

***TOWARDS THE DEVELOPMENT OF OECD
BEST PRACTICES FOR ASSESSING THE
SUSTAINABILITY OF BIO-BASED
PRODUCTS***



**ORGANISATION FOR ECONOMIC CO-OPERATION
AND DEVELOPMENT**

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FOREWORD

Economic recovery coupled with environmentally and socially sustainable economic growth (“green growth”) is a key challenge that all countries face today. Green growth is relevant beyond the current economic crisis, addressing urgent global challenges including the fight against climate change and environmental degradation, the enhancement of energy security, and the creation of new engines for economic growth.

Green technologies can help to address environmental challenges such as climate change. Some governments are supporting longer-term R&D in the area of green technology as part of their economic stimulus packages. Incremental technological improvement is not enough, however. Manufacturing industry should be restructured and existing and breakthrough technologies should be more innovatively applied to realise green growth.

Bio-based products and technologies (Industrial Biotechnology) are perceived today as a key source of radical innovations for green growth. Governments have developed and implemented supportive policies to boost R&D agendas and market development in this sector. However, while there are a myriad of activities in this area, there is still no agreed upon framework for sustainability, which would help governments and industry to identify; to evaluate performance; and to support the development of bio-based products that are likely to be most sustainable and thus beneficial.

Therefore, the OECD Task Force on Industrial Biotechnology has identified a need for best practices for the assessment methodologies based on sound principles, criteria, indicators and assessment tools. To launch this process, the Task Force held a workshop entitled “*Best Practices for Assessing Sustainability of Bio-based Products*”, (23-24 July 2009, Montréal, Canada). The purpose of the Workshop was (i) to identify best practices for the assessment of environmental and economic sustainability of bio-based products and (ii) to encourage their practical use and implementation.

This report outlines the current concepts and practices in the evaluation of sustainability of bio-based products. The report also identifies the development of international instruments in the field and options for implementing these in practice.

The report draws on debates first held at the Workshop. As it developed, the report benefitted from comments from experts at the Workshop and from delegates to the Task Force on Industrial Biotechnology and the Working Party on Biotechnology.

The report has been prepared by Ms. Maria Wellisch (Advisor, Sustainable Conversion of Bioresources, Natural Resources Canada, CanmetENERGY, Ottawa, Canada) and Mr. Alexandre Bartsev (OECD), with valuable inputs from Mr Saeed Khan (Industry Canada) and other members of the Task Force on Industrial Biotechnology. Mr. Jacques Whitford Stantec Limited (Stantec), Canada contributed to preparation of the workshop.

The Committee for Scientific and Technological Policy declassified this document.

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WORKSHOP REPORT

I. Background

The 2004 OECD Science and Technology Ministers meeting, which discussed “*Biotechnology for Sustainable Growth and Development*”¹, gave the OECD a mandate to take steps to realise an eco-efficient bioeconomy. Facilitating the transition towards a bioeconomy is perceived as a powerful way to mitigate global challenges such as climate change through sustainable development and global growth. Many OECD countries are committed to taking steps towards a bioeconomy.

The transition towards a bioeconomy is a challenging task, which requires a supportive policy environment: Industrial Biotechnology is seen as particularly important in successful delivery. Industrial Biotechnology can in principle help drive the transition of the manufacturing sector (*e.g.* IT, pharmaceutical, chemical, automotive, textile, food/feed, agriculture, *etc.*) towards more sustainable economic and environmental models, which are the foundation of the bioeconomy.

One of the main deficiencies in the current policy framework is the lack of evidence-based, internationally accepted instruments for assessing sustainability of bio-based products and processes. Such instruments might comprise analytical tools such as principles, best practices and/or standards.

A number of organisations are currently developing metrics and indicators to measure the sustainability of bio-based products and processes, in particularly in the field of bio-fuel production (for example, the World Business Council on Sustainable Development, UNEP, UNIDO, Global Bio-energy Partnership). In addition, ISO currently has a work item that focuses on sustainability criteria for bio-fuels (Germany and Brazil). However, while there are a myriad of activities in this area, there is still no agreed sustainability framework, which would help governments and industry to identify and support the development of bio-based products that are likely to be most sustainable.

Therefore, the TFIB has identified a need for best practices for assessment methodologies based on sound principles, criteria, indicators and assessment tools. The purpose of the present project is (i) to identify best practices for the assessment of environmental and economic sustainability of bio-based products and (ii) to encourage their practical use and implementation². Best practices will help governments develop evidence-based policies supportive of sustainable products.

¹ www.oecd.org/dataoecd/43/2/33784888.PDF.

² This project will build on the work already done by the USDA “Metrics to Support Informed Decision-making for Consumers of Bio-based Products”, USDA, 2008 (www.oecd.org/dataoecd/37/48/42400999.pdf).

One should note the present project is an integral part of the OECD strategic thinking and horizontal projects on green growth through eco-innovation. Green growth requires the integration of different policy areas for the environment, science and technology, trade and industry, innovation and entrepreneurship, labour. These policies need to be measured, analysed and evaluated so that they more effectively help to develop and diffuse green technologies and therefore to contribute to economic growth.

II. Summary of Key Messages

Sustainable development, or sustainability as many people refer to it today, is bigger than bio-based products...

It is about meeting today's needs (ecological, economic and social) without compromising the ability of future generations to meet their needs. Science is telling us that we have a number of environmental issues to address and ecological damage that need to be repaired. We need to be smart about our next development decisions.

There are many opportunities for biotechnology to make a positive contribution...

A lot is happening in the area of sustainable development. Research is underway to develop practical assessment methodologies. Social assessments are being incorporated into life cycle environmental models. In the biotechnology area, bio-fuels assessment is in the lead with the need to prove their real environmental and social benefits.

Given the work underway, do we need to do something else or more for bio-based products, Do bio-fuels differ from other bio-based products?

Bio-fuels could be considered as simpler bio-based product systems. From feedstock, bio-fuels are converted into fuel in one process, blended and "ready for use". Use and end of life are essentially one in the same for bio-fuels. There typically no opportunity for capture and reuse of the combusted products (at least not from mobile sources).

Other bio-based products would share the "biomass feedstock" stage with bio-fuels assessment. However other bio-based products can go through numerous processing stages, and given our globalised world, processing can take place in several different countries. The final products are generally a blend of bio and non-bio intermediates. Depending on the product, bio-based products can sometimes be decomposed and other times reused or recycled. At some point, they will be returned to the environment.

At a minimum it can be said that bio-based product assessment shares "biomass feedstock processing with bio-fuels" but that it involves more processes and life cycle stages. The scope is broader and more data will be required.

