

GBEP Working Group on Capacity Building for Sustainable Bioenergy (WGCB)

3rd Bioenergy Week Summary *Medan, Indonesia, 25-29 May 2015*

The 3rd GBEP Bioenergy Week was successfully held from 25 to 29 May 2015 in Medan, Indonesia, as part of efforts of the GBEP Working Group on Capacity Building for Sustainable Bioenergy to facilitate cooperation and capacity building on the potential benefits of sustainable modern bioenergy.

The event was hosted by the Government of Indonesia in cooperation with the GBEP Secretariat and the support of the Governments of Brazil and Italy, as well as of the International Energy Agency, the Asian Development Bank and GIZ. The event gathered around 120 participants from the Americas, Africa, Southeast Asia and Europe among scientists and government officials, including also representatives of the private sector, in particular from Asia, to discuss on specific sustainability themes that are of key interest for the region.

As a follow up to the 1st GBEP Bioenergy Week held in 2013 in Brazil and to the 2nd Bioenergy Week held in 2014 in Mozambique, the Medan event allowed having the opportunity to learn from positive experiences in the sustainable production and use of bioenergy that could guide the design and implementation of bioenergy policies in the interested countries. Furthermore it provided the opportunity to continue a dialogue with the Asian private sector and stakeholders on ways to improve mutual cooperation towards a more sustainable production and use of bioenergy.

Opening session

The 3rd Bioenergy Week was opened by welcome speeches of *Ms Maria Michela Morese*, GBEP Executive Secretary, *Ms R. Sabrina*, Assistant to the Governor for North Sumatra Province, *Counsellor Mr Rodrigo Andrade Cardoso*, from the Embassy of the Federative Republic of Brazil, *Mr Tisnaldi*, from the Ministry of Energy and Mineral Resources of Indonesia, and *Mr Nani Hendiarti*, Assistant to the Deputy Coordinating Minister for Maritime Affairs of Indonesia.

All speeches highlighted the added value of the 3rd Bioenergy Week in Indonesia to discuss sustainability themes which are of key interest for Asia, but not only, covering all three pillars of sustainable development, which holistically combine the environmental, social and economic aspects of development. It was also stressed the main aim of the event to learn from positive experiences in the sustainable production and use of bioenergy, which may guide the design and implementation of bioenergy policies in the interested countries, as well as to continue a dialogue with private sector and stakeholders on ways to improve mutual cooperation towards a more sustainable production and use of bioenergy.

GBEP was also praised for its enormous contribution to the sustainable development of bioenergy, in particular with the important discussion that brought the GBEP community to agree on a set of sustainability indicators for bioenergy and its implementation in several countries, in order to guide policy-makers towards a sustainable development path.

Bioenergy development and regulatory frameworks in Asia

Speakers in this session, moderated by *Mr Yandra Arkeman* (Surfactant Bioenergy Research Centre - SBRC), gave an overview regarding the role of bioenergy at the global level and in the Asian region.

Mr Keisuke Sadamori (IEA), gave an overview of both current and projected trends in bioenergy production and use. The share of bioenergy in heat and power generation and in the transport sector has grown significantly in recent years and this trend is expected to continue in the medium term. However, biofuels production is falling behind the targets set by the IEA Biofuel Roadmap in its low CO₂ scenario. In order for bioenergy to provide a growing contribution to energy needs and play a very important role in low-carbon energy scenarios in each energy sector, the following issues must be addressed: ways to reduce costs of the energy delivered so as to reduce the need for financial support; the resolution of outstanding sustainability uncertainties; the development of cost effective and sustainable supply chains; and the development of supportive policy and regulatory frameworks appropriate to the maturity of the technologies and markets.

Ms Rosemarie Gumera (Philippine Sugar Administration) briefly described the bioenergy regulatory frameworks of the countries in the Asian region. Most of these countries have put in place biofuel mandates with stepping up targets. However, as emerged during subsequent discussions, effective implementing measures are still lacking in some cases and oftentimes production has fallen short of mandates, due mainly to inadequate feedstock supply.

Mr Edi Wibowo (Indonesian Ministry of Energy and Mineral Resources) provided an overview of the Indonesian bioenergy sector and of the related regulatory framework. In 2014, renewables accounted for 6% of total primary energy supply in Indonesia. According to the National Energy Policy approved in 2014, this share should increase to 17% in 2020 and 23% in 2025, when bioenergy alone should account for 10% of total primary energy supply. Furthermore, ambitious biofuel mandates have been introduced, with the blending of biodiesel into traditional diesel in all sectors rapidly increasing from 15% in 2015 to 20% in 2016 and 30% in 2020. Biogas production (at both domestic and industrial levels) and biomass-based power generation have been growing as well, with the latter supported by a feed-in tariff system. Mr Wibowo also discussed the next steps for the further development of the bioenergy sector in Indonesia, including: monitoring and evaluation of the implementation of the biofuel mandates; increased productivity of biofuel feedstocks and development of dedicated, non-edible feedstocks; and development of second-generation biofuels, including through cooperation on R&D.

Mr Sunil Dhingra (TERI, India) discussed both the current and future potential role of bioenergy in India, where there is a large biomass resource base. Currently, the Indian bioenergy sector is focused around the following technologies: gaseous biofuels (i.e. producer gas, biogas); biomass-based electricity (i.e. small-scale using gasification, large-scale using steam route); and both first and second generation liquid biofuels. Each of these technologies has a strong growth potential in India, where the Government has identified a number of focus areas, including: development of fast growing species (e.g. bamboo); utilization of degraded forest / wasteland for production of biomass resources for electricity production; utilization of agricultural and forestry residues for briquetting and power generation; and biomass use for efficient cooking applications. In order to fully exploit the bioenergy potential in India, Mr Dhingra recommended a number of actions, including: development of improved dedicated bioenergy feedstock production systems and of advanced bioconversion technologies; development of bioenergy markets and supply chains and improvement of the related infrastructure and logistics; mapping of current and future biomass energy flow on a GIS platform; and analysis of the sustainability of biomass / bioenergy production.

