INNOVATIVE IDEAS AND MARKET OPPORTUNITIES IDENTIFIED BY THE BIOMASS UPSTREAM CONSORTIUM

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ABSTRACT: The Biomass Upstream consortium ("BUS") is an innovation platform in which market parties and research organisations jointly aim to develop ideas and initiatives on "upstream biomass" which covers the supply chain from production of biomass, harvesting, procurement, logistics and pre-treatment. The scope extends from agronomic and processing to economic, environmental and societal aspects. The use of biomass as raw material for bio-based chemicals, bio-fuels and heat and power will strongly increase in the next few years. The increased demand combined with a shift to sustainable non-food applications will lead to major changes in the production systems of biomass. On the one hand this change presents great economic opportunities but can equally have serious negative impacts on the environment and on society. An early assessment of the 'upstream' part of the biomass supply chain is the basis on which the consortium partners of the BUS develop initiatives, experiments and projects aimed at solving barriers to biomass deployment.
Keywords: biomass, supply chain

1 VISION ON THE FUTURE

A transition has started from a world that relies on abundant use of fossil fuels towards a world that is sustainable in its production and consumption of energy. Biomass will play a key role in that transition. It will contribute significantly towards energy in the form of electricity, bio-fuels for transportation and heat but also towards the production of bio-based chemicals and materials on a sustainable basis. In our vision biomass will have a central position in the economies of the future.

Unlike fossil fuels, biomass is a very diverse raw material. Biomass can be supplied from dedicated crops, as by-product of food-driven production, as rejects after fulfilling higher value primary applications or as pure waste streams. Biomass can originate from anything between algae and trees. Also animals can provide biomass raw material for example in the form of dung. Projecting ourselves into this biomass driven future, a broad spectrum of questions arises with respect to the sustainable origin and availability of the raw material and the associated logistical systems. Where does it come from? Who will produce it? Will it harm food production? What is the contribution of crossbreeding or genetic modification techniques? What is the economic context? Will it contribute locally to the development of biomass producing economies? And what about logistics?

2 APPROACH

The integrated chain has to be considered in order to understand the viability of a biomass utilisation route. Many steps lay between the production of biomass and its ultimate utilisation in an end product. The "upstream" part of the chain is not only characterised by availability and price. Key factors in the development of the emerging market for non-food biomass are the economic, environmental and societal conditions of production and supply. The BUS integrates all relevant factors in the generation of new ideas and the evaluation of existing ideas in order to move their implementation forward

The consortium consists of the following participants: Shell Nederland, Shell Global Solutions, Shell Research Foundation, the Institute of Forestry and Forest Products Probos, Department of Forestry and Nature Management of Wageningen University, WUR-Agrotechnology & Food Innovations, WUR-Agro Economics Institute ("LEI") and the Energy Centre for the Netherlands ("ECN").

Four times a year the participants of the BUS meet to generate new ideas, to select and rank the most promising concepts to be worked out in more detail by means of quick-scans and to discuss the results. Market parties are subsequently invited to jointly set up R&D projects and to take steps for their implementation. In this way, appealing ideas are supported financially both by the BUS and by market parties.

3 SCIENTIFIC INNOVATION AND RELEVANCE

An integrated approach to upstream and downstream aspects is key to the viability of biomass applications: downstream requirements determine to a large degree the upstream characteristics including the biomass itself. An innovation platform such as the BUS, is able to analyse the main barriers and market opportunities for the 'upstream' part of biomass deployment in an early stage. Expert agronomic resources at WUR support the selection of optimal biomass production systems. WUR-LEI adds broad understanding of societal and economic aspects. Combined with the broad experience of the other partners, fundamentally new options can be explored.

The BUS-consortium was created to ask the right questions, study and develop answers and follow-up with initiatives in the wide domain of biomass upstream. The

BUS makes early assessments of the 'upstream' part of the biomass supply chain and carries out practical experiments and projects which can contribute to identifying and resolving some the main barriers to its deployment.

Supply problems of biomass can only be resolved in a meaningful way through the complete chain from production to the final utilisation. The variety in biomass is orders of magnitude larger than various types of coals or crude oils, which show much more conformity than biomass. This offers opportunities for tailoring the supply of raw material to the application. Considering the upstream part in the context of its final use is essential. This aspect is also the basis for participation of the various parties in the BUS.

4 RESULTS

After one year of BUS activities over a hundred new ideas have been generated and discussed of which the top-ten have been worked out. These BUS-reports are published on internet (www.biomassa-upstream.nl). and have been presented to a wide target group of organisations participating in the national discussion on Biomass Transition in The Netherlands.

4.1 Examples of BUS quick scans:

SUSTAINABLE IMPORTS OF BIOMASS FROM LARGE SCALE TREE PLANTATIONS IN BRAZIL

Definition of the problem
The large scale production of biomass in fast growing, short rotation tree plantations, e.g. in Brazil, is considered an option to meet the ambitious targets of the Dutch renewable energy policy. The production and trade in biomass will have to be in line with social, economic and environmental criteria of sustainable development, which should be worked out and tested in close cooperation with local stakeholders.

Questions
1. For which countries such certification systems can be worked out (e.g. Brazil)
2. How can the participation of local stakeholders be organized to prevent unwanted competition with other forms of land-use?
3. What will be socio-economic and environmental impacts of large scale biomass plantations?

