely monitored and this sustainable management practices will be in place
More forests – better quality – more removal – loss of quality	Both can be positive and negative, the net is important.
Harvesting for pellets does not differ from harvesting for other products	Use different management practices Pellets will have to respect sustainability criteria, other products not.
Carbon debt	New bonus of timelines for use: paper 3 years; pellets 12 years, timber 25 years. Single tree looking is not practicable. Other trees compensate for the loss of one tree.
If nutrients are circulated, land quality will not be affected/damaged. Land quality change anyway.	Ensure that this is reality
Locking the land for several years.	Short rotation cropping system.
Not likely, it will be a small part	Demand might increase considerably

of the total impact related to land use	
Not in systems where soil organic matter is rich	Land quality is more than soil quality
Not if it doesn't change the premises true balance	Any removal affects land quality Faster removal of trees improves land quality Even if the tree balance remains, removing (more) biomass for energy use can have land-related ecological implications.

Table 7: Positive attitudes: Would recognition of ecosystem services affect biomass for energy production?– agriculture context

(Increased) farms' income 1. Increases profitability of biomass production 2. Recognition could lead to payment for ES - payment will drive investments and implementation in practice 3. Recognition of market value (publicity or money) 4. Make unprofitable crops on marginal land more profitable 5. If it translates into income or reduced cost 6. More benefit for ES intensively managed crops (e.g. Lignocellulosic) 7. Additional income to bioenergy investments will sometimes tip over a decision of investment 8. Investments in biomass production could become more profitable and benefit from more than one income source
Awareness of ecosystem services/ Environmental issues: 1. Increased awareness helps in local decision-making to select the best practices/landscape uses 2. That can add to a positive use 3. Positive market response = more demand 4. Support of water distribution companies 5. Fully recognize positive externalities 6. Increase biodiversity and productivity 7. Water-energy means in the context of GHG emissions 8. Cleaner water 9. Holistic approach for biomass production 10. Shift to sustainable agricultural intensification

Table 8: Negative attitudes with possible solutions: Would recognition of ecosystem services affect biomass for energy production?– agriculture context

Aspect	Negative attitudes	Possible solutions
Eco	No payment	• Legislation addressing the impact caused by

		absence of ES • Provide clear evidence on benefits to farmer and stakeholders • Give farmers a premium for growing crops in a way that improves ES • Look at good examples of PES schemes/incentives
	Negative If not reflected in revenue to farmer	• NGOs or institutions that connect farmers o supportive mechanisms/incentives e.g. C-credits
	Mainly determined by economic factors - ES small compared to cost of feedstock and equipment	• Make it a sales argument - a good story associated with products • Show evidence what public costs (ES damage costs) means for people e.g. health • ES fully & properly valued • Involve and give more importance to env. Indicators which can show actual potential, identifying trade-offs
	Difficult to value ES no one would like to pay	• Demand that industry take care of nutrient emissions
	If ES are not financially compensated	• Include CCS in the ETS to get payed
	Ecosystem payments are often short-term	• More stable C.A.P. (more than 6 years)
	Biomass for energy is a regular agricultural system - no extra payments for ES.	• Use innovative systems for producing biomass
Market	Uncertain market development and value added	• Awareness raising among producers on non-visible value added • Provide a specific premium • Give farmers a premium for growing crops in a way that improves ES • Guaranteed payments per ha if managed to support ES
	Shift to ES intensive farming in general = ES land available for energy crops	• Giving incentives for primary forest/natural area conservation if they intensify • Incentives for sustainable intensification
	When biomass production is done like classic production it is impossible to gain positive ES effects	• Policy would be needed
	Conservation or ecosystem regeneration would be a far more profitable land use	• Zoning policy and landscape planning
Complexity	Knowledge intensity of valuation of ES might slow down process	• Investment in research = value of ES • Discourage production that harm ES • Investigating on the development of standardized indicators

		• Make a story about ES - label to convince consumers
	Increase the complexity as what would comply with energy production	• Knowing soil characteristics to identify sites suitable and unsuitable for biomass production • Show positive cases
	Too complicated with too high transition cost	• A prime for ES • Rewarding system
	Unbalanced biomass flows towards energy use instead of nature conservation	• Sustainability safeguards
	Challenge to accurately measure ES	• Finance applied research projects • Pay for road cleaning, ditch cleaning, lake cleaning (remove reeds)
Policy	If there is no policy to connect practice to carbon markets = policy needed	• Policy could create a mechanism for coupling carbon storage to carbon offsets. Other aspects like water are more difficult.
	Additional framework & regulations cause more bureaucratic burden for farmers	• Use existing systems and keep them simple Streamlined with current ag. practices