Mr Takashi Hayashi (Ministry of Agriculture, Forestry and Fisheries of Japan) presented the 'Biomass Town' concept and then described the procedures for developing Biomass Town plans, providing examples of the design and implementation of such plans in Japan and in ASEAN countries. The Biomass Town is an area where a comprehensive biomass utilization system is established and operated through the cooperation of various stakeholders in the area. The Biomass Town Plan is a planning document that describes the target area characteristics, implementing bodies, goals and effects, procedure of developing the Plan, biomass potential, and biomass utilization, all of which eventually contribute to building consensus among various stakeholders to formulate the Biomass

Town. Since 2005, around 300 Biomass Towns have been developed in Japan. In addition, the PRIMAFF supported the formulation of Biomass Town Plans in four pilot areas in Indonesia, Malaysia, Thailand and Viet Nam. Building on these successful experiences, the Biomass Town concept should be scaled-up and replicated in the region, and the awareness of local communities about this concept and the related benefits should be promoted.

Social sustainability - Smallholder involvement and development opportunities

This session, moderated by *Mr Andrea Rossi* (FAO), was aimed at sharing best practices as well as discussing and identifying capacity development needs related to social sustainability of bioenergy.

Mr Thomas Wagner (Pt Austindo Aufwind New Energy) showed how in parts of Indonesia the electrical grid is subject to shortages during peak hours. In addition, in most of the country the electrification ratio is still relatively low (i.e. below 70-75%). The methane emitted by the decomposition of palm oil mill effluent (POME) can be captured and used to generate electricity, which can be fed into the grid, contributing to improve the quantity and quality of the power supply, while providing an additional source of revenues for palm oil producers. Mr Wagner described a project of this type that was implemented on the Belitung Island in Indonesia under the Clean Development Mechanism (CDM), where a palm oil mill with a capacity of 60 tph was equipped with a biogas power plant with a capacity of 1.2 MW increasing to 1.8 MW from Q3-2015. The electricity generated by this plant, which is enough for more than 2 500 small households, is saving 2 million USD in energy subsidies annually. After the presentation delivered by Mr Wagner, *Mr Wira* (PT Bhakti Mukti Bukti) presented another interesting case study from Bali, where community-based power generation from bamboo (including in terms of residues from handicraft making) has been found to be a cost-effective way to improve the reliability of power supply in the area.

Ms Lina Moeis (Yayasan Rumah Energi) described the Indonesian Biogas Program, under which almost 15 000 biogas digesters have been installed to date. A number of organizations are contributing to the implementation of this program together with the Indonesian Ministry of Energy and Mineral Resources, such as SNV and Yayasan Rumah Energi (YRE). Combined, these organizations cover all steps of the biogas supply chain.

Mr Chan Saruth (Ministry of Agriculture Forestry and Fisheries of Cambodia) provided an overview of biomass availability and use in Cambodia, where the following bioenergy pathways can be found: biogas production from animal waste; gasification of agricultural residues; biodiesel production from Jatropa; and ethanol production from cassava. The Government of Cambodia is actively promoting an efficient and effective use of biomass and especially residues both for energy generation and as soil amendment (e.g. bioslurry and biochar). Biochar, in particular, has been found to have very positive effects both in terms of productivity and soil carbon sequestration. Agriculture residues can thus contribute to increase both energy and food security. As reported by Mr Chan, the Government of Cambodia is now planning to raise the awareness among relevant stakeholders, promote better information sharing and extension of the technology, support research and development, and carry out training workshops and field demonstrations.

Mr Ahmed Abdelati (Ministry of Agriculture and Land Reclamation of Egypt) discussed about the importance of public awareness and multi-stakeholder engagement in the context of programs and projects addressing sustainability. To provide examples he described two projects, one on the installation of biogas fermenters along the North Western coast of Egypt, and one on the installation of units for the gasification of rice straw and agricultural residues in the Nile Delta. He then walked the audience through the main steps that should be followed in order to design and implement a public awareness strategy, namely: pre-feasibility stage; configuration stage; application stage; stability stage; and follow-up stage. Mr Abdelati also shared some lessons learnt, such as the importance of

understanding and respecting local values, the need to always maintain a neutral role with respect to any possible conflicts, and the importance of setting clear and realistic goals and timelines.

Mr Mansuetus Duarte (Oil Palm Smallholders Union, Indonesia) provided an overview of the main opportunities and challenges related to the involvement of smallholders in the palm oil supply chain in Indonesia. The need for a fundamental market transformation was stressed in order to address the aforementioned challenges and ensure a stronger and more effective engagement of oil palm smallholders. In particular, Mr Duarte highlighted the importance of strengthening the capacity and increase the productivity and sustainability of smallholder-based production, e.g. through improved agricultural practices, seeds and fertilizer. National policies and regulations and the National Development Plan should be revised so as to address more effectively and through a more inclusive approach issues of relevance to oil palm smallholders. Financial institutions have an important role to play as well, by supporting pioneering approaches and initiatives that contribute to the needed market transformation and by ensuring increased access to capital for smallholders.

Mr Harry Hanawi (Partnership for Indonesia Sustainable Agriculture – PISAgro) highlighted the importance of palm oil for the Indonesian agricultural sector and economy in general. He also discussed the main advantages of palm oil in relation to other vegetable oils, especially in terms of productivity per hectare and versatility. He then presented the Partnership for Indonesia's Sustainable Agriculture (PISAgro) initiative, which aims to increase oil palm yields by 20%, reduce GHG emissions from the sector by 20%, and reduce poverty of local communities by 20%. Mr Hanawi also described the Palm Oil Replanting Program and its innovative financing mechanism. This program aims to increase the average yield of smallholders from 2 to 5 or 6 tons of crude palm oil (CPO) per ha, decreasing the amount of new land required by 1 million ha.

