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

4th Bioenergy Week Summary

Budapest, Hungary, 21-24 June 2016

The fourth Bioenergy Week of the Global Bioenergy Partnership (GBEP) was successfully held from 21 to 24 June 2016 in Budapest, Hungary, as part of efforts of the GBEP Working Group on Capacity Building for Sustainable Bioenergy (WGCB) to facilitate cooperation and capacity building on the potential benefits of sustainable modern bioenergy.

The event was kindly hosted by the Hungarian Ministry of Agriculture and supported by the Food and Agriculture Organization of the United Nations (FAO), in cooperation with the European Bank for Reconstruction and Development (EBRD) and the *Deutsche Gesellschaft fur Internationale Zusammenarbeit* (GIZ). The event gathered around 80 participants from the Americas, Central Asia, Southeast Asia, Eastern Europe and Western Europe among scientists and government officials, including also representatives of the private sector to discuss on specific sustainability themes that are of key interest for the region.

As a follow up to the first GBEP Bioenergy Week held in 2013 in Brazil, the second Bioenergy Week held in 2014 in Mozambique and the third Bioenergy Week held in 2015 in Indonesia, the Budapest 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 region (Eastern Europe and Central Asia). Furthermore, it provided the opportunity to continue a dialogue with the private sector and stakeholders on ways to improve mutual cooperation towards a more sustainable production and use of bioenergy.

Opening session

The fourth Bioenergy Week was opened by welcome speeches of *Ms Maria Michela Morese*, GBEP Executive Secretary, *Mr Zsolt Feldman*, Deputy State Secretary of the Hungarian Ministry of Agriculture, *Mr Vladimir Rakhmanin*, FAO Regional Representative for Europe and Central Asia, *Mr Giovanni Brunelli*, Director of the Italian Ministry for the Environment Land and Sea, and *Amb. Valter Pecly Moreira*, of the Embassy of the Federative Republic of Brazil in Hungary.

All speeches highlighted the added value of the fourth Bioenergy Week in Hungary to discuss sustainability themes which are of key interest for Eastern Europe and Central 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 during its ten years of activity (2006-2016), 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 Eastern Europe and Central Asia

Speakers in this session, moderated by *Mr Jeffrey Skeer* (International Renewable Energy Agency - IRENA), gave an overview regarding the role of bioenergy at the global level and in the Eastern European and Central Asian regions.

Mr Jeffrey Skeer (IRENA) provided an overview of recent developments in the bioenergy sector as well as the potential for bioenergy in Eastern Europe and Central Asia. The reputation and prospects of bioenergy have suffered from at least three major blows: food versus fuel debate, concern over land-use change and most recently, the low price of oil. Yet there are ways to expand bioenergy production that allow for the efficient use of land as well as the avoidance of converting one type of land to another. For instance, forest cover in Europe has been growing steadily by 800 thousand hectares per annum, despite increasing production of lumber for housing and use of wood residues for energy. In Sweden, the forest cover has doubled in the last century while output has never been higher. A study by the International Energy Agency (IEA) Bioenergy Agreement and Swedish Environment Agency has shown that there is a sustainable potential for forest output there to grow by another 80 percent. There is similar potential in many other countries in these regions. Surplus agricultural land in Europe could also be converted to bioenergy crops – reducing food surpluses and the burden of agricultural support while also boosting indigenous bioenergy to displace imported oil and gas. In short, there is substantial potential to sustainably expand the use of biomass for energy, both globally and in the countries of these regions.