Should the OECD develop "Best Practices for Sustainability Assessment of Bio-based Products"?

The workshop participants appeared to agree. The speakers stressed that we need international agreement and provided strong justification that included the loss of consumer confidence, cost burden and potential trade conflicts – if we don't have international agreement on how to assess our bio-based technologies and products.

It appears logical to recommend that the OECD knows the scope and timeline of these initiatives, and finds ways to work in concert with relevant initiatives.

In terms of approach, it was unanimous that a life cycle thinking (LCT) approach should be adopted..

However, in terms of assessment, both the presenters and participants acknowledged that there is no “one size fits all” assessment. The type of assessment is determined by the purpose and objective of the sustainability assessment. Is it to develop supportive policies, to show that product A is superior to product B, to confirm that a bio-based products facility is realising its claimed environmental benefits, or to qualify a product for a subsidy or tax incentive, etc.?

Use of LCA for Environmental assessment ...

It was recognised by all participants that life cycle assessment (LCA) is a tool that can be used to quantify the potential benefits and impacts generated during the life cycle of a product - from raw material production or extraction, material production, manufacturing, use to end-of-life treatment. It can be very effective in helping to avoid the unintentional shifting of burdens.

Sustainability assessments should include the social and economic dimensions...

There was agreement that social and economic dimensions should be included in sustainability assessments. Ms. Barbara Lippiat mentioned that life cycle costing (following ASTM E917) was the approach adopted in BEES for product evaluation.

These two dimensions were not discussed in much detail likely because the strength of the participants and experts was in the area of “environmental assessments”. It is recommended that future work includes economists and social scientists to better cover these dimensions, as well as sustainable development practitioners who can describe multi-criteria assessment tools, *etc.*

Communication of assessment results...

Communication is never an easy task. But communication of complex issues, such as sustainability is even tougher. Surveys from the “food consumer products” area may provide some valuable insight for other bio-based products. Consumers appear to be increasingly overloaded with product information. In addition to nutritional information in the country’s required languages, consumers can now find information on the ingredients country of origin, potential allergic reactions, fair trade, and yes ... sustainability.

While consumers want assurances that their product purchase is a more sustainable choice, they don’t want the purchasing process to become more complicated or too confusing. The “best practices” could provide suggestions regarding communication to different audiences.

III. Workshop

The workshop was designed to:

- i)* Take stock of existing sector, national, or international approaches for assessment of sustainability of bio-based products, such as bio-based chemicals, bio-based plastics, enzymes, bio-based materials, bio-fuels, etc.;
- ii)* Consider what might constitute a comprehensive sustainability assessment;

- iii) Discuss what are the common and divergent approaches in existing assessment methodologies;
- iv) Identify barriers to the application of current assessment methodologies;
- v) Discuss the key elements of potential best practices in the assessment of the environmental and economic sustainability of bio-based products, as well as how these might be further developed within the OECD.

The overall approach to the workshop was to blend a traditional conference style featuring multiple panel speakers with interactive sessions designed to provide participants with an opportunity to consider specific questions and issues raised over the course of the workshop. This blending process was highly successful with many participants offering positive comments and feedback at the conclusion of the event.

The sections below provide views on the expert presentations and the workshop discussion. The presenters were experts who had been working on the sustainable development of the bio-based economy for a substantial number of years. The participants were a mixture of environmental assessment practitioners and bio-based economy stakeholders, i.e. representatives from agriculture, government and bio organizations. This report is intended to capture the “gems” that the participants generously shared and provides main outcomes of the workshop presentations, discussions and conclusions.

The workshop began with a review by the OECD of why we were meeting. “There are no internationally accepted best practices – or instruments – for assessing the economic and environmental sustainability of bio-based products and processes.”

Participants were presented with 2 options for the form “best practices” could take, namely:

- i) Technical guidance document – a scope of best practices to identify indicators, evaluation approaches, software tools, *etc.* under a given sustainability framework.
- ii) OECD instrument – a high level document identifying principles and best practices in non-technical language that would be delivered by the OECD Council; although it would not be legally binding document, it would represent an important political commitment on the part of the Member countries.

As most workshop participants were practitioners, either carrying out environmental assessments or users of the results, it was not unexpected to hear their preference was to pursue “Option 1” - the development of a technical guidance document, something more relevant to their day-to-day work.

Mr. Alexandre Bartsev (OECD) described than the structure and content of a typical OECD technical guidance document, and proposed a skeleton. This skeleton was discussed in the breakout discussions where participants suggested the points that should be included in a technical guidance document.

The sections below provide views on the expert presentations and the workshop discussion. The presenters were experts who had been working on the sustainable development of the bio-based economy for a substantial number of years. The participants were a mixture of environmental assessment practitioners and bio-based economy stakeholders, i.e. representatives from agriculture, government and bio organizations. This report is intended to capture the “gems” that the participants generously shared and provides main outcomes of the workshop presentations, discussions and conclusions.

IV. Highlights from Speakers' Presentations

The following are short summaries of the experts' key messages. The order of the speakers has been changed to organize their talks into 3 groups: the big picture; current initiatives; and specific tools and issues related to bio-based products assessment.

Keynote speech - the "Big Picture"

Mr. Harvey Mead is the former Province of Québec's first Sustainable Development Commissioner (2007-2009). Prior to this he held senior level positions with the Ministry of Environment in Quebec and was founder of the environmental non-government organisation "Nature Québec". As a former senior government official who has made a lifelong commitment to sustainable development, Dr Mead was invited to give the keynote presentation available at <http://oecd.org/dataoecd/43/56/43902275.pdf>.

Mr. Mead challenged the audience by reminding the participants that we (the "global we") are already exceeding the resource limits of this planet in several different ways (*e.g.* biodiversity loss, drought, poverty, etc.) and the pressures on resource use are increasing each year. This situation of "ecological overshoot" should be considered as the starting context as we deliberate further development of bio-based economies that provide ecosystem services, habitat, food, building materials, medicinal ingredients, heat and power and industrial products such as bio-fuels, bio-polymers, bio-chemicals and new materials, *etc.*

While Dr Mead appreciated the sincerity of this initiative and acknowledged the need for effective assessment tools, he reminded us that it should be done within the context of an Earth that is already damaged to some extent and needs to be treated with care.