Economic Sustainability - Increasing energy security and energy access

This session, moderated by Mr *Do Trong Hieu* (Viet Nam), encompassed eight presentations aimed at sharing best practices related to economic sustainability of bioenergy with particular focus on increasing energy security and energy access.

Mr Paulus Tjakrawan (Indonesia Biofuels Producer Association) provided an overview of the Indonesian palm oil and biodiesel sectors, of their growth prospects and of the related challenges. The Indonesian palm oil-based biodiesel industry is highly competitive, especially thanks to the high productivity of palm oil compared to other vegetable oils used to produce biodiesel. Recently, the Indonesian Government has significantly raised its biofuel mandates and has extended them to all sectors, leading to an increase in the domestic demand for biodiesel from 5.5 billion liters in 2015 to 16.2 billion liters in 2020 and 23.8 billion liters in 2025. This will result in a sharp increase in the demand for palm oil, considering also that at the same time Indonesia plans to continue expanding its exports of crude palm oil. Mr Tjakrawan briefly discussed also the Indonesia Sustainable Palm Oil (ISPO) Standard, which is a mandatory sustainability scheme for palm oil producers which comprises a number of sustainability criteria, including in relation to the issue of methane capture from POME. Finally, he concluded his presentation with a list of challenges facing the Indonesian palm oil-based biodiesel industry, including the sustainability requirements of key importing markets such as the European Union and the United States, which were presented as 'trade barriers'.

Mr Lattana Phaxaysombath (Ministry of Agriculture and Forestry of Lao PDR) explained to the audience that in Lao PDR biomass accounts for 68% of primary energy consumption. In particular, the majority of households relies on fuelwood as their main source of energy for cooking and uses inefficient cookstoves. For this reason, the Ministry of Agriculture and Forestry of LAO PDR has launched a Clean Cookstoves Program, which Mr Phaxaysombath described in his presentation. The Program aims to scale up access to clean and efficient stoves in LAO PDR, promoting the use of agricultural residues and reducing fuelwood consumption, including through support to research and

development of tools and equipment for building the cookstoves. The implementation of the Program has shown the importance of understanding – and taking into account – users’ behavior and cooking traditions and customs; and of promoting people awareness and knowledge.

Mr Do Trong Hieu (Ministry of Industry and Trade of Viet Nam) discussed about biofuel potential in Viet Nam and provided an overview of the related policy framework and of the main biofuel projects in the country. With regard to ethanol, sugarcane, maize and cassava are among the most promising feedstocks. In the case of biodiesel, the feedstocks with the highest potential are fish waste (from catfish farming) and coconut. Concerning the policy framework, Viet Nam has introduced stepping up blending mandates for both ethanol and biodiesel. In the case of ethanol, for instance, the mandate will increase from 5% in 2015 to 10% in 2017. The Government has also initiated a number of actions to support the development of the domestic biofuel industry and to protect it (e.g. through an ethanol import tax, which was set at 20% in 2014). With regard to ethanol, as of today there are four plants producing fuel ethanol and four blending stations. A number of challenges still remain that limit the development of the industry, such as instability of feedstock supply, lack of knowledge and consumption behavior, lack of adequate infrastructure for distribution, and volatile biofuel prices.

Mr Sunil Dhingra (The Energy and Resources Institute – TERI, India) presented the status of bioenergy in India and then discussed TERI’s experience in the development of biomass gasifiers for thermal application in MSMEs and for electricity generation in rural areas. Bioenergy has a strong potential for meeting India’s energy needs and for promoting a low-carbon development path. In India, over 650 thermal gasifiers have been installed in MSMEs. Replications have established biomass gasifiers as a cost-effective energy delivery system, generating positive spin-off effects within and across clusters, e.g. in terms of local manufacturing and services creating clean energy entrepreneurs and employment. Biomass gasifiers were found to have a payback period of 2 years. They lead to a reduction in the cost per unit of useful energy of around 50%, and to improved productivity and quality of end products due to better process/heat control. In addition, they act as a driver for a shift towards cleaner technologies/processes. However, a few challenges remain, including the need for customized/tailor-made system design for each end-use application, which impedes scale-up; the lack of supportive services; the lack of strong sustainable biofuel supply linkages and local delivery mechanisms; and information failure and consequent slow pace of technology upgradation. Bioenergy also has strong potential for meeting the electricity needs of households and micro enterprises in the rural areas of India, for instance through power plants running on agricultural and forestry residues and connected to local mini-grids.

Mr Rafael Wiese (Promotion of Least Cost Renewables in Indonesia, GIZ Energy Program Indonesia/ASEAN) described GIZ’s Energy Program in Indonesia and in the ASEAN region. Indonesia has set two very ambitious energy-related targets: 23% share of renewables by 2025 (up from 5% today) and universal access to electricity by 2019 (up from the 81% electrification ratio of today). The highest potential for biomass-based power generation is on the islands of Sumatra and Kalimantan, where there is a significant amount of residues from the production of rice, sugarcane and especially palm oil. A significant amount of electricity could be generated, in particular, from the methane captured from Palm Oil Mill Effluent (POME). Currently, only a limited share of mills is equipped with methane capture systems. In addition, power generation at palm oil mills equipped with such systems can be maximized by optimizing the biogas yield from the POME biogas system and by increasing additional power generation through energy efficiency. At the POME Biogas Plant in Belitung, measures were taken in order to address both of these aspects, through: the optimization of fermenter efficiency by adding nutrients, leading to 20% - 40% more biogas; and the improvement of steam efficiency through blow off steam recovery, the utilization of recovered heat, and the re-utilization of blow down steam as pre-heating. This, combined with the boiler operating 24/7 with all fibers/shells, led to additional excess power of around 3 MW. Beside the additional power generation, these measures can result in additional income for agro-industries and mitigation of GHG emissions.

