Corporate Public Affairs
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DSM Position on Sustainable Biomass

Key messages

DSM is a leading Life Sciences and Materials Sciences company that is active in health, nutrition and materials. DSM uses its bright science to create brighter lives for people today and generations to come by providing the ingredients to innovative, more sustainable, healthier, more nutritious and better performing products.

Responsible sourcing and use of sustainable biomass are key in meeting the needs for food, energy and materials of the present generation without compromising the ability of future generations to meet their own needs.

DSM is involved in the use of all types of renewable resources like wind, sun and biomass. We increasingly use sustainable biomass as a renewable alternative to petrochemical raw materials in a broad range of applications.

DSM's growing involvement in industrial biotechnology is attended by the need to secure a sustainable raw material base that is complementary to the food supply chain.

We aim to avoid detrimental effects on land use, direct or indirect, and on biodiversity.

DSM uses validated, internationally accepted and standardized methods to assess the environmental and social impacts of biomass utilization. Decisions with respect to product and process development as well as sourcing of feedstock are made on the basis of such assessments.

We recognize that certain aspects related to the use of biomass give rise to public concern. In keeping with our tradition of responsible care for safety, health and the environment, and strategic, pro-active and ongoing dialogue with key stakeholders, we take a careful, step-by-step approach in our research and production, scrupulously adhering to applicable regulations, legislation and industry's best practices.

We believe that current and future needs for food, energy and materials can be met in a responsible way, provided that the available arable land is optimally used in a sustainable manner and all parts of the plant, non-edible crops and agricultural residues are used in the most efficient way.

Why is sustainable biomass important to DSM?
DSM believes that non-renewable fossil feedstocks, like crude oil, will become increasingly scarce in the decades to come. The use of sustainable biomass not only offers an alternative to fossil feedstock, but also has environmental benefits in reducing the ecological footprint. Sustainable bio-based products, derived from biomass, are therefore a strategic focus area to DSM. Biomass is used in many parts of DSM's businesses in Life Sciences and Materials Sciences. DSM adheres to the principles of environmental responsibility, conservation of natural resources and biodiversity. DSM's growing involvement in the use of biomass is accompanied by the need to secure a sustainable supply of biomass that is complementary to the food supply chain. The DSM Supplier Code of Conduct already addresses the fact that our suppliers should show their commitment to sustainable business practices with regard to People, Planet and Profit. This, together with company's Code of Business Conduct, is the foundation for DSM's position on sustainable biomass.

Biomass definition
Biomass is a renewable organic material, e.g. agricultural crops or residue streams, wood, grasses, or municipal wastes. In the context of biomass as a feedstock for energy or products, it is often referred to as plant-based material. Whereas fossil feedstocks are finite, biomass is renewable; it can be grown on the land. Biomass has been hailed as a viable alternative for fossil feedstocks, mitigating greenhouse-gas emissions and providing a major opportunity for rural development and increasing prosperity on a global scale.

Biomass as feedstock
Biomass can be used for the production of power & heat, and as a raw material for the production of bio-based products such as fuels, chemicals and materials. One can distinguish between first, second and third generation renewable feedstocks. First generation feedstocks comprise plant oil, starch and sugar, which can also be used in the food chain.
Second generation feedstocks comprise non-edible plant material and residues from forestry, agriculture and industry, and energy crops that do not directly compete with food crops. Third generation feedstocks comprise the direct use of CO_2 and can for example be based on algae that do not require fertile agricultural land.

Sustainability issues around biomass
The use of biomass - a source for food, feed, energy and bio-based products – also raises questions and (public) concern. Where industry would like to do everything in a correct way from the start, unfortunately, we do not yet have all the answers to the questions and concerns. One of the concerns around the use of biomass for bio-energy and bio-based products centers on the use of crops for food or feed production. Other concerns are direct or indirect changes in land use, loss of biodiversity, the use of genetically modified seeds, crops, or microorganisms, the use of fertilizer, insecticides, and water. These issues around biomass are addressed in the Annex. In addition to the benefits of biomass for bio-based products and materials, one needs to acknowledge these concerns, albeit on the basis of facts.

Conclusions on the use of sustainable biomass by DSM

DSM is committed to sustainable use of biomass. DSM considers the conservation of biodiversity and ecosystems an essential part of sustainable development and corporate (social) responsibility, including the societal effects on communities. In this way, DSM wants to ensure that biomass is available as a sustainable feedstock not only today, but also for generations to come.