Mr. Rob Anex, is a well known professor from Agricultural and Bio-systems Engineering Department at Iowa State. Having been involved in 2 similar workshops³ in the US and edited the special issue of the Journal of Industrial Ecology⁴ on the industrial ecology of bio-based materials, among other work, Prof Anex has spent a great deal of time thinking about sustainability and the potential role of the bio-based economy. His presentation "*Searching for Sustainability: the Best as the Enemy of the Good*" is available at <http://www.oecd.org/dataoecd/28/24/43457664.pdf>. His key message was that seeking the perfect, or even the best, is likely to be an unrealistic goal when it comes to sustainability. Instead our goal should be to seek "*highly desirable alternate futures characterised by resilient systems*". Some of his main points included:

- i) Sustainability is a challenging task. It has to do with the big picture, not with one particular sector, or one region, *etc.* (It isn't something that bio-based products or biotechnologies can do on their own). That being said, in the bio-based products area, we need to address sustainability. It is part of the public debate. There are real economic, environmental and social questions to answer. The issue cannot be ignored.
- ii) It is very unlikely that science will be able to provide all of the information needed by policymakers. There are very real limitations with respect to time and resources. In addition, all social and biophysical systems are constantly changing.

³ Assessing the Sustainability of Bio-based Products (2003) Norman, Oklahoma; and Workshop on the Economic and Environmental Impacts of Bio-based Production (2004) Chicago, Illinois.

⁴ Volume 7, Issue 3-4.

- iii) We might have to accept “satisfying solution” - a solution path that is acceptable (not optimal) for the majority of parties concerned.
- iv) We have no choice but to “muddle through” with successive limited comparisons based on a few important evaluation criteria (The best is the enemy of the good).
- v) While evaluating the sustainability, it is critical to be clear about the purpose and objectives of the assessment because they will determine the assessment methodologies, appropriate indicators, *etc.*
- vi) There is no “one size fits all” assessment. The goal of the study or the research question to be answered should define the system under study. For example, should we use an attributional or contributory LCA⁵. The systems should be designed for resilience and self-renewal through built-in redundancy and diversity.

Current Sustainability Initiatives for Bio-based Products

Three of the speakers discussed some of the initiatives that are underway related to sustainability assessments of bio-based products:

- Mr. Michele Galatola, European Commission.
- Mr. Guido Reinhardt, IFEU – Institute for Energy and Environmental Research, Germany.
- Mr. Kevin Boehmer, Canadian Standards Association.

Mr. Michele Galatola, European Commission’s DG Research – Directorate Environment, provided an overview of the EC’s work researching sustainability assessment methodologies, requiring assessments to be completed and the first EU environmental sustainability standards being developed for bio-based products. His presentation is available at <http://www.oecd.org/dataoecd/29/4/43457216.pdf> and his key messages included:

- i) In the EU, Life Cycle Thinking (LCT) is integrated into numerous policies. It is considered to be essential to avoid the shifting of burdens from one stage to another or from one group to another.
- ii) To successfully promote a bio-based economy, EU experience has shown that there needs to be coherence amongst a variety of different legislation (including agriculture, environment, rural development, innovation, *etc.*).
- iii) There is a strong need for international agreement in the area of sustainability assessment because there is an increasing number of inconsistent schemes, LCA data, *etc.* Consequently, there is a loss in stakeholder confidence. International agreement⁶ is needed to:
 - Provide consistency.
 - Establish consumer confidence that they are doing the right thing in buying X.

⁵ An attributional LCA describes the pollution and resource flows within a chosen system attributed to the delivery of a specified amount of the functional unit, whereas a consequential LCA estimates how pollution and resource flows within a system change in response to a change in output of the functional unit. These LCAs will give different results because they model different systems.

⁶ For example, International work is underway on LCI database and LCA guidance *e.g.* ILCD – international reference LCA system handbook.

- Reduce data and assessments costs (which are high).
- Avoid trade conflicts.
- Improve assessment quality.

EC Research on and Adoption of Sustainability Assessment Methodologies

Several examples were provided of sustainability assessments, both universal application and bio specific examples:

- i) ELCD core database: comprises Life Cycle Inventory (LCI) data from front-running EU-level business associations and other sources for key materials, energy carriers, transport, and waste management.
- ii) PROSUITE: new project that is developing sustainability assessment methodologies for technologies (four areas have been selected, biotechnology is one of these).
- iii) FP7 Call for “Sustainable Biorefineries”: this call required mandatory sustainability assessment (economic, environmental, and social) to be part of every proposal.

With respect to the three pillars of sustainability, Mr. Galatola recommended that the assessment results from the economic, environmental, and social dimensions be kept separate; *i.e.* the information sets should be separately provided to the decision makers. Integration amongst the different dimensions of sustainability and trade-off decisions should be made by the decision makers to maintain the distinction between “what is science” and “what is policy”.

Environmental assessment

Life Cycle Assessment (LCA) is considered to be the assessment tool for assessing the potential environmental impacts of products. Bio-based content (¹⁴C measurement) on its own is insufficient. The fact that a product is bio-based is not alone a proof of its environmental sustainability.

Standards for environmental assessment are being developed for bio-based products. European standards would cover: product functionality; impact on GHG emissions and raw material consumption; measurement methods, LCA procedures; and biodegradability (for some products).

Two results for 2 projects should be available next year (in 2010):

- EU standardisation programs for bio-based products – M/429 and M/430.
- Working group on Bio-polymers: CEN/TC249 Plastics and biopolymers.
- Working group on Bio-lubricants: CEN/TC19 Gaseous and liquid fuels, lubricants and related products of petroleum, synthetic and biological origin.

Mr. Guido Reinhardt, Scientific Director of Institute for Energy and Environmental Research (IFEU), Germany, described the insights he gained from extensive work carried out on in defining principles and the sustainability of bio-fuels. He recommended how this work could be extended to apply to bio-based products (other than bio-fuels) assessment. His presentation is

available at <http://www.oecd.org/dataoecd/28/22/43457961.pdf>. The study he draws upon is: “Criteria for sustainable bio-energy use on a global scale” (2008)⁷.

Existing Sustainability Initiatives related to Biomass, Food, Bio-fuels, etc.