Mr Simone Landolina (IEA) discussed global bioenergy supply and demand as well as the policy support required to accelerate bioenergy production and use. In the IEA's perspective, bioenergy accounts for 12 percent of the global emission reductions needed to move from a six-degree scenario (6DS) to a two-degree scenario (2DS). In this 2DS, the share of fossil fuels in primary energy is almost halved while biomass becomes the largest energy source by 2050. However, the status of the different energy technologies with respect to the intermediate targets of the 2DS indicates that progress needs to be accelerated. There are areas which are significantly off-track and a few others that still need a further policy boost to reach the required deployment. For instance, high levels of incentives are no longer necessary for solar PV and onshore wind in many markets. Bioenergy has the potential to provide a contribution to all energy needs and plays a very important role in low-carbon energy scenarios in each sector. With cost reductions in onshore wind and PV systems, biomass power applications focus on the most promising technology under local conditions. Further policy action is needed for heat and biofuel sectors, in the face of structural challenges (low oil price environment). Wavering policy commitments risk undermining investor confidence and market growth.

Mr Gianluca Sambucini (United Nations Economic Commission for Europe - UNECE) provided an overview of the bioenergy findings from the UNECE Renewable Energy Status Report. The report found that there were big variations in the capacities of the 17 UNECE countries to develop their bioenergy sectors. Most of them were in the nascent stages of development and had large resources that could be harnessed to produce bioenergy. However, it was only being partially utilized. These countries were also transitioning from traditional to modern biomass heating. The challenges to bioenergy growth in these two regions are: investor security and experience; unstable political situations; experience in and operation of infrastructure; cost of switching to renewables; and supportive regulatory policies.

Mr László Szabó (Regional Centre for Energy Policy Research - REKK) presented on the bioenergy regulatory frameworks in Southeast Europe (SEE). In this region, renewable energy is mainly used for heating purposes by the residential sector with solid biomass being the major contributor, followed by electricity. Biofuels for the transportation sector are not as widely utilized. RES heat sector offers comparatively promising RES potentials due to their geographical locations (solar irradiation, wind), but also biomass potential is relatively high. Limited support schemes exist for this sector. As for the electricity sector, the level of feed-in tariff is adequate. Problems arise from other elements, such as lengthy administrative procedures and limited grid connectivity. With respect to biofuels in the transport

sector, the region is lagging behind as there is no real market for biofuel (except Ukraine) and present policy measures are not sufficient to spur demand.

Mr Szabolcs Vágvölgyi (Századvég Gazdaságkutató Zrt) provided an overview of the role of bioenergy in Hungary. Bioenergy sources dominate the Hungarian renewable energy landscape. In 2015, 63.7 PJ energy was produced from biomass and the renewable parts of municipal waste (incineration). Energy produced from biomass accounted for three times the amount of the rest of renewable energy sources combined. Based on the company's projections, bioenergy has a large growth potential, particularly from 2015 to 2020. Electricity production though will not be the primary destination for bioenergy feedstock but rather heat production. Currently, a considerable number of Hungarian households still use wood as their primary source of energy for heating as they do not have access to the natural gas network. The company projects that there will be a doubling of biomass used in the district heating sector so that by 2025 biomass usage will be the single most important source of energy for district heating. Furthermore, they see Hungary as having large biogas potential, which after further treatment can be used as biomethane in the transport sector. Based on even the most pessimistic projections, the lowest biogas production potential may meet 19 percent of the energy consumption requirements of the entire transport sector (excluding other uses of biogas).

Key elements to develop a bioenergy value chain

This session, moderated by *Ms Sabine Ziem-Milojević* (E4tech), was aimed at explaining bioenergy related value chains with specific reference to actors involved, phases of the value chains and distribution of responsibilities among actors, status quo in the region, challenges and opportunities.

Mr Guido Bezzi (Italian Consortium Biogas - CIB) provided an overview of the biogas value chain. Biogas is scalable, flexible, and programmable and can promote residues' recycling and circular economies. The biogas value chain begins with municipal waste (sewage, solid waste and sludge), agro-industry by-products or farming by-products, such as animal manure and crops. These products are turned into biogas through anaerobic digestion, which can then be used for electricity generation, heat production or biomethane for transport. The remaining digestate can be used as fertilizer, closing the circle. Some of the benefits of the biogas value chain are that it: valorizes waste products; can be used in either home or industry applications around the world; can be integrated with other energies; and can help farms go from being carbon emitters to carbon sinks (among other things). Some of the challenges that the industry faces are: politics, laws and public opinion.