Mr Marcelo Alves de Sousa (International Center on Renewable Energy-Biogas CIBiogás-ER) gave an overview of biogas production for both domestic use and industrial use in Brazil and of the related policy and regulatory framework in the country. At domestic level, biogas is used for cooking and for pumping water and agricultural slurry. At industrial level, biogas is further processed into biomethane, which is used to power vehicles and tractors. At both these levels, biogas production and use has been linked to a number of benefits in Brazil, including generation of income, enhancement of the rural economy, reduction of water contamination and eutrophication, production of biofertilizer, and enhancement of distributed energy generation. Mr de Sousa concluded his presentation with an overview of key follow-up actions related to the 2nd GBEP Bioenergy Week. In particular CIBiogás have signed Letters of Intent with Egypt, Ethiopia and Mozambique. In Mozambique, for instance, a 30-day training was offered on biogas systems and a Biogas Center was established in Bilibiza, while in Egypt and Ethiopia the English version of an e-learning course on biogas systems originally developed in Portuguese will be launched in July 2015.

M. Luigi Pari (Agricultural Research Council CRA-ING, Italy) presented the applied research that CRA-ING has carried out on both perennial and annual biorefinery crops supply chains, as well as on chipping systems and residues harvesting, among other things. He then showed various innovative systems and prototypes that CRA-ING has developed to: improve fiber sorghum harvesting; separate seeds and biomass of *Cynara cardunculus* (i.e. Cardoon) on stony soils; improve the harvesting and storage of *Arundo Donax*; and enable poplar felling and subsequent chipping between rows. Mr Pari also presented a number of tools that CRA-ING has developed and applied in order to assess residual biomass availability, analyze the land suitability for the introduction of new crops; and using crops according to a ‘cascading use of biomass’ approach. The presentation was very well received by the audience and a few participants expressed interest in receiving technical assistance in relation to some of the prototypes presented by Mr Pari.

Ms Seema Patel (Global Alliance for Clean Cookstoves - GACC) provided an in-depth overview of the mission and activities of the Global Alliance for Clean Cookstoves. Every day, three billion people (500 million households) rely on solid fuels to power their rudimentary stoves. This gives rise to significant environmental and socio-economic issues. The Global Alliance aims to save lives, improve livelihoods, empower women and protect the environment, by promoting the adoption of clean and efficient cookstoves by at least 100 million households by 2020. The Global Alliance for Clean Cookstoves uses a market-based approach built on three core strategies: Enable markets; Strengthen supply; and Enhance demand. With regard to fuel options, the Alliance focuses on improving the use of available fuels and on expanding access, affordability and scale of clean fuels. Towards the end of her presentation, Ms Patel listed the main challenges which are currently limiting the adoption of clean cooking solutions. These challenges include: fuel costs to the consumer; perception of safety by the consumer; reliable sources of the fuels within each country; challenges for distributing the fuels; and lack of supporting policies.

Environmental Sustainability - Mitigation and opportunities

This session was moderated by *Mr Shabbir H. Gheewala* (University of Technology Thonburi, Thailand) and focused on best practices related to environmental sustainability of bioenergy.

Ms Delima Hasri (Ministry of Agriculture of Indonesia) provided an overview of the Indonesian palm oil sector and of the related challenges and opportunities. The palm oil industry plays a key role in the Indonesia economy, providing millions of jobs. In 2014, exports of crude palm amounted to USD 17.46 billion, with India, China and Malaysia as the main importing markets, followed by the Netherlands. In the past couple of decades and especially in recent years palm oil production has increased significantly in Indonesia. This trend is projected to continue in the future and palm oil-based biodiesel is expected to play an increasingly important role in the Indonesian energy mix, thanks

mainly to the recent increase in the biofuel blending mandates. However, there are a few challenges that still need to be addressed. Among them, Ms Hasri emphasized the low productivity of independent smallholders, due to poor varieties (need for replanting) and limited access to capital, technologies and inputs. Another challenge faced by the Indonesian palm oil and especially palm oil-based biodiesel industries is the issue of the sustainability requirements and concerns of key importing markets. In order to foster sustainable palm oil production, Indonesia has introduced a mandatory sustainability certification scheme (Indonesia Sustainable Palm Oil – ISPO) and it is working with UNDP in order to help smallholders comply with it. In addition to the need to increase productivity and sustainability, Ms Hasri discussed, among other things, the importance of strengthening farmer organizations.

Ms Nongkran Maneewon (Ministry of Agriculture and Cooperatives of Thailand) provided an overview of the main advantages of organic fertilizers, especially in terms of soil quality and productivity. She then described a number of processes and best practices in the production and use of organic fertilizers in Thailand and she discussed the related benefits. However, there are a few challenges that limit the uptake of this type of fertilizers by farmers, including lower perceived effectiveness compared to chemical fertilizers, low credibility of suppliers and lack of motivation from extension agencies. Ms Maneewon described a number of initiatives that have been implemented in order to address these challenges and promote farmers' shift to organic farming practices, such as the Volunteer Soil Doctors programme.

Mr Nguyen The Hinh (Ministry of Agriculture and Rural Development of Viet Nam) discussed about biogas systems in Viet Nam and advantages and limitations of bio-slurry use. In 2014, there were a total of 26.7 million heads of pig and 427.7 million heads of poultry in the country. Biogas technologies are key measures for livestock waste treatment in Viet Nam. In 2014, there were around 500,000 biogas digesters in the country, with a target of 2 million by 2020. A by-product of biogas production is bioslurry, which cannot be directly discharged into water bodies according to the Vietnamese law. Bioslurry may be a good quality organic fertilizer. However, there are some challenges limiting its use, e.g. the distance from fields/gardens of livestock-producing households, which continue discharging bioslurry into water bodies. In addition, among the challenges Mr Hinh mentioned the low nutrient concentration, the high labor cost linked to its use and the lack of commercial-scale technologies and demonstrations. Finally, he presented two models that have been recently identified for the efficient use of bioslurry in Vietnamese pig farms.