DSM believes that the bio-based economy can only develop satisfactorily if consumers, businesses and governments support and stimulate investment and make decisions based upon comprehensive sustainable assessments. The bio-based economy requires the development of global assessment systems that go beyond narrow Life Cycle Assessments, and which assess the sustainability impact of bio-based processes and products in a broad sense. It is essential that international, recognized (legal) frameworks, standards and certification systems are put in place through multi-stakeholder engagements. DSM actively campaigns for these goals and seeks to take a proactive leading role in international dialogues on the creation of such standards and frameworks.

DSM believes that *bright science* plays a key role in realizing the sustainable use of biomass, while using our biotechnology and chemistry competences, including e.g. our pioneering in the development of lignocellulose-based technologies. We believe that current and future needs for food, energy and materials can be met in a responsible way, provided that the available arable land is optimally used in a sustainable manner and all parts of the plant, non-edible crops and agricultural residues are used in the most efficient way.

Annex: Sustainability issues around biomass

Food and fuel
Since bio-based products rely on biomass, a debate has developed as to whether the world's scarce land resources are better employed producing food rather than feedstock for industrial processes. This debate intensified as a result of a global food crisis in 2008 and remains an issue today, even though subsequent research into the food price spikes of that year by the World Bank[1] suggests that the role of biofuels in this context was overrated.
DSM believes that the production of food must take priority over the use of biomass for bio-based industrial products. Moreover, we believe that over time, bio-based products will predominantly be made from non-edible feedstocks and potentially from third generation feedstocks. DSM also believes that, for a period of time, we can't do without starch and sugar as feedstocks as a stepping stone towards use of second generation technology.

Land use change factors
An intense debate centers on the use of land for the cultivation of feedstocks for industrial biotechnology. The key question is whether increased global demand for biofuels has a knock-on effect on the use of land around the world and/or the expansion of croplands for ethanol or biodiesel production. There are many drivers for land use changes, directly or indirectly, that have no relation to biofuels production. Examples of land use changes are illegal tropical wood logging, urbanization, deforestation for subsistence farming, pastoral activities and wood gathering. It is good to note that there are other major land use change drivers such as timber harvesting, increased meat consumption, soy meal production and poor subsistence farming techniques, where the projected land requirements for biofuels are in the range of 2.5 - 4.2% of the total arable land[2].

DSM acknowledges that the subject of land use change is of great complexity and that the scientific work on modeling of the land use change impact of biofuel does not yet provide clear and unambiguous answers. However, it is DSM's strong belief that jeopardizing an endangered habitat for cultivation of feedstocks for the bio-based economy should be avoided. For that, we need measures to improve agricultural management systems to increase agricultural productivity, and carefully balance water use and protect endangered habitats and secure biodiversity.

DSM believes that the available agricultural resources are sufficient to provide enough feedstock for food and feed and for bio-based products as well, making use of increasingly efficient methods for agricultural production, especially also in developing areas.

Indirect land use change factors
The cultivation of yet uncultivated arable land for the production of food and feed crops, for urbanization and industrialization may lead to direct land use change. If existing arable land is used for industrial purposes, e.g. the production of biofuels instead of food, this will likely cause indirect land use change (ILUC) due to the necessity to replace land for food and feed production. Although studies reveal that ILUC factors vary greatly[3] it makes sense to take ILUC effects into account.

[1] Placing the 2006/08 Commodity Price Boom into Perspective *John Baffes Tassos Hanioti,* The World Bank Development Prospects Group, July 2010
[2] FAO, Food and Agricultural Organization of the United Nations, "Climate Change, biofuels and land" ftp://ftp.fao.org/nr/HLCinfo/Land-Infosheet-En.pdf
[3] Searchinger *et al*. (2008) Science

The impact of ILUC can be reduced by employing unused or badly used by-products such as lignocellulose as feedstocks: the existing arable land can thus be used for food or feed and in addition for non-food uses. Other ways of reducing or preventing ILUC are intensification of agriculture, optimization of agriculture management, the combination of extra food production with biomass sourcing (using more of the plant) and by the use and upgrading of marginal and degraded land.

The scientific work on modeling of the land use change impact of the use of biomass is still very much in its infancy and is mostly theoretical or hypothetical. At this stage, current models cannot deliver consistent and reliable results, fail to address critical issues for land management (such as productivity improvement, or use of byproducts as high quality feed or as alternatives to fossil resources), and do not differentiate between types of biofuels or bio-based chemicals on their provenance[4].

Consequently, DSM cannot currently include ILUC in its assessments until generally agreed models for assessment have been established.