Table 9: Positive attitudes: Would recognition of ecosystem services affect biomass for energy production?– forestry context

Sustainable forest/landscape management: 1. It prevents fire risks 2. Improvement of forest management 3. When forests are managed sustainably their contribution to ES increases 4. Forest bioenergy from residues could be sources from underutilized areas contributing to a higher degree of management 5. Different trees are planted and use of mixed wood instead of conifers (broadleaves are more often used for energy) 6. Would help the rural development – landscape management 7. Some ES influence aspects of landscape that people care about. E.g. Water flows and water quality
Additional biomass for bioenergy: 1. Recognition of role of forests for climate change mitigation 2. If recognition = pay for - could be a competing management 3. Increased public acceptance due to recognition of ES increases producer's willingness to provide wood for bioenergy 4. There would be now economic competition between different biomass uses including conservation
Profit: 1. More returns for forestry could make it more profitable = more forest for bioenergy

Table 10: Negative attitudes with possible solutions: Would recognition of ecosystem services affect biomass for energy production?– forestry context

Aspect	Negative attitude	Possible solutions
Market	Difficult to get paid for ES in the long run	• Tax on citizens to contribute to ES
	Payment for ES would hardly be "wholesale" and apply to everything - ES wouldn't be relevant here	• Does not need to apply to everything. Pick specific ES • If payment does not work = laws
	If ES are valued - ES need for added value from biomass for bioenergy	
Complexity	Too much restrictions are lowering wood harvest/production	• Create only easy and smart regulations on sustainability • ES can include increased biodiversity and improve public view on bioenergy production
	ES is a complicated concept that will not influence decisions	• Have a working simplification of ES • Provide good examples and demonstration • Make it understandable by translating it into regulations and incentives • Focus on the impacts of absent ES
Relation of ES to biomass for bioenergy	The availability of biomass is affected by other factors too.	• Engage other value chain actors to ES provision • Flexible ES policy to accommodate for that variability • Support bioenergy at the same time e.g. C-tax • Make ES valuable so that landowners become motivated
	It will mostly affect other biomass production systems that are already established	• Bioenergy applications can help address ES issues related to established products • Specific designed policy in coherence between ES and bioenergy production • The existing uses are for bioenergy
	Forest management for ES is needed disregarding the end use of wood	
Reluctance to change	Resistance on transition from traditional systems	• Examples from municipalities trigger entrepreneurship • Economic incentives • Training • Education on understanding ES
Forest management	Foresters are not involved	• Involve forests owners' associations
	Biodiversity - Leaving dead trees, tops and branches might be more attractive	• Coupling ES

Table 11: Positive attitudes: What is the community perception of increased biomass production for energy? – agriculture context

Sustainable landscape management: 1. There is a growing awareness that more bioenergy is needed 2. Reduction of fossil energy and save GHG emissions 3. Biomass and energy production can add income to communities 4. Value added use of biomass 5. Job opportunities 6. Rural development 7. Now it is possible to make money with waste! 8. Can provide or increase access to energy where it is not available or intermittent 9. More jobs, economic benefits 10. Biomass and biomass residues mobilization and concentration 11. Increased jobs, incomes, ecosystem services 12. New income opportunity 13. A better environmental outlook compared to fossils 14. Increased income opportunities 15. Rural development 16. Rural incomes 17. Cheap energy source 18. We can replace fossil gasoline and diesel in transport sector with biofuels 19. Its' renewable! 20. Green, energy security! 21. It can diversify economy.
Additional biomass for bioenergy: 1. Recognition of role of forests for climate change mitigation 2. If recognition = pay for - could be a competing management 3. Increased public acceptance due to recognition of ES increases producer's willingness to provide wood for bioenergy 4. There would be now economic competition between different biomass uses including conservation
Profit: 1. More returns for forestry could make it more profitable = more forest for bioenergy