There are numerous initiatives underway. For example,

Government Initiatives:

- Netherlands: “Cramer Commission”/Ministry of Environment. Involved organisations: Senternovem (lead-manager), CE, Ecofys, University of Utrecht
- United Kingdom: Low Carbon Vehicle Partnership/Department of Transport. Involved organisations: E4Tech, Ecofys
- Brazil: National Institute of Meteorology, Standardization and Industrial Quality
 - INMETRO develops sustainability standard with focus on sugarcane ethanol.
 - “SocialFuelLabel” with focus on biodiesel.
- EU: Proposal for EU-Directive

International Initiatives:

- ISO
- CEN
- FAO

Multistakeholder Initiatives:

- GBEP Global Bioenergy Partnership
- RSB Roundtable on Sustainable Biofuels
- RSPO Roundtable on Sustainable Palm Oil (Pilot phase)
- RTRS Roundtable on Responsible Soy

Several sustainability assessment schemes have identified principles and criteria for assessment. For examples, principles from the NL/UK schemes include:

- There is no competition with food, local energy supply, medicines, building materials
- Biomass production will not lead to the destruction or damaging of high biodiversity areas
- Biomass production does not lead to soil degradation
- Biomass production does not lead to the contamination or depletion of water resources
- Biomass production does not lead to air pollution
- Biomass production contributes to local and national prosperity
- Production of biomass contributes to the well-being of workers and the local population
- Labour standards are respected

⁷

www.senternovem.nl/mmfiles/Report%20-%20criteria%20for%20sustainable%20bioenergy%20-%20German%20reseach%20project%2Edoc_tcm24-280148.pdf

- Land use rights are respected and opportunities are provided for participation

While many assessment schemes share common principles and criteria, there are no identical schemes. From the bio-fuels and bio-energy perspective, Mr. Reinhardt considers the most promising schemes to be:

- EU Renewable Energy Sources Directive
- GBEP Global Bio-energy Partnership
- ISO/PC Sustainability criteria for bio-energy
- CEN TC 383 Sustainability criteria for biomass
- BIAS Bio-energy Environmental Impact Analysis

Implications for bio-based products application

It is important to be clear on one's environmental goals and objectives as different uses of biomass will have different environmental benefits. (Comparison was shown of biomass used for surfactant production, biodiesel, small CHP, biogas, etc.).

There is no need to reinvent the wheel, *i.e.* there is no need to implement a new institution, nor to develop criteria concerning the sustainable biomass production from forestry or agriculture. For example, the biomass production (terrestrial) is well addressed by existing initiatives for the sustainable production of biomass and bio-fuel related initiatives. However, this is not the case for aquatic biomass - marine and freshwater resources.

Biodegradability is by no means a criterion for the sustainability of a bio-based product. For bio-based products assessments, there are at least four issues that need further work:

- i)* Agreement and guidance on co-products allocation.
- ii)* Better understanding of the use phase for different bio-based products.
- iii)* Better understanding of open loop recycling and disposal schemes.
- iv)* More information on final product biodegradability, and disposal via composting.

Mr. Kevin Boehmer, Manager of the Sustainability Program at the Canadian Standards Association, provided an overview of what voluntary standards were, how they are developed (*i.e.* process and bodies involved), how they differ from regulation, etc. His presentation is available at www.oecd.org/dataoecd/28/39/43459498.pdf.

Namely, voluntary standards are used by business, governments and civil society to:

- Promote interoperability and trade through the harmonization and compatibility of requirements.
- Standards set a bar (*i.e.* minimum admissible requirements for desirable characteristics of products/services such as quality, environmental, friendliness, safety, reliability and efficiency); and
- Standards provide information that safeguard consumers/buyers with consistent and comparable information; among others.

Mr. Boehmer provided examples of ISO standards related to GHG mitigation and support climate change programs. Example of a product standard: ISO/WD 14067-1,-2; Carbon footprint of products – Quantification, Communication.

Specific Tools and Issues related to Bio-based Products Assessment

Four of the speakers discussed specific tools and issues related to sustainability assessments of bio-based products (including bio-fuels):

- Mr. Olivier Jolliet, University of Michigan
- Ms. Barbara Lippiat, US NIST Building and Fire Research Laboratory, Office of Applied Economics
- Mr. Terry McIntyre, Environment Canada
- Mr. Joel Velasco, UNICA (Brazilian Sugarcane Industry)

Mr. Olivier Jolliet, School of Public Health at the University of Michigan, shared “lessons learned” gained from many years of carrying out quantitative environmental and health assessments. His presentation is available at <http://www.oecd.org/dataoecd/29/2/43457426.pdf>.

Key messages from his presentation included:

- The purpose and objective of the assessment should determine the basis for comparison. Know what you are comparing and why, and select the right unit (or basis) of assessment.
- Products or service systems should be compared in terms of their total system-wide environmental consequence (*i.e.* from cradle to grave).
- Not all bio-based products had the same environmental impact or benefit.
- If land area was your constraint, what bio-based product should you produce from the biomass on the land?

Mr. Jolliet presented a comparison of energy saved for different bio-based products, on a land area basis. Bio-based materials had greater environmental benefits than bio-energy and bio-fuels – on a per hectare basis. He showed similar results from a study commissioned by ADEME (France) commissioned a study that compared the LCA results of 9 different bio-based product categories, including surfactants; lubricants and hydraulic fluids; solvents; construction wood; biomaterials; biopolymers; energy from forest biomass; energy from agricultural bio-fuels; biodiesel and bio-ethanol. The different bio-based product categories varied with respect to their energy savings, CO₂ emissions, eutrophication impact, *etc.*

- Bio-based products can have a lower impact compared to their petroleum counterpart for some environmental aspects but a great impact for other aspects. Prof. Jolliet provided the example of biodiesel *vs.* petroleum derived diesel. Biodiesel had lower impacts with respect to CO₂ and non-renewable energy use but higher impacts for carcinogens, non-carcinogens, respiratory inorganics, aquatic toxicity, land occupation, etc.
- LCAs require a great deal of data and often many assumptions, therefore uncertainty analysis is necessary to place the appropriate level of confidence in the LCA results. Prof. Jolliet proposed the Taylor series expansion technique as a simpler and more practical analysis than the more traditional Monte Carlo technique.
- As LCA results are increasingly being used to inform policy, uncertainty analysis is becoming a very important aspect of interpretation of LCA results.

Ms. Barbara Lippiat, an economist in the NIST Building and Fire Research Laboratory’s Office of Applied Economics, provided a high level overview of the BEES (Building for

Environmental and Economic Sustainability) tool. BEES is used to make environmental and economic assessments of products for a US government product procurement program. Ms. Lippiat highlighted several points that should be part of good assessment practices. Her presentation is available at www.oecd.org/dataoecd/29/3/43457299.pdf.

The 2002 Farm Bill authorized the establishment of a program, known as BioPreferred, awarding Federal purchasing preference to bio-based products. To address the questions of environmental and cost performance⁸, candidate bio-based products are evaluated by the BEES tool or ASTM standard, and performance results shared with Federal purchasers.

Using Simapro as its modelling base together with consensus-based methods⁹, BEES estimates 12 environmental impacts (global warming, acidification, eutrophication, fossil fuel depletion, indoor air quality, habitat alteration, criteria air pollutants, water intake, ozone depletion, smog, human health, and ecological toxicity); and economic performance in terms of first and future costs.