Mr Shabbir H. Gheewala (University of Technology Thonburi, Thailand) presented the results of two analyses that were performed in order to assess the impacts on water resources of increased ethanol and biodiesel production in Thailand, using both Water Footprint (WF) and Water Stress Index (WSI) approaches. With regard to ethanol, three feedstocks (i.e. cassava, sugarcane and molasses), 48 plants, 26 provinces and 13 watersheds were analyzed. Concerning biodiesel, the analysis focused on oil palm and on three regions falling under 13 watersheds. The results show that feedstock cultivation is by far the most water intensive step along the biofuel supply chain. Additional freshwater withdrawal for biofuel feedstock cultivation will lead to higher water deprivation especially in watersheds having extreme and moderate water stress. Therefore, feedstock cultivation should target low water stress areas. Furthermore, drought-tolerant, high yield varieties should be developed and improved agricultural practices implemented. With regard specifically to ethanol, use of sugarcane should be promoted, due to its lower water footprint compared to the other two feedstocks considered, i.e. cassava and molasses. In addition, water use efficiency should be enhanced in both feedstock processing and ethanol conversion.

Mr Udin Hasanudin (University of Lampung, Indonesia) provided an overview of the sustainability assessment methodology developed by the Working Group on 'Sustainability Assessment of Biomass Utilization in East Africa' of the Economic Research Institute for ASEAN and East Asia (ERIA). This methodology is based on an indicator or index for each pillar of sustainability, i.e.: Lifecycle GHG emissions (Environmental), Total Value Added (Economic), and Human Development Index – HDI (Social). These indicators/indexes were applied in a few pilot studies, including ethanol production

from cassava in Lampung, Indonesia. The pilot studies confirmed the relevance of the methodology developed by ERIA, while pointing to the need to consider additional indicators of environmental, social and economic sustainability (e.g. soil quality, income, employment and access to modern bioenergy). Based on the results of the pilot studies, utilization of all by-products in the production of bioenergy is key in order to minimize the environmental impacts and optimize the social and economic benefits. Finally, Mr Hasanudin presented two case studies: one about oil palm biomass-based power generation on the Bangka Island in Indonesia; and one about an energy self-sufficient village on West Sumatra based on biogas from cow manure.

Mr Yetti Rusli (Ministry of Environment and Forestry of Indonesia) described the multiple, key services which are provided by forests, such as carbon sequestration. Among other things, forests can be a major source of raw materials for modern bioenergy production and for the bioeconomy in general, especially in tropical countries such as Indonesia. She also provided an overview of the Indonesian forest sector and of its categorization into protected and conservation forests vs. production forests, with the latter representing the largest category. Mr Rusli also mentioned a number of initiatives that Indonesia has engaged in (e.g. REDD+) to address the issue of deforestation. She then showed the evolution of the rate of deforestation in Indonesia, which decreased for a couple of years up until 2011 and then has been gradually re-growing since then.

Ms Helena Chum (National Renewable Energy Laboratory, USA) provided an overview of the main types of biorefineries. She then focused on the palm oil example and on best practices in the integrated production of palm oil and of its multiple products and co-products, including heat and power. In addition, Ms Chum discussed about the advantages offered by biorefineries in terms of productivity and sustainability. With regard to the latter, she also mentioned the main schemes that have been developed to certify the sustainability of the production of biomass, bioenergy and biomaterials. Finally, Ms Chum mentioned country-wide best practices examples, as well. In this context, she stressed the importance of GHG emissions inventories as a tool to show how palm oil production is improving countries' emissions.

Field visit

On 27 May 2015 participants had the opportunity to visit the following plants, just outside Medan city:

- *Palm oil mill PT Perkebunan Nusantara II (Persero)*, which is a state-owned enterprise to process fresh fruit bunches (FFB) into crude palm oil.
- *Biogas POME-based power plant of PT Pasadena Engineering Indonesia (PEI)*. PEI is a private national company and its plant in Medan is aimed to capture emissions generated by the decomposition of the wastewater from palm oil processing, known as Palm Oil Mill Effluent (POME). Methane gas can be utilized as fuel for power generation and cogeneration. At the current stage the PEI plant has the technology to capture the methane gas produced from POME with a covered lagoon, however it is not yet producing electricity and connecting it to the grid due to a final governmental authorization still pending.
- *Iron and steel foundry PT Growth Asia producing electricity from wood residues*. It is a 15 MW plant distributed as follows: 5MW for the operation of the iron and steel plant and additional 10 MW put into the grid. Five additional similar plants, of the same Growth Asia Company, are located in Medan and in Kalimantan.

Round table discussion among policy makers, business sector and international banks/funds

The Round table discussion day (28 May 2015) was opened by an **Introductory Session on the development opportunities in Asia**.

Mr Simone Landolina (IEA) provided an overview of outlook, market and technologies related to advanced biofuels. Advanced biofuels represent a key step towards a low carbon transport sector. They tend to offer good carbon savings and lower land-use impacts compared to conventional biofuels. In recent years, there have been interesting developments in terms of large scale demonstration of technology. However, products are not cost competitive yet and, to date, progress in the deployment of advanced biofuels has been slower than hoped for. As argued by Mr Landolina, in addition to research and development, a supportive policy framework which allows the next generation of plants to be built and operated is needed, e.g. by providing loan guarantees and by creating quotas for advanced biofuels.

Mr Badan Penelitian (Indonesia Agency for Agricultural Development and Research - IAARD) discussed the potential for increased agricultural production in order to meet the demand for food and energy, and the enabling role played by the Ministry of Agriculture. Overall, the agricultural sector has the potential to produce enough feedstock to meet the demand for bioenergy. As stressed by Mr Penelitian, bioenergy feedstock production should not displace - and compete with - other types of agricultural and food production. In order to avoid this competition, agricultural production should be intensified. In addition, suitable unused land should be targeted. Finally, Mr Prastowo emphasized the strong potential of second generation biofuel technologies, which present important advantages from an environmental and climate change perspective.