Table 12: Negative attitudes with possible solutions: What is the community perception of increased biomass production for energy?- agriculture context

Negative attitudes	Possible solutions
Too expensive in comparison to fossil fuels It is more expensive than current	• Improved technology lowers costs • Communicate about external costs of fossil fuels and benefits of bioenergy (jobs etc.)

sources Costly Climate change comes with tremendous costs	• Combine it with policies to disincentivize cheaper (but less environmentally friendly) sources • Carbon pricing is the most efficient was to lower the emissions and make solutions profitable • Increase prices for fossil energy • Sustainability assessments of biomass provide evidence of benefits • Increase the access to energy markets • Make point that rural development bring income opportunities
Might increase competition for feedstock (feed vs. fuel for example) First to consider the material use (chemical industry)	• Improve local productivity to free-up land for energy crops • Do a better cost/benefit analysis to really understand the benefits • Awareness raising: new feedstocks from residues actually come up free from fields
Too intensive forest/agriculture management We do not have enough forests to cover all needs for products, recreation and energy due to biodiversity reasons Negative environmental impact ("industrial countries") perspective Maize and grass monocultures	• Zoning policy • "No go" areas to some natural habitats while other areas can be productive • Labelling e.g. Fair trade • Demystifying by providing clear and transparent knowledge transfer mechanisms • Grass: bring biodiversity into grasslands; maize: sustainable agriculture intensification • Sustainability certification • Demonstrate to environmental impact (e.g agroforestry may turn monoculture to biodiversity)
Why waste time on bioenergy instead of solar and wind?	• Investments in biomass collection is smaller than in solar or wind
General reluctance to change New and risky	• Need positive examples of bioenergy driving multiple benefits: environmental, jobs etc. • Community/local stakeholder involvement in developing the project • Awareness raising about positive impacts • Familiarize with biomass: extension services and newsletters/radio broadcast… • Education of farmers • Economic composition for tailoring risks • Capacity building
Misconceptions: NGO bias is that increase of biomass production would have negative impacts. "starves people" "causes CO2	• Sustainability policy • Feasibility assessment • FAO BEFS tools to tease out how food security can be strengthened • Extension service solutions on sustainable

emissions" "reduces biodiversity" Affecting the sustainability of food production systems Global fear of increased food insecurity Replaces food production No room for quality production Food vs. fuel debate – a common conception of straight competition between the two goals Traditional cultivation measures are disturbed	practices • Educating communities and reporting on the strengths and limitations on biomass use related to that community • More integrated food-non food production systems that foster food security and bioenergy production • Less and less people suffer from food insecurity. If people have money, they don't starve. • Better communication about the reason for food insecurity (not food shortage!) • Sustainability assessments of biomass provide evidence of benefits • Capacity development activities with processing industries/companies • Tailor made advisory services/skills • Show people eating more than ever • Show sustainable intensification practice and avoid land use change
Negative external effects: noise, smell, traffic, local impacts on soil, water, air quality	• Bring the energy production closer to the biomass production • Densify biomass
Absence of local / accessible markets	• Integrated production systems • Plan biomass production and supply chain simultaneously
If there is no policy to connect practice to carbon markets = policy needed	• Policy could create a mechanism for coupling carbon storage to carbon offsets. Other aspects like water are more difficult.
Additional framework & regulations cause more bureaucratic burden for farmers	• Use existing systems and keep them simple Streamlined with current ag. practices

Table 13: Positive attitudes: What is the community perception of increased biomass production for energy? – forestry context

Community branding: 1. One possibility among others to solve the climate problem 2. Wood is cheaper than fossil fuels 3. Positive image 4. Safer environment 5. Stoves make their houses more comfortable (warm, enjoy firewood) 6. Replacing fossil fuels is generally well perceived 7. Contributing to non carbon energy sources 8. Fire from logwood is so nice and "positive" warmth 9. Foster wooden buildings in construction sector

Benefits to the community: 1. Getting more added value locally from biomass 2. Potential additional revenues for the community 3. Increased value added 4. Helps silviculture 5. Job creation 6. Helps when new jobs for forestry communities 7. New income opportunity
Additional biomass for bioenergy: 1. It can maximize resource use and help make production systems more efficient 2. Use of poor timber 3. More returns for forestry could make it more profitable = more forest for bioenergy 4. Diversification of traditional use of biomass