The BEES tool can be used to compare products of equivalent function to another. While BEES was initially developed to evaluate building products, a variety of other products such as cleaners, lubricating oils, *etc.* have since been evaluated.

Ms. Lippiat recommended the following items be considered for quality assessments:

- i) Assessment methods should include the use of consensus standards, life-cycle assessment and life-cycle costing.
- ii) Indicators should be science-based, peer reviewable and performance-based.
- iii) Metrics should be transparent and comparison-enabling.
- iv) Data should be consistent and reproducible.

Mr. Terry McIntyre, Senior Science Advisor, Bio-fuels, Environment Canada, spoke of the need for better environmental information to support the claimed environmental merits of bio-fuels development in Canada. The purpose of this type of assessment work is to show that bio-fuels are making a positive contribution to the environment. His presentation is available at www.oecd.org/dataoecd/28/23/43457717.pdf.

Some of his key messages were:

There are many unknowns in Canada's baseline environmental data. Given the size of the country and its large regional diversity, the job of filling these data gaps is no small undertaking. He reviewed the main unknowns in 5 areas:

- i) Biomass feedstock selection and harvesting.
- ii) Biomass conversion to bio-fuels and other co-products.
- iii) Blending, transportation, storage and distribution of bio-fuels.
- iv) Tail pipe emissions from combustion of blended bio-fuels.
- v) Spills of bio-fuels and fate in ambient environment.

⁸ Products must also meet product performance standards, and have a minimum bio-based content.

⁹ Consensus standards used to develop BEES: Environmental Life-Cycle Assessment (ISO 14040); Multiattribute Decision Analysis (ASTM E1765); and Life-Cycle Costing (ASTM E917).

Because of these unknowns, the claimed benefits are for the most part theoretical, and might considerably overestimate what is actually achieved. Mr. McIntyre provided examples of several government-funded research activities that are underway to help fill these info gaps while noting that the environmental assessment requires a scientific approach, and the indicators need to be measurable.

Environment Canada is developing environmental sustainability indicators and metrics:

- Indicators are defined as a variable that can be measured, derived, estimated or calculated.
- Metrics, in turn, provide an operational definition of sustainability; qualitative to quantitative measure of sustainability and measure aspects of sustainability and will be used as a comparative tool to assess different technologies.

To have a credible sustainability scheme, Dr. McIntyre proposed that we need environmental performance standards:

- Need standards or set of criteria which defines what is “sustainable”
- Independent certification or verification to confirm standard is implemented
- Accreditation to control certification bodies
- Product traceability /supply chain control

Mr. Joel Velasco provided an industry perspective as a representative of UNICA (Brazilian Sugarcane Industry Association). His presentation illustrated how Brazil’s sugarcane industry, which has been under the spotlight regarding sustainability, is making its case. Mr. Velasco’s presentation did not address assessment methodology, but presented the type of information stakeholders (*i.e.* assessment results) that people are asking for. His presentation is available at www.oecd.org/dataoecd/29/1/43457520.pdf.

The following are examples to frequently-asked questions that UNICA needs to answer to respond to its critics:

- Why do bio-fuels make sense for Brazil? - Brazil has flex fuel cars and an ethanol distribution system (92% of new cars sold are Flex Fuel and they use ethanol 80% of the time)
- What is the efficiency of ethanol production on land basis and how does it compare to other bio-fuel crops? 800 gallons of ethanol produced per acre – much higher than other crops
- What is the energy balance and how does it compare to other bio-fuels? - better
- What are the GHG reductions and how do they compare to other bio-fuels? - better
- How does the carbon uptake of sugar cane compare with pasture and other land uses? - Carbon uptake for cane is greater than that of pasture land in Brazil
- How does the price of ethanol compare with that of gasoline? - Since 2005, the price of ethanol has been consistently below that of gasoline
- Where sugarcane is actually grown in Brazil? - In South-eastern Brazil, not in or near the Amazon Rain Forest; this can be validated with satellite images
- How much land is used for bio-fuel production? - 1% of Brazil’s arable land displaces 50% its gasoline consumption
- Is food production compromised? - Food production in Brazil is increasing due to gains in yields
- Has income changed? - Average income has been on the rise

- What social investments are being made? - UNICA is the first trade association to make GRI social-environmental investments; most of these have targeted healthcare.

The industry is working hard to show that sugarcane ethanol produced in Brazil works from economic, environmental and social perspectives.

V. Main Discussion Points

There was a consensus amongst participants that there is a need for a best practices guidance document. The best practices document should be high level, focused on principles that guide assessments and not be too prescriptive. There was also concern that if this document is not developed soon that the existing vacuum will be filled by a range of third party labelling processes.

The participants were supportive of this OECD initiative and, in essence, said *“let’s clarify some points and move ahead”*. To start the process the participants’ advice was *“Let’s get a good understanding of the initiatives underway and identify where the OECD Task Force can complement and contribute to these efforts.”*

During the workshop, participants were invited to work in small groups and using the presentations and the experience of the experts to:

- Propose what should be included in the OECD best practices document to plan for and assess the sustainability of bio-based products; and
- Define the scope for such best practices.

In order to facilitate this discussion, the project team asked participants to focus on specific themes related to sustainability assessment of bio-based products.

The sections below provide a summary of the discussions and organised by theme and sub-topic.

Assessment goal and scoping

Assessment scope

- The key scoping question is “Where do you start the analysis?”
- The primary purpose of assessments should be to make comparisons rather than “absolute” judgments.
- There should be a requirement to clearly specify: who is the sustainability assessment is being done for; why is it being done; and who is it doing it?
- One comment that summed up the thoughts of many was *“Look at what exists first and then address gaps”*.

Level of detail and overall organisation

- Many participants felt that there is a need to develop a “higher level” and then move to a more detailed document depending on content. One group suggested a two part approach – first agree on principles and then agree on which indicators to use.

Include a three pillar approach

- Most participants acknowledged the need to address all three pillars of sustainability in the framework, but there was no consensus about how to do that – in fact most felt that it was important to focus on the environmental dimension first.
- Some participants felt that the best practices should include social and economic components along with environmental while others were uncomfortable with prescribing social and economic methods (*e.g.* Cost-Benefit Analysis).
- Despite being able to further define how to approach the social dimension, many were reluctant to leave it behind. Others discussed health in the same manner.
- It was suggested that an effort should be made to highlight best practices that address the social dimension.

Definitions

- Any further work should include clear definitions for best practice, goal, indicator, objectives, and so forth.
- There is a need to clearly define bio-based and bio-based products, and a need to include bio-fuels.