Round table – Advanced biofuels

The Round table discussion on advanced biofuels, moderated by *Mr Gerard Ostheimer (SE4All Bioenergy, Novozymes)* and *Ms Maria Michela Morese (GBEP Secretariat)*, was divided into two sessions respectively on aviation biofuels and on cellulosic ethanol.

The first speaker of the “**Aviation biofuels**” session was *Mr César Velarde (International Civil Aviation Organization - ICAO)* who gave an overview of the international discussions related to aviation biofuels. He highlighted that the aviation sector is committed to zero increase in emissions after 2020 in view of which a “basket of measures” is under development, including: i. measures to improve efficiency, both at aircraft technology and operations; ii. measures to facilitate market viability and deployment; and iii. measures to introduce low carbon emission fuels, therefore sustainable alternative fuels. Mr Velarde stated that more than 1700 biofuel flights have been done to date since the first commercial flights in 2011, however a lot still needs to be done to address the following challenges: 1. bring technology to the market; 2. decrease production costs; 3. invest in conversion facilities; 4. produce enough sustainable feedstock; 6. ensure sustainable deployment. On top of these challenges, supportive policy frameworks and time, before larger market penetration, are needed.

Mr Andianto Hidayat (PT Pertamina) presented Pertamina’s aspiration to become an energy leader for Asia, including renewable energy. With a growing fuel demand by 2020, Indonesian oil imports could increase to a total of USD 50 billion. In November 2014 Indonesia became the largest gasoline importer in the world and is expected to become the biggest fuel importer in the world by 2018. In addition to this the Indonesian government has recently (March 2015) accelerated its biofuels mandate: B15 and E2 by 2015; B20 and E5 by 2016; B30 and E20 by 2025. In response to this, Pertamina is working to bring biodiesel and cellulosic ethanol projects operative.

Mr Kann-Ern Liew (Might/AMIC) referred to the “Centre of Excellence on Biomass Valorization for Aviation” initiative established in Malaysia by AMIC/Airbus in 2014. The initiative is focused on identifying sustainable biomass suitable for efficient conversion towards sustainable jet fuel. In light of this a number of feedstocks and conversion technologies are currently explored by this initiative: e.g. oil palm, rice, rubber, sugarcane, coconut. He also added that only Malaysia consumes over 3 billion liters of jet fuel per year, or over 50 thousand barrels a day. Considering passenger traffic from Malaysia to Europe it is foreseen to achieve up to 5-6% biofuel blend on all flights from Malaysia to

Europe if all biomass feedstock potential is used (reduced to 1.5-2% if palm oil is excluded; and 1,5-2% with only paddy and forest residues). *Mr Jean Marc Roda (CIRAD)* added the importance of an improved landscape management to provide fuel expansion, reduce smoky haze and increase rural incomes, as well as an increased use of wastes and residues from drylands as biomass.

Mr Novianto Herupratomo (Garuda Indonesia), closed the session on aviation biofuels with a presentation on Garuda's vision to provide the highest level of sustainable environment by reducing emissions, and contribute to maintain the noise and other impacts on the environment at acceptable levels. He provided an insightful simulation of a flight from Jakarta to Bali, with a 50:50 biofuel blended (which requires no engine modification) to highlight that biofuel emissions would be very low (equivalent to 4 ton CO₂ with respect to normal fuel that would be of 13 ton CO₂) while biofuel costs would be extremely high (equivalent to around USD 15 300 with respect to normal fuel that would cost USD 2 600). This simulation was extremely useful to stress the competitive advantage of aviation biofuels in terms of CO₂ emission reductions, but its non-economic viability as of today. Mr Herupratomo mentioned the Indonesia Aviation Biofuels and Renewable Energy Task Force (ABREFT) launched in 2014 by the Indonesian Government with the objective to implement the National Plan for GHG aviation sector, including the development of aviation biofuels in Indonesia.

The first speaker of the “*Cellulosic ethanol*” session was *Mr Pierluigi Picciotti (Beta Renewables)*. He stressed the experience of Beta Renewables as a joint venture established in October 2011, with the 1st commercial-scale 2nd generation biofuel plant operating in Crescentino (Italy) with 13 million gallons per year capacity. In addition to this, the group is building a 2nd generation biorefinery in the Fuyang region (China), with the potential production of 200 000 Mton/year of ethanol and 170 000 Mton/year of glycol; and using 1 000 000 Mton biomass/year (mainly wheat straw and corn stover as feedstock). Beta Renewables sees potential for cellulosic ethanol in Indonesia, Malaysia, Thailand and the Philippines. The following measures were highlighted as essential to drive the growth of cellulosic ethanol in the region: implement stringent blending mandates; remove subsidies for conventional fossil fuels; incentivize electricity from renewable sources; introduce fair profit sharing mechanisms with local biomass suppliers; and penalize uncontrolled burning of agricultural residues on the field.

Mr Bas Melssen (Novozymes) highlighted the importance to ensure that first 2nd generation plants are built in South-East Asia. He stressed the need for advanced biofuels and bio-chemical mandates to be introduced, access to low interest debt/financing to stimulate investments to be provided, as well as access to large volumes of feedstock to be ensured through infrastructures, logistics and pricing mechanisms.

Mr Paul Twine (NexSteppe) gave an overview on the NexSteppe's agriculture experience and expertise in Asia. NexSteppe is proposing to introduce in Asia a short cycle multi season crop developed as a feedstock for cellulosic biofuels and biochemical and which is already supplementing existing first generation ethanol production. This crop was developed with capacity to have a broad geographic adaptation to various soil types and growing conditions. He stressed the need for supportive governmental policies to incentivize *inter alia* biobased products, foreign investments, advanced farming, sustainable land use and market access.