Mr Stefano Capaccioli (European Biomass Industry Association - EUBIA) described the liquid biofuels value chain. There are three main types of first generation biofuels. The first type corresponds to petroleum-gasoline substitutes produced via biological fermentation of starch and sugar rich crops (e.g. corn, sugar beet, sugarcane). The second type relates to petroleum-diesel substitutes, such as straight vegetable oil and biodiesel produced by transesterification of plant oils and fatty residues (e.g. soy, palm, jatropha, used cooking oil and animal fats). The third type corresponds to natural gas substitutes, such as biogas, generally produced via anaerobic digestion of organic matter. A range of fuel blends can be produced. Liquid biofuels are being produced in large quantities across Europe and there are a number of projects ongoing in the region.

Ms Nicoleta Ion (ENERO) presented a case study on the Romanian experience with the woody biomass value chain. Woody biomass is typically used for heat production in low efficiency traditional stoves in the country. Moreover, the production of pellets and briquettes increased in Romania after the country joined the European Union. There is very limited information available on their production though. Initially the government created a support scheme that was too generous and focused heavily on electricity; biomass was not encouraged enough. The regulatory framework has since changed but a number of issues still remain for the production of electricity/heat from woody biomass in Romania,

including pollution, securing a stable supply chain, grid integration, raw biomass cost and regulatory stability. There are also concerns over the efficiency of the technology being used, illegal logging versus energy poverty, deforestation and landscape transformation.

Mr Federico Grati (Clariant) spoke about the value chain for second generation biofuels. For some time now, many companies have shown a growing interest in the production of ethanol from renewable lignocellulosic resources, such as agricultural residues. These resources do not compete with food and feed crops but are created in sufficient quantities worldwide as a by-product of current agricultural practices, as in the case of straw from cereal production. Clariant has developed the sunliquid process, which converts agricultural residues – non-food feedstocks – into biofuel. The process is being tested at a pre-commercial plant in Germany. Wheat straw is widely available across Europe and could be a potentially sustainable solution.

Solid biomass and agricultural residues – exchange of experiences and opportunities in the region in light of the advances in technology, market conditions and biomass solid fuel availability

This session, moderated by *Mr George Abulashvili* (Georgian Energy Efficiency Centre), encompassed 16 presentations aimed at sharing experiences and opportunities in the region related to the production and use of solid biomass and agricultural residues.

Mr Arnold Gór (Hungarian Chamber of Agriculture) explained Hungary's experience. Hungary has the potential to utilize nearly 5 million tons of winter wheat in the production of biofuel. However, this is one area that needs to be enhanced as biofuels have an unequal market position with respect to fossil fuels. Suggestions to improve support are: reconversion of marginal lands and semi-arid areas; collect, create and disseminate valid business models; make the distance from the field to the power plant as short as possible; encourage the adoption of biobased products in public procurement criteria; and increase access to credits and fiscal measures to facilitate the adoption of new technologies in production.

Mr Péter Rudolf (Biomasszaerőművek Egyesülése) provided an overview of Hungary's experience with biomass power plants. There is an association of biomass power plants (BEE) in Hungary that is comprised of seven members and its objectives are to: increase the investment potential of the biomass power plants; create a long-term and predictable economic environment; support the production of 'green heat'; develop a support system for energy plantations; develop and operate an information system for residents; and shape public opinion. These plants mostly use agricultural residues, forest woodchips and logwood in either bubbling fluidized bed boilers or grate-fired boilers. The use of biomass by BEE has led to creation of 2 000 jobs outside of power plants; nearly 800 000 tons/year CO_2 emission savings; nearly 400 million m^3 of import gas savings; contributions to Hungary's commitments in its National Renewable Energy Action Plan for 2020; favorable producer heat prices; and increased energy security.