Table 14: Negative attitudes with possible solutions: What is the community perception of increased biomass production for energy?- forestry context

Negative attitudes	Possible solutions
Whole trees shouldn't be waste on energy production Soil quality will be affected (mis)believes on deforestation Burning trees for energy seems to be the lowest use that could be made of them!	• Introduce concept of cascading use • Use residues and trees that are not useful for other purposes = unloved wood • Nutrients can be recirculated • Forest management can handle the needles fall of in forests before use etc. • Involvement of the community in planning the projects • Avoid negative effects • Capacity building & discussion lead from technical and neutral institution • Transparency on communication on pros and cons of bioenergy production based forestry • Burning trees for energy is indeed the lowest value added that a wood can get and that is why the trees of higher value are sold to other markets – cascading use • Cascading use
Community tends to perceive bioenergy as detrimental to the environment Afraid for negative external effects/ loss of ecosystem services Cutting trees ruins wood and my favourite place for biking and	• Education: community ignores the fact that bioenergy can be sustainable and needs to be educated just like they were educated that electric cars are cool • Transition into bioeconomy • Concrete regulations and laws for the purposes of forests and contacts-solutions for biking in forests

hiking	
It would lead to high energy costs	• Tax fossil carbon emissions • Convince: not if wood is "unused" and otherwise wasted
Will there be enough to handle all needs for products, electricity, heat and transport?	• Education and communication to explain potential of forest • Legislation: to have "no go" areas, conservation areas. If there is not enough prices rise and we find other solutions
Not worth the extra trouble	• Demonstrate how/why it can make sense sometimes • Present as good forest management practice • Regulation to require removal of unprofitable "slash" for bioenergy (tops and branches) along with the profitable stem wood (for lumber) • Priority to biodiversity as forest service and not forest production • Find ways to do it that are acceptable from a sustainable point of management • Managed forests are more biodiverse than primary wooded

Table 15: Can international organizations collaborate with IEA Bioenergy to affect biomass production outcomes? – proposals on ways of cooperation to achieve wider outreach based on the common interests

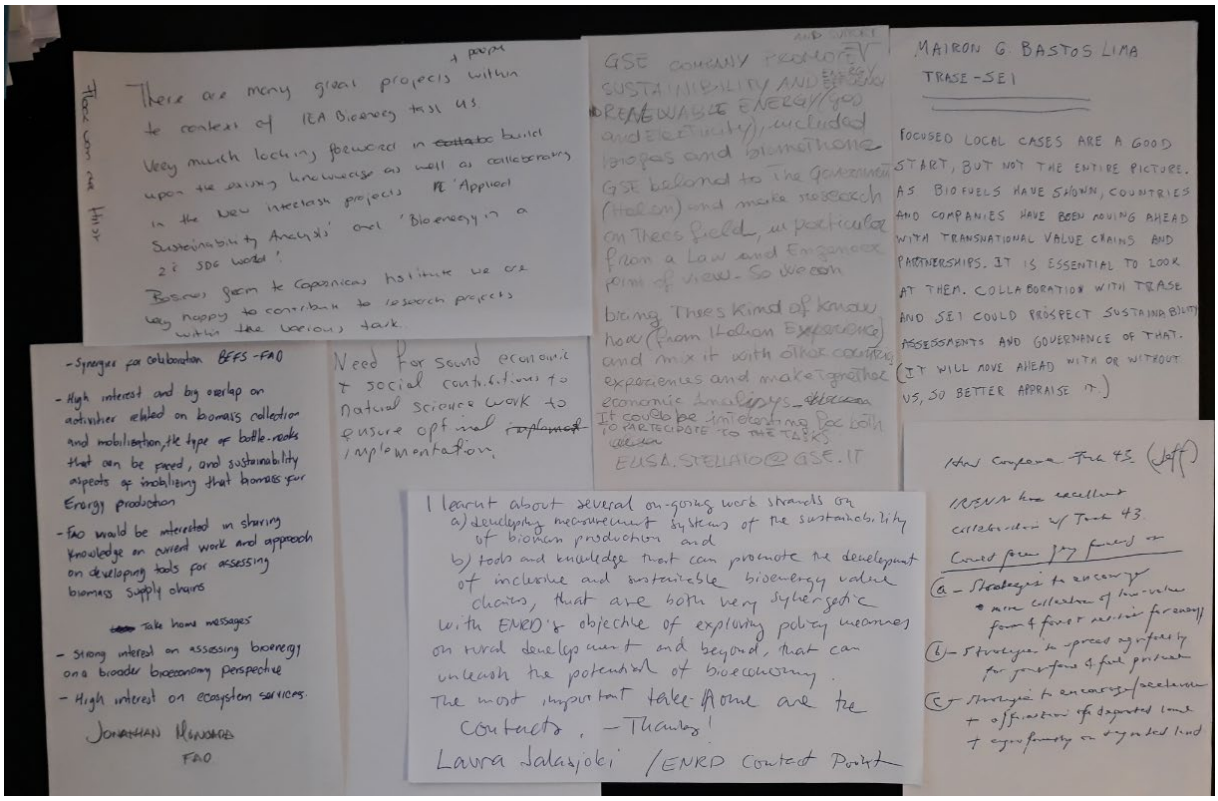
1. Content and promotion of events/publications
2. Share stories and good practices
3. High level experts welcome to spread right messages to international organizations
4. Sharing contents: studies, projects, good practices and communicate or participate at event/publication