Mr Juan Barcala (Abengoa) presented the experience of Abengoa in the region and referred to the main opportunities identified in Asia as follows: sugar cane bagasse/straw hybrid projects; EFB and other palm oil residues; and rice straw. The main challenges identified in the region are related to market access, and biomass availability and supply. Finally, four were the main “must” areas identified: clear regulatory framework with biofuel mandates; governmental support to face feedstock supply risk; integrated projects among all relevant stakeholders; local investors; R&D programmes.

Mr Adrian Suharto (Neste Oil) closed this second session on “cellulosic ethanol” by stressing the need of conducive regulatory environment to enable bioenergy growth in Asia. Sharing of lessons learned

was highlighted as a key issue, together with the need of governmental mandates and governmental support only to sustainable investments.

After the panel presentations, participants were divided into *groups/tables* to engage in an open discussion regarding “coordinated actions towards sustainable advanced biofuel development in the region”. At the end of the discussion the following short list of main opportunities, challenges and coordinated actions to exploit opportunities and address challenges were identified:

<i>Opportunities</i>	<ul style="list-style-type: none"> - Biomass availability in the region - Existing synergies among different countries in the region - Large demand for biofuels and abundance of feedstock types - Simple and proven technology ready for deployment
<i>Challenges</i>	<ul style="list-style-type: none"> - Market acceptance - Risks linked to policy frameworks and governmental support - Few reliable infrastructures - Feedstock supply and low productivity
<i>Coordinated actions</i>	<ul style="list-style-type: none"> - Applied research cooperation - Technology transfer and trainings - Integrated supply chain models - Raising awareness campaign also for policy makers - Landscape management - Support to improved productivity of smallholders

Over lunch, participants were divided into different thematic tables to separately discuss the following themes:

- Technology cooperation;
- Regulatory frameworks; and
- Bioenergy sustainability.

The main messages from these parallel thematic discussions were presented during the conclusion session of the Bioenergy Week (see the next section of this summary).

Round table – Sugarcane based ethanol opportunities

This session, moderated by *Ms Rosemarie Gumera (Philippine Sugar Regulatory Administration)* had the main aim to share experiences in two countries of the Asian region – Indonesia and the Philippines - to highlight commonalities and make best use of the lessons learned.

Mr Untung Murdiyatmo (ASENDO, Indonesia) gave an overview of the ASENDO company, owning 63 mills (51 state owned and 12 private) producing 1.3-1.5 million ton/year of molasses. This production is used in equal measure for MSG/amino acid, export and ethanol industry. He stressed the importance to improve yield from sugar cane varieties and technology transfer in order to facilitate a better competitive bioethanol industry. Policy regulations in this sense are needed.

Ms Rosemarie Gumera (Philippine Sugar Regulatory Administration) shared the experience of the Philippines in the sugarcane based ethanol. She stressed that while policies on ethanol are effective in the Philippines since 2007 not many investments have taken place on this sector. She continued highlighting that from 2008 to 2014 in the country there had been increased production and demand of sugar cane ethanol thank to the support of policies fixing targets: voluntary in 2008; 5% blending in 2009; 10% blending in 2012. In 2015 the Philippines are expected to produce 129 ml liters of bioethanol.

As a result of this exchange of experiences in Indonesia and the Philippines it was noted that despite the two countries have a very similar background, in Indonesia sugar cane bioethanol is growing faster due to a high demand, while in the Philippines it is growing slowly due to a still low demand.

Round table – Project financing

This round table session was introduced and moderated by *Mr Pjotr Schade* (Everest Energy Group) with the aim to analyze and discuss the necessary steps to best develop and finance bioenergy projects in Asia.

As a starting point Mr Schade shared the “7 building blocks” that are necessary to develop sustainable bioenergy projects, and to identify key risks and opportunities:

1. Financing;
2. Sales and trading;
3. Logistics;
4. Permits, licence and subsidies;
5. EPCM (engineering, procurement, construction and management) and OM (output management);
6. site selection; and
7. sourcing.

Furthermore, he guided participants through the various “Qualitative and Quantitative analysis elements” that are necessary to be considered during the development phase of a project.

Qualitative strategic analysis:

- Project description
- Strategic Business Plan
- Process Flow Diagram
- SWOT Analysis
- Project Success Factors Analysis

Quantitative analysis:

- Income Statement
- Balance Sheet
- Discounted Cash Flow
- Sensitivity Analysis

Key information related to the project is then recommended to be summarized in an “Investment Pitch” which is a single document presented to multiple stakeholders to support the project in fulfilling its financial needs. He mentioned that the financial world comprises a wide variety of potential bioenergy funders. There are financial institutions specialized in providing: debt; equity; technical assistance; or grants and subsidies.

He concluded by sharing information on a number of projects developed with the support of the Everest Energy Group: 21 international bioenergy projects developed in support of the Dutch cooperation agency, as well as projects in Costa Rica and Colombia.

Mr Nazir Foead (Climate and Land Use Alliance Indonesia) gave an overview of the production of CPO in Malaysia and Indonesia, and stressed the economic viability of methane capture systems from POME, to produce electricity to be put on the grid. More work on this sense was suggested to be done considering the very strong potentials. Regulatory frameworks and promotion of successful projects were identified as the key tools to make it happen.

Conclusions - Main messages of the Bioenergy Week and the role of GBEP to exploit opportunities and address challenges

- **Environmental, Social and Economic Sustainability**

A summary of the main opportunities and challenges that were discussed during the sessions dealing with the environmental, social and economic sustainability of bioenergy production and use was presented, with a focus also on actions identified to address the aforementioned challenges and exploit the opportunities associated with modern bioenergy development.

The growing demand for liquid biofuels can lead to a number of benefits in the region and beyond, including: new market outlet for farmers; agricultural development; economic development and increased value added generation; job creation; reduced dependence on fossil fuels and fossil fuel imports; and climate change mitigation. A number of opportunities were identified in relation to household level biogas systems as well, namely: increased access to modern energy services; and reduced dependence on traditional biomass, with environmental benefits (e.g. avoided deforestation and reduced emissions) and social benefits (e.g. improved health and education). With regard to industrial level biomass-based heat and power generation, the main benefits that were discussed include: increased quantity and quality of power supply; displacement of fossil fuels; and climate change mitigation.