Target audiences

- The key target audiences are policy makers first and then practitioners. The preference is for a guide for practitioners (detailed) and a high level guidance document for policy makers.
- However the point was made that there are several key audiences beyond above – important secondary audiences that need to be considered. They included private sector companies, consumers and the general public.
- Public awareness, understanding and acceptance are all essential. One participant stated *“Consistency and credibility are needed to support public education and awareness built on evidence.”*

General advice

- One groups stated simply “Let get started.”
- There is a need to align with other OECD groups working on the same topic.
- If science is to support policy, there was a question “Do we have tools needed to do this?”
- We need to be more innovative and look at public participation in sustainability science.

General principles (to be considered while assessing the sustainability of bio-based products)

- The goal should be to make the information more accessible.
- It is important to get agreement on the principles. It was felt that the OECD has to define principles first, and then find the best practices.

- Independent peer review is needed.
- It is important to ensure that trade protectionism is not supported through the principles.

Best practices advice

- Note there is a distinction between “standard practice” (which is legally accepted/lower level) and “best practice”.
- Participants felt that social best practices should be referenced where good practices are emerging.
- There were questions about where to start with no agreement. Some favoured a focus on seed to disposal, *i.e.* cradle to grave for best practices, while others selected harvest as the starting point.
- Some suggested a focus on best practices that provide absolute data and then a move towards weighting or other tool for tradeoffs.

Assessment framework

General Advice

- The framework is important because it sets the context for the assessment.
- There is a problem with comparability or consistency between different frameworks. There is a desire from some to move to a simple, high level process.
- There is a concern that the data becomes obsolete quickly.

Life Cycle Assessment (LCA) Issues

- It was suggested that the OECD use the phrasing from LCA ISO documents, as much of this has already been worked out for LCA. Confusion over which form of LCA to use can be eased this way.
- It was noted that the OECD needs to be careful not to preclude non-LCA approaches in goal scoping statements.
- There was considerable discussion about LCA with considerations of the benefits of consequential LCA *vs.* Attributional LCA. Certainly there was no consensus on the use of LCA.

Operational method

- Data comparability is essential and uncertainty needs to be applied to the data.
- Weighting was discussed. Some felt that it was practically impossible to do this without weighting, while others disagreed. The main concern is that weighting may push problems away and shift impacts.
- Operational method must incorporate other assessment approaches, including environmental impact assessment (EIA), strategic environmental assessment (SEA) and risk assessment.
- There should be a requirement to reference data quality and reporting format.

Indicator selection

Desired characteristics

- Indicators should be direct and unambiguous.
- Indicators can be quantitative or qualitative or a combo.
- Non-directional indicators are preferred.
- The objective of indicator selection should be to achieve comparability and transparency.
- The overall goal is to promote innovation.
- There is concern about using indicators as trade barriers.

Thoughts on process

- The best practices document should reference existing documents on indicator selection.
- National sustainability indicators used should be consistent with one or several of accepted international frameworks and should include a set of core indicators that are validated, widely used and practical for the sustainability evaluation of bio-based products.
- There is a need for a framework for indicator selection.
- There is a need to address the weighting of indicators and we need a system for this or guidance on how to do this.
- For core indicators we need a high level of agreement *e.g.* conservation of water.
- There was some question about if the best practice document will be an outline/guidance document or if it will specify indicators. The follow up suggestion for specific indicators is to divide residues *vs.* crops and account for methodological aspects/differences.

Thoughts on sharing information about indicators

- There was an acknowledgement that an information sharing system would be an excellent resource. It was noted that a knowledge database needs to be established for past work and that it should be maintained by an agency, university or similar institution. The Knowledge-based Bio-economy inside the European Commission is an example of a knowledge sharing initiative.

Thoughts on social indicators

- There are data gaps in social sustainability that still need work. It was suggested that there is a need for specific research on social indicators at the university level.

Data and knowledge gaps

- Credibility and public trust in assessments are important to maintain.
- Stakeholder engagement and public communication are important parts of the process.

- Public awareness and acceptance of the eventual outputs (labels, recommendations, assessments, *etc.*) is important.
- There is a need to deal with privacy rights and confidential information.
- Some suggested that sensitivity and uncertainty analysis must be common practice.

VI. Concluding Remarks

Sustainable development, or sustainability as many people refer to it today, is bigger than bio-based products...

It is about meeting today's needs (ecological, economic and social) without compromising the ability of future generations to meet their needs. Science is telling us that we have some environmental issues to address and ecological damage that need to be repaired. We need to be smart about our next development decisions.

The use of renewable feedstocks to produce needed products and adoption of efficient, clean and safe biotechnologies are considered to be part of the solution. There is also a need to do better at closing the loop – using discarded materials as feedstocks, instead of solely relying on resource extraction. At the same time, there is a need to develop land use practices that regenerate or enhance the earth versus slowly erode its potential - a regenerative agriculture.

There are many opportunities for biotechnology to make a positive contribution...

A lot is happening in the area of sustainable development. Research is underway to develop practical assessment methodologies. Social assessments are being incorporated into some life cycle environmental models. In the biotechnology area, bio-fuels assessment is in the lead with the need to prove its real environmental and social benefits. What isn't always clear is what we are trying to achieve? What we are aiming for?

One of the workshop speakers suggested that our design goal should be to “*highly desirable alternate futures characterised by resilient systems*”. The use of tools of fore sighting and fundamental principles such as The Natural Step's system conditions to describe these futures might be of help.

Numerous sustainability schemes are currently under development, and they identify “principles, criteria and indicators” for sustainability assessment. The principles and criteria are a way to provide limits to our human activities. The German report “*Criteria for sustainable bio-energy use on a global scale*” proposed the following principles related to bio-fuels and bio-energy production:

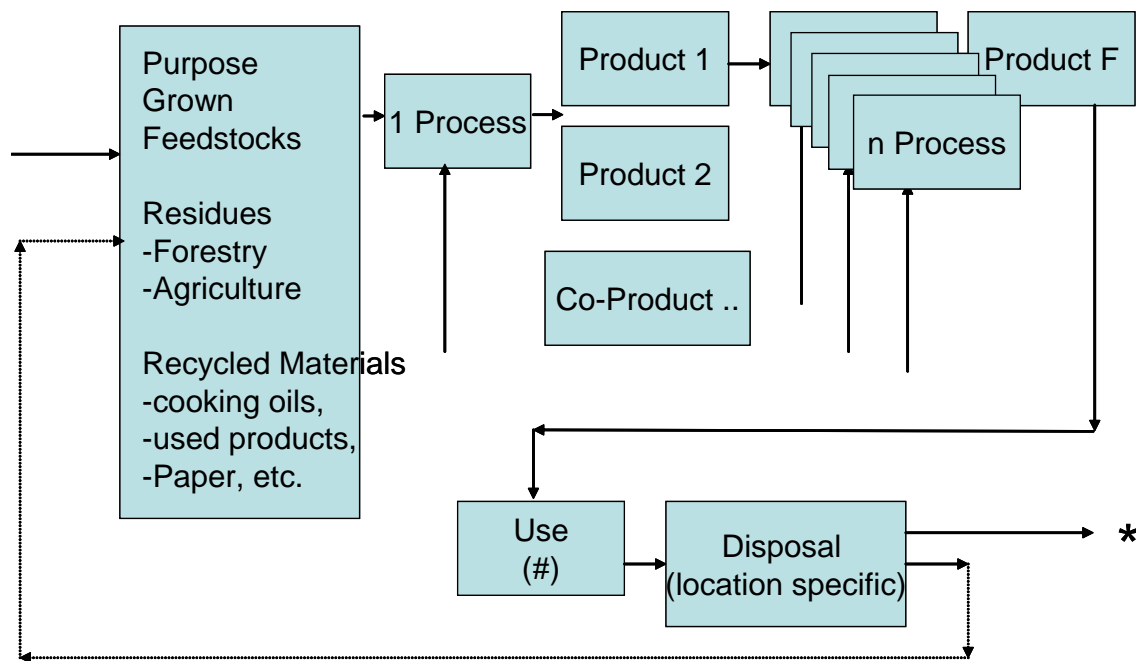
Principles - Ecological

- There must be a significant contribution to GHG reduction.
- Minimisation of negative consequences of indirect land use changes and compensation of competing land use.
- Exclusion of the loss of biospheres with high natural value (HNV).
- Exclusion of the loss of biodiversity.
- Negative effects on soil, water and air must be minimised.

Principles – Socio-Economic

- The local population should not suffer any disadvantages, but should participate in the opportunities of biomass cultivation.
- Internationally recognised standards for working conditions should be observed.

Given the work underway, do we need to do something else or more for bio-based products? Do bio-fuels differ from other bio-based products?



As shown on the above scheme, bio-fuels could be considered as simpler bio-based product systems. From feedstock, bio-fuels are converted into fuel in one process, blended and “ready for use”. Use and end of life are essentially one in the same for bio-fuels. There typically no opportunity for capture and reuse of the combusted products (at least not from mobile sources).

Other bio-based products would share the “biomass feedstock” stage with bio-fuels assessment. However other bio-based products can go through numerous processing stages, and given our globalised world, processing can take place in several different countries. The final products are generally a blend of bio and non-bio intermediates. Depending on the product, bio-based products can sometimes be decomposed and other times reused or recycled. At some point, they will be returned to the environment.

At a minimum it can be said that bio-based product assessment shares “biomass feedstock processing with bio-fuels” but that it involves more processes and life cycle stages. The scope is broader and more data will be required.

Should the OECD develop “Best Practices for Sustainability Assessment of Bio-based Products”?

The workshop participants appeared to agree. The speakers stressed that we need international agreement and provided strong justification that included the loss of consumer confidence, cost burden and potential trade conflicts – if we don’t have international agreement on how to assess our bio-based technologies and products.

It appears logical to recommend that the OECD knows the scope and timeline of these initiatives, and finds ways to work in concert with relevant initiatives such as:

- EU standardisation programs for bio-based products – M/429 and M/430; Working groups on Bio-polymers and Bio-lubricants are expected to release technical standards next year.
- ISO PC Several ISO/PC 248 Sustainability Criteria for Bio-energy; this work is just starting and will include bio-fuels.
- Industry association initiatives; several large multinationals are seeking to green their supply chain and be more socially responsible; they seek to influence all of their suppliers including biomass producers and manufacturers of bio-based products.

In terms of approach, it was unanimous that a life cycle thinking (LCT) approach should be adopted...

However, in terms of assessment, both the presenters and participants acknowledged that there is no “one size fits all” assessment. The type of assessment is determined by the purpose and objective of the sustainability assessment. Is it to develop supportive policies, to show that product A is superior to product B, to confirm that a bio-based products facility is realising its claimed environmental benefits, or to qualify a product for a subsidy or tax incentive, etc.?

Defining the purpose of the assessment will identify the broad dimensions should be assessed. As discussed in the paper “Metrics to Support Informed Decision-making for Consumers of Bio-based Products” prepared by USDA¹⁰, to assist consumers with the selection and use of bio-based products, first and foremost, the product needs to meet the same performance standards as the non-bio-based product it is substituting. In terms of the broad dimensions to be assessed, they were found to include: bio-based content, lifecycle environmental performance and life cycle cost.

Knowing the purpose, objective and the broad dimensions, we can then decide on the “how”, that is:

- Type of assessment – measurement or modelling, quantitative or qualitative, “stand alone” dimension or integrated.
- Scope of the system.
- Methodology (*e.g.* functional unit, source of inputs, software, *etc.*).
- Required resources, *etc.*

¹⁰ Paper is posted: www.oecd.org/dataoecd/37/48/42400999.pdf.

Use of LCA for Environmental assessment ...

It was recognised by all participants that life cycle assessment (LCA) is a tool that can be used to quantify the potential benefits and impacts generated during the life cycle of a product - from raw material production or extraction, material production, manufacturing, use to end-of-life treatment. It can be very effective in helping to avoid the unintentional shifting of burdens.

An LCA is more than an energy or GHG assessment, it should include all relevant problem areas, *e.g.* global warming, ozone depletion, acidification, eutrophication, resource depletion, toxicity, smog formation, water pollution, *etc.*

It is not an exact measurement as it is not feasible to measure every input and output in a product lifecycle. While the use of measurement data is encouraged, LCAs often have to rely on industry or sector averaged data from commercial databases.

There are well established rules, developed by ISO, on how to carry out an LCA. Nevertheless, there is significant variation in LCA results resulting from the purpose of the assessment, system boundaries, data limitations, software, interpretation of the results, *etc.*

Work is underway to further improve the quality of LCAs through the establishment of a common database, further guidance on allocation rules, uncertainty techniques, *etc.* In addition, with respect to bio-based products, it was suggested that more work is needed to better understand:

- Sustainability issues related to production and harvest of aquatic resources.
- Co-product allocation.
- Product use phase in different countries.
- Product disposal in different countries.