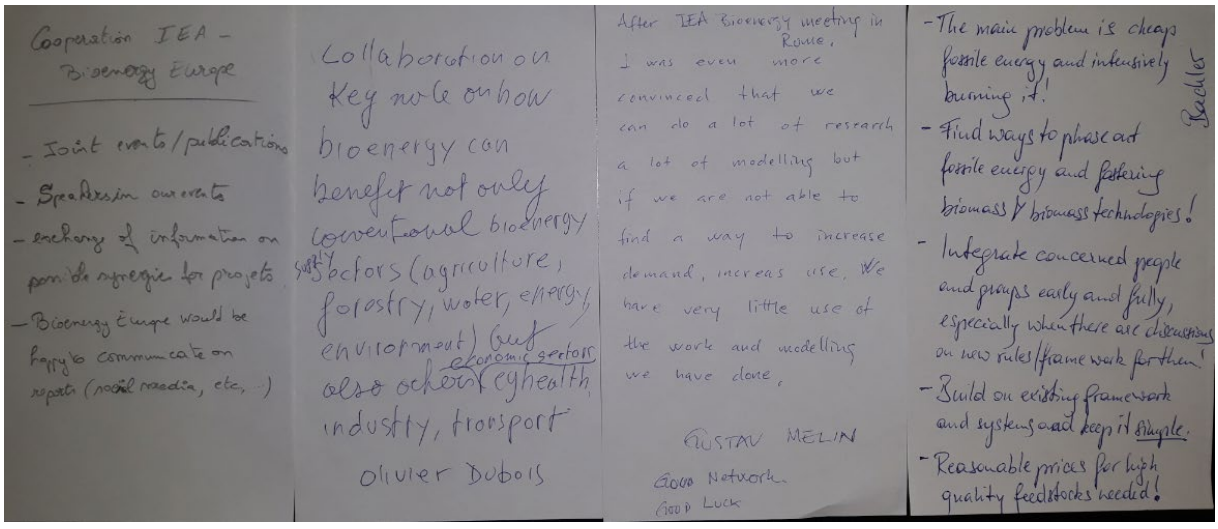
Table 16: Can international organizations collaborate with IEA Bioenergy to affect biomass production outcomes? – issues raised with possible solutions

Issues:	Solutions:
Lack of funding (3)	Show value to organization; Show "return on investment" and give credit for successes to organization; Bring in other partners, private sector sponsors, Make relationship with direct transfers that provide results to industry in return for industry support
IEA Bioenergy is too biased "pro biofuels" (2)	Ensure reflexive/balanced analyses and reports; Be open minded; Invite and accept criticism; Put bioenergy into context of Bioeconomy; Engage with those holding opposing views

Lack of relevance to local conditions (2):	Education and extension services; Co-production of knowledge involving locals; Early engagement of producers; Build capacity and identify new resources that are viable
Large commitments of time	Integrate with ongoing workload and projects; Identify synergies Involve others in your organization
HR policies prevent networking	Build constituency in your organization; "buy votes"

STATEMENTS – TAKE AWAY MESSAGES





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