Ms Sabine Ziem-Milojević (E4tech and GIZ, Serbia) discussed one of the components of a GIZ programme in Serbia that aims to establish a sustainable bioenergy market in the country, which is to improve the efficiency of firewood utilization in households. The share of biomass for heating in households is 67 percent and the two pilot regions had even higher rates of utilization. Furthermore, in the two pilot regions approximately 75 percent of the stoves were six years or older and there was a reliance on seasoned wood. The purpose of this component of the project was to increase the share of households in the pilot regions that are using efficient wood-based heating technologies and/or dried firewood from 1 to 15 percent. The team focused not only on supply and demand side activities but also on establishing an enabling environment.

Ms Sonja Malicevic (United Nations Environment Programme - UNEP) described the Programme's work with promoting a switch to the use of biomass for district heating in the Balkans. Three cities –

Sarajevo, Banja Luka and Belgrade – have varying issues and needs related to their district heating systems. Sarajevo has the largest district heating system in Bosnia and Herzegovina with a total capacity of 502 MW and its main source of energy is natural gas. Most of the heating network is scattered around the city and has little connection with other parts of the system, contributing to air pollution. There is a need for network extension and exploring options for alternative fuels sources. A rapid assessment of the Banja Luka district heating system showed that it was dependent on crude oil that was being acquired at high prices and not compensated by the achieved income. The city is resolved to shift almost entirely to biomass, using crude oil only for peaks. In Belgrade, the system is dependent on costly imported gas and usage of crude oil and it has an inefficient management structure. Sarajevo and Belgrade have joined the District Energy Systems Initiative and are working with organizations like UNEP to improve their district heating systems. Banja Luka recently received approval from EBRD to move forward with the development of a set of due diligence studies and define in detail the priority investment package.

Mr Leonid Poleschuk (Ministry of Agriculture and Food, Belarus) described Belarus' experience and prospects of use of animal waste in the country. There is a legislative basis for the implementation of biotechnologies as well as renewable energy sources in Belarus. Green tariffs are also in place to help stimulate the sector. There is great potential to produce biogas from cattle manure as there is a large number of heads of cattle. The country is developing biogas complexes (more than 10 units) in a number of regions and in some areas up to 4.8 MW has been installed. There are plans to install around 10 MW. The work that has been done thus far helps to alleviate the burden of greenhouse gas emissions into the Balkan region. Belarus is also taking part in the work of different foundations, including the EBRD, and expanding its cooperation with other countries.

Ms Natalia Jamburia (Ministry of Energy, Georgia) and *Mr Giorgi Ghambashidze* (Ministry of Agriculture, Georgia) gave an overview of the Georgia experience. Ms Natalia Jamburia explained part of Georgia's experience with solid biomass. Firewood plays a major role in Georgia's heat supply. In fact, more Firewood is used for heating in Georgia than gas, electricity and all other sources; firewood accounts for 60 percent of all heating resources. In rural areas, about 700 000 households and public buildings use on average about 9 m^3 firewood per household for heating and cooking (7 m^3) and for hot water (2 m^3). Energy savings are being achieved through the introduction of energy efficient wood burning stoves as well as educational and awareness raising activities. There is another project in Georgia that works to promote biomass production and utilization through research and development and awareness raising. The next steps of the project are to develop a national bioenergy strategy and action plan, establish a bioenergy association and formulate a proposal for improving access to finance for biomass projects.
Mr Giorgi Ghambashidze explained the second part of Georgia's experience with agricultural residues. There was a World Bank project that aimed to demonstrate and disseminate good agricultural practices and technologies for animal waste management, soil fertilization and erosion control as well as river and ground water quality monitoring. As part of this project, 272 biogas digesters were installed across 56 villages, mainly in Western Georgia. The annual production of each farm was 700 to 800 m^3 (14 to 20 tons), allowing for an annual reduction of fuelwood consumption of 8 m^3. There was also the Southern Caucasus Compost Project, which evaluated existing resources of biodegradable waste used for bio-composting and assessed the quality of compost produced from biodegradable household waste as organic fertilizer through field experiments.