Water use
There is a possibility that large scale production of bio-based feedstocks leads to pressure on water supply and eventually, shortages. Typically, the water used for growing the crops exceeds the amount of water needed to run a biotechnological or chemical conversion process.

For this reason, DSM prefers that bio-based feedstocks are grown in locations and regions where water is in abundant supply and that process water is re-used as much as possible, in order to avoid environmental impacts.

Biodiversity
In addition to food prices and land use, biodiversity is often discussed in the context of biomass for food and non-food applications. The option to use agricultural land for food as well as the agricultural residues for second generation applications is appealing from a biodiversity point of view.

DSM believes that land can be used efficiently for food and non-food purposes at the same time and that this practice will minimize (further) degradation of biodiversity. Careful use of agricultural residues remains essential in order to avoid erosion and preserve nutrients and soil structure.

Genetically modified (micro)organisms
The use of genetically modified microorganisms and genetically modified biomass feedstock has generated some controversy in some regions. The microorganisms used in industry for biotechnological processes are well-contained in bioreactor systems and do not end up in the final products. Any side streams that contain genetically modified microorganisms will need to be handled appropriately.

DSM does not produce genetically modified crops. In certain areas where permitted, DSM is using agricultural residues that can contain genetically modified biomass. In these cases we strictly adhere to local policies and legislation.
For a matter of fact, all bio-based end products of DSM do not contain genetically modified biomass and/or genetically modified microorganisms.

DSM is aware of the different public perceptions regarding the use of biotechnology. DSM executes thorough safety and suitability assessments before any (internal) use of genetically modified material. Microorganisms are only used in contained systems, i.e. closed and carefully controlled and operated

[4] http://ec.europa.eu/energy/renewables/consultations/2010_10_31_iluc_and_biofuels_en.htm

systems. All DSM laboratories and facilities worldwide comply with the same high, internal safety and quality standards. For any scale up activities, DSM is compliant to all existing local legislation and DSM only uses microorganisms classified in the safest class of current legislation. So, with regard to genetically modified (micro)organisms, DSM works in accordance with laws and regulations and applies the highest safety standards. We use safe organisms in contained systems and are transparent to our stakeholders about the way our products are produced.

Distributive justice
Concerns do exist whether local indigenous communities will benefit from the expected increase in economic activity or whether the provision of biomass as a feedstock will be dominated by industrial agriculture. The nature of the 'bio-based economy' can lead to revitalization and economic development in rural areas including e.g. Eastern Europe, Africa or Latin America regions.

DSM believes that strong measures should be taken to ensure that bio-based products and biomass feedstocks are produced in a manner that respects and lets benefit local communities and the local environment too.

Need for regulatory measures on biomass utilization
The availability and use of biomass and the development of the bio-based economy is and will be heavily regulated by the national and global political and regulatory legislation. The potential of using renewable resources to replace fossil sources is acknowledged. However, when compared to the fossil economy, the bio-based economy is still in its infancy and not yet optimized. Incentives to optimally use the intrinsic value of biomass, which exceeds the mere caloric value of biomass, are not yet in place in many regions. As a result there is as of yet no level playing field for the sourcing and use of (second generation) biomass. Internationally, it is vital that comprehensive long term climate change agreements are reached and regulations and norms are put in place to create the business case security, which is necessary for agriculture and industry alike to make the considerable investments in a bio-based infrastructure and bio-based technologies. Likewise, at regional and national levels, policies must support R&D, deployment and venture funding, as well as demand-led interventions in order to create a sustainable market.

Therefore, DSM believes that action is required at every governmental level to create a competitive and sustainable environment.

Sourcing of biomass
DSM recognizes that biomass is a precious and scarce resource. Its production and use must balance the needs of society with preservation of biodiversity. DSM's position on responsible sourcing of biomass is based on generally accepted certification and standardization procedures for sustainable soy, palm oil, cocoa, sugar cane production as well as forestry with respect to land use and land use change issues. With respect to conservation and compensation of native vegetation, DSM requires that aspects of plantation management that have environmental impacts are identified, protected areas are respected and management plans are made to mitigate the negative impacts.

Assessment of sustainability criteria for biomass
With respect to environmental effects, DSM continuously implements measures for improvement. Lifecycle greenhouse-gas emissions of biomass are calculated using IPCC (Intergovernmental Panel on Climate Change) methodology, which incorporates methodological elements and input data from authoritative sources; is based on sound and accepted science; is updated periodically as new data become available; includes greenhouse-gas emissions from land use change, including, but not limited to above- and below-ground carbon stock changes; and incentivizes the use of co-products, residues and waste.