QUICK-SCAN ON THE SUPPLY OF BIOMASS IN CHINA

Definition of the problem
Studies have estimated a large, unused biomass potential in China, mainly consisting of forestry and agricultural residues and municipal solid waste. However, it is unclear what the impact is of current agricultural practice, traditional uses of residues and the future demand for food, on the availability of these residues.

Questions
1. How large is the biomass potential in China, especially in the forestry and agro-sector for the main types of residues?
2. What is the current use of agricultural residues and how much of it can be sustainably used for bioenergy purposes? What problems are to be expected?
3. What are the characteristics of the current agricultural practice, how is it expected to change and what would be the influence on the future biomass supply?

AVAILABILITY OF BIOMASS IN EASTERN EUROPE

Definition of the problem
In 2004 the EU 2004 was expanded with ten new Member States These acceding countries have a large agricultural area, which could imply a significant increase in production level. It is certainly conceivable that these countries may produce biomass at lower costs. Biomass production should be sustainable and not compete with the production of food and feed crops.

Questions
1. How big is the market for biomass for energy purposes in the new Member States?
2. What is the potential for biomass production when taking into consideration the developments in the demand for food and feed.

DEVELOPMENTS IN GENETICALLY MODIFIED OILSEED RAPE

Definition of the problem
Oilseed rape (*Brassica napus*) is cultivated on a large scale as an oil plant from which oil can be pressed for numerous food and non-food applications including bio-diesel. Bio-fuels are irrefutably the way forward. However, oilseed rape is also one of the four crops subject to the most genetic modification worldwide. Globally, oilseed rape is one of the most important crops for which genetic modification (GM) is applied in practice on a large scale. However, GM is not always acceptable as far as sustainability is concerned. There is therefore a real risk that a certain proportion of liquid bio-fuels consists of genetically modified oil. This paper deals with the issue of GM oilseed rape.

Questions
1. What is the amount of GM oilseed rape and which are the possibilities to distinguish it.
2 What is the opinions of non-governmental organisations about GM oilseed rape?

LARGE SCALE PHYSICAL PRE-TREAT-MENT OF BIOMASS AT A CENTRAL YARD

Definition of the problem
In the very near future The Netherlands will need huge amounts of biomass for co-combustion in existing coal plants. Furthermore, there will be substantial extra demand for biomass for liquid and gaseous bio-fuels, most of which will be imported. To be able to handle these large amounts of biomass central yards could be needed, where handling, blending and pre-treatment can be optimized to achieve the desired fuel mix. In the coal industry this is already common practice; for the emerging biomass industry it will be useful too.

Questions
1. Which locations will be most suitable to establish central biomass yards in The Netherlands?
2. Which pre-treatment technologies need to be included? (see BUS-ticket 16 as well)
3. Which scale is the most feasible? What will be the approximate investment costs involved?
4. Which parties are willing to set up a joint venture to establish such a central biomass yard?

POSSIBILITIES OF SOCIAL FORESTRY AND AGRO-FORESTRY FOR THE PRODUCTION OF BIOMASS IN THE TROPICS

Definition of the problem
Large scale (energy)plantations are relatively labour extensive, because of this social problems can arise in densely populated areas in developing countries. Plantations can also be established at the expense of agricultural lands. For this reason social- and agro-forestry have been promoted as a social friendly alternative. In these systems each individual farmer can grow a limited number of trees and supply these together to a timber processing industry. So far there are no examples known for the production of biomass, but there are examples in the pulp- and paper sector. Is it possible to predict whether this could also work for producing biomass and if so: in which way?

Questions
1. What are the experiences with such a sound social production method?
2. Could similar systems work for the production of biomass?
3. If so, under which conditions?

HOW MUCH BIOMASS CAN BE REMOVED FROM A SYSTEM WITHOUT NEGATIVE EFFECTS ON SOIL FERTILITY?

Definition of the problem
Crop residues usually are left on the fields or put back to contribute to the maintenance of soil fertility (C, N, K, P, etc). In case all biomass is going to be harvested the nutrient cycle is no longer in balance and diminishing of soil fertility may occur.

Questions
1. How much biomass can be removed from a system without negative effects on soil fertility?
2. Discuss the factors that determine these effects on soil fertility, with special emphasis on straw in Poland.
3. Discuss the effect on farm management and agri-economy.

HOW TO GET MORE WOOD FROM THE DUTCH FORESTS?

Definition of the problem
In general, wood harvest in the Dutch forests is much lower than the annual increment, resulting in an increase in the growing stock of 800,000 tons each year. At present, no extra wood is expected to become available from our woodlands for biomass-utilization. The wood is certainly there, but it doesn't come out of the forest. What is causing this? We have asked the forest owner and the forest manager!

Questions
1. Which categories of forest owners are most willing to increase their harvest and to provide (more) biomass?
2. Would it be possible to harvest more wood without jeopardizing the sustainability of the forest?
3. What is the forest manager's view on pre-commercial thinnings?
4. Which extra financial support is necessary to increase the amount of biomass to be extracted from the forest?

5 CONCLUSIONS

The great strength of the BUS is its unique position to merge all relevant factors and develop them into applied R&D projects.