Mr Rainer Schellhaas (GIZ, Serbia) presented the results of a macroeconomic study on the net effects of import substitution of fossil fuels with solid biomass in Serbia. Substitution of fossil fuels with biomass in district heating systems would have the effects on the: cost of heating energy production; end-user's price of heating energy; local and regional economy (new jobs and income); national economy (trade deficit and import dependency reduction). GIZ undertook a study to measure these impacts in six municipalities across Serbia. The net effects on the local economy (GDP and employment) were estimated using the adapted Biomass Socio-Economic Multiplier model (BIOSEM), which is a quantitative economic model that captures the income and employment effects arising from the deployment of bio-energy plants in rural communities. The results showed that each municipality could

cumulatively save anywhere from 1.5 to 8.5 million euros by switching to biomass. They could also create a total of 88 new jobs and the induced income effect would be around 1.8 million euros.

Mr Nicolae Olari (Ministry of Economy, Moldova) discussed the results and lessons learned from the first phase of Moldova's Energy and Biomass Project. Moldova is highly dependent on energy imports – 88 percent of the country's energy sources are imported – and it has an energy intensity three times higher than the European Union average. The combination of these two things makes the development of renewable energy and energy efficiency projects a priority. By 2020, Moldova wants to reduce primary energy consumption by 20 percent; increase the share of renewable energy sources in the overall energy balance up to 20 percent; increase the share of biofuels to at least 10 percent in the total amount of fuels used in 2020; and reduce greenhouse gas emissions by 25 percent. There are a number of bioenergy promotion projects ongoing, and through some of these programs the country now has an installed capacity of 112 570 KW from biomass boilers.

Mr Khusrav Abdulloev (Ministry of Energy and Water Resources, Tajikistan) described the alternative sources of bioenergy in Tajikistan. The government has stated that it would like to become more involved in the bioenergy sector due to concerns over energy security, transportation isolation and food security. Currently, the installed capacity of Tajikistan's power plants is 5400 MW with 95 percent of the power generated coming from hydroelectric sources and the remaining 5 percent from geothermal. Due to this configuration there is an excess amount of hydropower generated in the summer months and during winter there are energy shortages of more than 1.5 billion KWh. By 2030, the country would like to be able to provide stable and reliable electricity to its people. In rural areas, it is difficult to get natural gas, which is why the government is looking into technologies that would allow for the recovery of heat and electricity production from animal manure on farms. Tajikistan also has a small bioethanol plant that can produce 1 million liters of ethanol per year.

Mr Volodymyr Ivasiuk (Ministry of Agrarian Policy and Food, Ukraine) discussed the status and prospects of raw materials for biofuel production in Ukraine. In forecasts of Ukraine's Energy Strategy for 2030, bioenergy makes up almost 72 percent of the country's renewable energy mix, including bioethanol, biodiesel, biogas and solid biofuels. The feedstocks with the greatest potential for bioenergy production within the country are energy crops (willow, miscanthus, poplar and switchgrass), sunflower waste, corn silage, straw cereal crops, straw rape and woody biomass.

Mr Nasriddin Najimov (Ministry of Agriculture and Water Resources, Uzbekistan) detailed Uzbekistan's experience with solid biomass and agricultural residues. The country is on the doorstep of bioenergy and renewable energy resources. The economy has grown recently, necessitating the need for more energy, and while Uzbekistan has a number of indigenous energy sources, there is a problem with pollution. The government is in the process of establishing a regulatory framework for renewables. Furthermore, the country is focused on increasing the use of biogas on farms because of the large amount of livestock. There are currently biogas units across the country with an installed capacity of 300 m^3 but experts estimate that about 13 billion m^3 of biogas can be produced.