With reference to challenges posed by bioenergy production and use in the region and beyond, one of the main challenges identified during the sessions on environmental, social and economic sustainability was inadequate feedstock supply due to: low agricultural productivity, especially among smallholders; lack of adequate infrastructure/logistics, e.g. storage facilities; lack of robust supply chains for biomass and residues; and market uncertainty and price volatility. In addition, a number of sustainability issues still requiring consideration were identified, namely: land-use change / GHG emissions / biodiversity; methane emissions from POME; low efficiency/productivity of feedstock production and processing; potential competition with other uses of crops and residues, e.g. food, feed, fertilizers; and uncertain/insecure tenure rights. Finally, the implementation of sustainability requirements and certification poses a number of challenges, especially in relation to smallholder-based production.

Finally, a summary of the actions that were discussed in order to address the challenges associated with bioenergy production and use, and exploit the related opportunities was presented. Key actions that were identified include: conduct thorough assessments of local energy needs and of sustainable biomass/bioenergy potentials, taking into account all relevant environmental, social and economic dimensions and related trade-offs; ensure multistakeholder engagement in bioenergy planning and decision-making; ensure stable, long-term policy frameworks; streamline and speed-up authorization/licensing procedures; phase out fossil fuel subsidies; promote sustainable agricultural intensification, e.g. through the introduction of improved varieties, technology transfer and exchange of good practices; if feedstock expansion necessary, prioritize low carbon stock areas and avoid displacement of staple crops; promote the integrated production of food, feed, biofuels and biomaterials through an efficient use of land, biomass and residues; invest in improved infrastructure and logistics; promote methane capture and biogas production from POME; promote the establishment of robust and efficient supply chains for biomass and residues; promote the inclusion of smallholders in bioenergy supply chains through inclusive business models; and strengthen the capacity of smallholders in order to increase their productivity and help them comply with sustainability requirements.

- **Advanced biofuels**

A summary of the main messages arising from the roundtable dealing with advanced biofuels was provided. During this roundtable, a number of key actions were identified in order to unlock the significant advanced biofuels potential in the region. In particular, the following actions aimed at promoting the production and use of advanced biofuels were discussed: implement stable and stringent blending mandates; remove subsidies of conventional fossil fuels; incentivize electricity from

renewable sources; establish a fair profit sharing mechanism with local biomass suppliers; penalize uncontrolled burning of agri- residuals on the field; provide governmental support to face feedstock supply risk (long term, fixed price, logistic investment); develop and implement integrated projects involving farmers, local investors, government and technology providers; invest in R&D programs, as technology must be adapted to different biomasses; and improve logistics in order to increase access to feedstock.

- **Sugarcane-based ethanol opportunities**

In Asia there are vast opportunities for both first and second generation ethanol production using sugarcane as feedstock. However, certain conditions have to be put in place by the governments of Asian countries, namely: development of programs on sugarcane intensification which will ensure enough production of sugarcane for food and fuel purposes taking into consideration the socio-economic benefits of small landholders and workers; implementation of measures and guidelines which promote ethanol production and which are supportive of long-term investments; and application of appraisal tools and sustainability indicators which can inform and guide the identification of suitable feedstocks and of a sustainable supply and which can measure the success of program implementation in terms of environmental, social and economic impacts.

- **Project financing**

A quick recap of the various steps necessary to develop and finance a project was provided, in light of what described in detail during the related roundtable.

- **Technology Cooperation**

The main areas with high potential for technology cooperation/transfer identified during the thematic table were mentioned, namely: agronomic practices (e.g. breeding, harvesting, etc.); biogas; second-generation ethanol (e.g. from the US and Europe); and transfer of ethanol technology from Thailand to Indonesia and transfer of biodiesel technology from the latter to the former. This technology transfer could build upon the successful example of technology cooperation in the area of coffee production between Indonesia and Viet Nam. Another important issue that was discussed is the fact that for countries such as Viet Nam, Laos and Cambodia, any technology transfer should not involve necessarily the same technologies that other countries in the region with higher levels of economic development might exchange. In order to promote and support technology cooperation and transfer in the aforementioned areas, the following actions and recommendations were discussed: global experts could train local experts on key technologies; the technology licensor should participate in the first cases to increase confidence from the local shareholders; and influential policy makers from the region should be brought to reference installations abroad.

- **Regulatory Frameworks**

During the discussions related to regulatory frameworks it emerged that most countries in the region have put in place biofuel mandates with stepping up targets. However, there tends to be limited coordination among different decision-making levels. In addition, effective implementing measures are still lacking in some cases, and oftentimes production has fallen short of mandates, due mainly to lack of adequate feedstock supply.

- **Bioenergy Sustainability**

A summary of the main challenges for bioenergy sustainability discussed during the related thematic table, and of selected approaches to address them was provided. The main challenges affecting the sustainability of bioenergy and especially of feedstock supply in the region are: land use change, deforestation and potential competition with food production; emissions and air, water and soil quality. In addition, compliance with sustainability regulations is still a challenge due, among other things, to governance fragmentation and lack of enforcement. The implementation of voluntary sustainability standards is challenging as well, due to lack of local ownership and to the difficulties faced by smallholders in complying with these standards. As regional markets become increasingly integrated, regional level sustainability standards and indicators should be developed.

A number of innovative approaches to sustainability were identified during this thematic table, namely:

- the Territorial Unit (KPH) in Indonesia;
- biomass towns in Japan and pilots in SE Asia;
- the Village Energy Security Program in India; and
- the Indonesia Sustainable Palm Oil (ISPO) Standard, which applies to all palm oil production, regardless of its end use, unlike most other sustainability certification schemes and regulations.