There have been significant advances in LCA software and databases since the 1990s, and today there are many new users. However, there is a lack of interpretation capacity, *i.e.* people with the sufficient experience to carry out interpretations of complex analyses. Training and certification programs are starting to emerge.

Sustainability assessments should include the social and economic dimensions...

There was agreement that social and economic dimensions should be included in sustainability assessments. Ms. Barbara Lippiat mentioned that life cycle costing (following ASTM E917) was the approach adopted in BEES for product evaluation.

These two dimensions were not discussed in much detail likely because the strength of the participants and experts was in the area of “environmental assessments”. It is recommended that future work includes economists and social scientists to better cover these dimensions, as well as sustainable development practitioners who can describe multi-criteria assessment tools, *etc.*

UNEP SETAC published in 2009 Guidelines for Social Life Cycle Assessment¹¹. This document provides high level guidance for how to incorporate the social dimension into lifecycle work

¹¹ http://lcinitiative.unep.fr/default.asp?site=lcinit&page_id=A8992620-AAAD-4B81-9BAC-A72AEA281CB9

Practitioners are working on the inclusion of social indicators in LCAs by linking to the GTAP database. Therefore, it would be valuable to follow this work.

Communication of assessment results...

Communication is never an easy task. But communication of complex issues, such as sustainability is even tougher. Surveys from the “food consumer products” area may provide some valuable insight for other bio-based products. Consumers appear to be increasingly overloaded with product information. In addition to nutritional information in the country’s required languages, consumers can now find information on the ingredients country of origin, potential allergic reactions, fair trade, and yes ... sustainability.

While consumers want assurances that their product purchase is a more sustainable choice, they don’t want the purchasing process to become more complicated or too confusing. The “best practices” could provide suggestions regarding communication to different audiences.

VII. WORKSHOP AGENDA

OECD Workshop on Best Practices in Assessing the Environmental and Economic Sustainability of Bio-based Products

Thursday, 23^d July 2009

Venue: Delta Centre Ville, Montreal

Keynote Address: *Mr Harvey Mead (former Sustainable Development Commissioner, Province of Quebec)*

Introduction: *Ms Benedicte Callan (OECD)*

Chair: *Ms Benedicte Callan (OECD)*

Facilitator: *Mr Don Grant (Stantec, Canada)*

Session I – Current Approaches to Planning for and Assessing the Sustainability of Bio-Based Products

Speakers:

Mr Michele Galatola (European Commission): “Environmental Sustainability Assessment of Bio-based products: current activities and future options”

Ms Barbara Lippiat (US): “Sustainability Assessment of Bio-based Products in the U.S.”

Mr Olivier Jolliet (University of Michigan, USA): “Life Cycle Assessment of Biodiesel compared to other biomass uses”

Mr Joel Velasco (UNICA): “Towards Sustainable Bio-fuels in Brazil - UNICA’s Efforts”

Objectives of the session: *This session reviewed the sustainable development context and some of the existing approaches for planning for and assessing the sustainability of bio-based products in different context*

Roundtable Discussion

Questions addressed:

- Is there a need for an internationally agreed instrument that identifies best practices in the assessment of the sustainability of bio-based products?
- What are the most important or influential assessment methodologies?
- What are their objectives, and what sustainability pillars are covered?
- How comprehensive are the different approaches identified (*e.g.* cradle-to-cradle; cradle-to-grave)?
- What are the current limitations, gaps or uncertainties that remain in these approaches?

Session II – Key Issues and Parameters in Assessing the Environmental and Economic Sustainability of Bio-Based Products

Speakers:

Mr Robert Anex, (US, Iowa State University): “Searching for Sustainability: The Best as the Enemy of the Good”

Mr Terry McIntyre (Environment Canada): “In Search of the “Holy Grail”- Baseline Environmental Data to Help Support Biofuels and Canada’s Sustainable Development Agenda”

Mr Guido Reinhardt (IFEU, Germany): “Towards criteria for the sustainable use of bio-based materials: lessons learnt from biofuels”

Objective of the session: *This session identified what key issues and parameters/indicators currently can be assessed and what test methods can be used to confirm whether parameters have been met; and to agree what combination of parameters constitute a comprehensive assessment.*

Roundtable Discussion

Questions addressed:

- What parameters/indicators are used for assessing environmental and economic sustainability of bio-based products? How practical are the parameters/indicators in terms of their use for industrial and public policy development?
- What should constitute the minimum set of parameters used in assessing environmental and economic sustainability of bio-based products?
- Can one set of parameters be applied to different groups of bio-based products?
- What might be the means to select and evaluate parameters in a systematic way?
- Is it possible to build a flexible system of parameters and tools that would serve various national/regional needs?
- Are there data available to accurately evaluate the parameters? If not, how it could be gathered?

Session III – Discussion on Best Practices in Assessing Sustainability of Bio-based Products

Introduction: *Alexandre Bartsev (OECD) on “OECD Best Practices”*

Instructions by Facilitator

Objectives of the session: *Based on the experience of experts and previous presentations, proposals on what should be included in best practices for planning for and assessing the sustainability of bio-based products; to define the scope for such best practices; to discuss the need for an international standard in this area given the different initiatives that are underway*

Roundtable Discussion

Questions addressed:

- What sorts of assessment best practices would be most helpful for policymakers and for what sorts of decisions?
- What should be the scope of Best Practices for assessing sustainability of bio-based products (*e.g.* parameters/indicators; pillars of sustainability; groups of products concerned; groups of targeted stakeholders?)
- Are there core methodologies that should be used in sustainability assessments (*e.g.* bio-content, LCA, LCC, etc.)
- What are the points of commonality (*e.g.* similar set of parameters/indicators, assumptions) between the different methodologies?
- Could the current bio-fuel-related national/international sustainability assessment methodologies be expanded for assessing other bio-based products?

Friday, 24 July 2009

Recapitulation of Day 1 – Saeed Khan (Industry Canada)

Session III(continued) – Discussion on Best Practices in Assessing Sustainability of Bio-based Products

Session IV – Next Steps – Towards Implementation

Speaker: *Mr Kevin Boehmer (Canadian Standardisation Organisation): “Use of Voluntary Standards for Sustainable Bio-based Products”*

Objectives of the session: *This session discussed possible next steps such as alignment with other initiatives, movement towards the development of standards*

Roundtable Discussion

Questions addressed:

- Who should OECD include as stakeholders in developing best practices?
- What other initiatives should we be aware of /coordinate with?
- How can one balance the sustainability goals of different stakeholders (e.g. policy community and a wide range of industries concerned) while developing best practices?
- How can best practices be practically used (implemented)?

Rapporteur’s report and Closing Remarks by the OECD