Mr Franco Cotana (University of Perugia, Italy) outlined four of Italy's research and development projects related to bioenergy. The first is a project that utilizes the stranded driftwood from riverbeds and drainage canals to produce energy. The second aims to show the techno, economic and environmental sustainability at industrial scale of a value chain where underutilized oil crops are exploited for the extraction of vegetable oils to be further converted into bioproducts. By and co-products from the process will be valorized for energy, feed for animals and value added chemicals in order to increase the sustainability of the value chain. The third is the FACEB project, which creates a circular economy in a small village in Italy through the creation of a vegetable oil pathway that is comprised of an oil milling plant, trigeneration plant, LEED-HB building and mini biogas plant for the community. The last project creates renewable energy from vineyard pruning in Umbria. The pruning are rotobagged, then the bales are transported to a chipping factory where they are turned into chips, and then those chips are used to generate 400 kW of energy through a moving grate burner.

Mr Takashi Hayashi (Ministry of Agriculture, Forestry and Fisheries, Japan) outlined Japan's experience with competition of wood resource procurement among biomass power plants. After the Fukushima crisis, Japan introduced a feed-in tariff scheme in 2012 to increase the production of renewable energy. A number of new biomass power plants were developed. Plant owners were responsible for creating their own plans for biomass collection. The Ministry of Agriculture, Forestry and Fisheries conducted a study of the Iwate prefecture to see if there was competition for the collection of biomass and what the impacts of that competition might be. The study found that there are six biomass power plants located close together, leading to competition of resources and therefore severe thinning of the nearby forests. To avoid this type of competition there should be some sort of local, regional or even national coordination scheme.

Ms Francesca Ettorre (Turboden) gave an overview of Turboden's experience in the region. Turboden has a history of turning residues into local resources, leading to a valorization of local resources, diversification of the energy mix, development of a local supply chain and job creation. The company has 12 plants in the Balkans, 21 in the Baltics and 11 in the CIS region. In its application of biomass, Turboden has woody biomass, rice husks, cotton residues and waste for cogeneration for district heating; olive husks for power production; wood pellet production and wood chips for combined heat cooling plants.

Mr Nihad Harbas (GIZ Bosnia and Herzegovina) explained the experience of Bosnia and Herzegovina. Nearly 40 percent of the energy consumed by the residential sector comes from wood. ESCO pilot projects in the country focus on technical assistance to support project identification, preparation, support on project implementation and capacity development of public building owners. Thus far, two hospitals and one district heating system have received assistance. The lessons learned from these projects were: feed-in tariffs are insufficient for significant renewable energy investment; incentives need to be introduced for heating and cooling; special models for supporting district heating systems with wider socio-economic benefits should be created; innovative technologies, especially in the biomass sector need to introduced or developed in the case of cogeneration; update and increase feed-in tariffs for biomass to attract ESCO companies; and there should be a focus on small and medium enterprises in the sector.

Mr George Abulashvili (Georgia Energy Efficiency Centre) described how agricultural wastes were utilized to meet cleaner energy demand for Georgian Covenant Signatories. Thirteen cities across Georgia signed the Covenant of Mayors to strive for sustainable energy development and eight of those cities have produced sustainable action plans. Of these cities, the residential and transport sectors consume the most energy, respectively, and 40 percent of the total primary energy supply comes from imported natural gas followed closely by imported oil products. The eight cities are looking to supply energy to their citizens through residues from vineyards and hazelnuts.

Liquid biofuels opportunities in the region – Exchange of experiences and opportunities on liquid biofuels

This session, moderated by *Mr Simone Landolina* (IEA), focused on speakers' experiences and lessons learned regarding liquid biofuels.

Mr Marco Colangeli (FAO) gave the first part of a presentation on the opportunities for development of sustainable biomass value chains on underutilized lands. The FORBIO project is a Horizon 2020 project that will assess the feasibility of using underutilized lands in Italy, Germany and Ukraine for biomass production without interfering with the production of food or feed, or with land currently used for recreational and/or conservational purposes. Romania, Poland, Ireland, UK and Hungary are outreach countries. FORBIO will develop a methodology to assess bioenergy production potential on available "under-utilized lands" in Europe (contaminated, abandoned, fallow land etc.) at national and local level. The project is divided into four stages: 1) evaluation of the agronomic and techno-economic potential

of the selected advanced bioenergy value chains in the case study sites of the target countries; 2) assessment of environmental, social and economic sustainability of the selected advanced bioenergy value chains in the target countries; 3) identification and removal of barriers to the market uptake of bioenergy in the case study sites; and 4) knowledge transfer and capacity development for innovative value chains.

Ms Nicoleta Ion (ENERO) presented on the second part of the opportunities for development of sustainable biomass value chains on underutilized lands. The focus was on the outreach country of Romania. The potential of dedicated short-rotation plantations for energetic use in Romania is not fully exploited. Starting from 2011, energy crops (non-farm, non-food) are eligible to get support from the government. In 2013, an assessment was done on the potential for using marginal lands for producing bioenergy feedstocks in the southern region of Romania. It found that the estimated energy production from this land had a capacity of 15 MW, heat production of 350 GWh/year and power production of 90 GWh/year. There are a number of opportunities that Romania can capitalize on through the FORBIO project, including fair quality infrastructure and government schemes. Some of the barriers to implementing this project in Romania are a lack of available and reliable data on underutilized lands, general lack of awareness and complicated process for procuring the necessary permits.

Ms Anita Simon (Biofilter Zrt. Co.) spoke about the production of second generation biodiesel from waste and secondary raw material. Biofilter collects used cooking oil from over 8 000 collection points across Hungary and we have more than 4 500 business partners. The oil is treated and then converted into biodiesel. 6 174 tons of used cooking oil was collected in 2015, preventing over 13.5 million tons of CO_2 from being emitted. The mixture rate for 2016 is 4.8 percent and by 2020, the target blending rate is 10 percent. The advantages of using used cooking oil are: no threats to the food chain, readily available, easily converted to biodiesel, can be burned directly in some engines, low in sulphur and there are no associated land use changes. Biofilter's process is certified sustainable by International Sustainability and Carbon Certification (ISCC). There are future growth potentials for used cooking oils due to growing international markets and new regulations.

Mr Giuliano Ghiglione (Beta Renewables) explained Beta Renewables' experience with producing second generation ethanol with its PROESA technology. It utilizes the sugars present in lignocellulosic biomass to obtain fuel and other chemicals with lower greenhouse gas emissions at competitive costs compared to fossil fuels. The technology has been scaled-up to the industrial level at the Crescentino plant in Italy, which is a first-of-its-kind biorefinery. It is the first commercial cellulosic ethanol plant in the world and can produce 40 000 Mt per year of ethanol with zero water discharge. Wheat straw, arundo donax, rice straw and poplar are the main feedstocks used. New technologies for sugars conversion and lignin processing are on development in our research and development facilities.

Mr Eric Sievers (Pannonia Ethanol Zrt.) described Pannonia's experience of ethanol production in Hungary. Pannonia currently invests in about 12 technologies, supporting bioeconomy entrepreneurs in manufacturing bioproducts. One such investment is the Pannonia Ethanol biorefinery, which supports more than 2 000 jobs and has 67 percent greenhouse gas savings. Pannonia also produces (and uses) 100 000 cbm of biogas every year. The parent company, Ethanol Europe Renewables Limited (EERL), has been increasing its investments in bioeconomy projects. However, its efforts have been frustrated by policies at the European Union level.

Mr Zoltán Reng (Hungrana Kft.) gave an overview of Hungrana's experience with biofuels in Hungary. Hungrana is a bioeconomy company that processes corn-based products. It utilizes 3 500 tons per day of corn to produce high fructose corn syrup, glucose/dextrose, starch, alcohols, feeds and ethanol. It applies a wide range of technologies to make these products, has zero waste and 25 percent of the energy that it uses comes from a biomass plant. Sixty percent of its products are exported while the remaining 40 percent are sold within Hungary. The company has plans to expand further.

Side event – Accelerating transition to sustainable climate technologies: EBRD-FAO-IEA collaborative work

This side event, moderated by *Ms Astrid Motta* (EBRD), aimed to highlight the work being done by EBRD, FAO and IEA on the Finance and Technology Transfer Centre for Climate Change (FINTECC) programme (additional information available at http://fintecc.ebrd.com/index.html). The objective of the cooperation is the development of a methodology to assess the penetration of climate technologies and the potential for their development.

Mr Nuno Santos and *Mr Alessandro Flammini* (FAO) explained the fundamentals of the methodology developed by FAO in the agri-food sector. This is one portion of a larger collaboration between EBRD and FAO and the presentation focused on the pilot study that had been recently completed in Morocco. The process has four key steps: 1) identify the sources greenhouse gas emissions; 2) conduct a techno-economic evaluation to ascertain the maturity of technologies/practices and their costs and potentials; 3) evaluate potential sustainability issues; and 4) identify key factors hindering uptake. After the team has finalized the results from the Morocco pilot, the methodology will be revised and presented at COP22.

Mr Simone Landolina and *Ms Sonja Lekovic* (IEA) described how the IEA is assessing the market penetration of renewable energy and energy efficiency technologies, highlighting the case study of Belarus. Over the past year, the team at IEA has worked to create a methodology for assessing clean energy technology markets. It is comprised of a three step process that includes prioritization of climate technologies, metric formulation and monitoring of penetration levels and trends. From there, this methodology was piloted in three countries (Belarus, Kazakhstan and Morocco). In Belarus, the study highlights the benefit of strong government attention to energy savings; clear renewable energy policy direction and increasing public awareness; and the progressive phase-out of electricity and heat subsidies. Suggested areas for improvement included: improving energy efficiency indicators by expanding data collection methods and improving market conditions for the development of ESCOs.

Biogas opportunities – Exchange of experiences and opportunities of biogas and biomethane developments in the region

This session, moderated by *Mr Georgiy Geletuka* (Bioenergy Association of Ukraine - UABio), focused on speakers' experiences and lessons learned with biogas in the region.

Mr Tarlan Askarov (Ministry of Energy, Azerbaijan) gave an overview of Azerbaijan's experience on bioenergy development starting with the policy and institutional framework governing the sector. Subsequently the speaker gave an understanding of the concrete targets and the share of renewable energy sources in 2020, including bioenergy. The representative of Azerbaijan then presented one case study of an integrated renewable energy project which will produce 31 MW of electric power and 48 MW of thermal energy, in a district heating shape. Photovoltaic panels will be installed for further 2.8 MW. This highly integrated food and energy system will include 30 ha of greenhouses, 10,000 livestock heads (cattle) that will produce biogas and heat to be used in this closed-loop system.

Ms Tatiana Vedeneva (Centre for Renewable Energy and Energy Efficiency Development - CREEED) participated remotely through a video presentation on biogas plants for small and medium size farms in Kyrgyzstan. Part of CREEED's mission is to support and promote local innovators and producers of renewable energy solutions, which is why the presentation focused on the experiences of one of CREEED's partner organizations, Public Foundation Fluid. Ninety percent of Kyrgyzstan is covered by mountains, which makes supplying energy difficult. Furthermore, 66 percent of the population live in the rural areas and are employed by the agriculture sector. Crop yields are very low and most of the land has been classified as being degraded. The country has a large amount of livestock, which leads to large amounts of production of manure that is applied directly to fields. Fluid started experimenting with

biogas technologies that address the issues of livestock waste, fertilizer, and energy access for farmers in the country, which has resulted in a number of plants that are tailored to local needs. For instance, one project were mobile biogas plant for the use on pastures during both the winter and summer months, which is very convenient for the livestock-breeding farmers of the country.

Mr Zhanybai Tumanov (Kyrgz Agrobio Center, Ministry of Agriculture and Melioration, Kyrgyzstan) elaborated on Kyrgyzstan's experience with biogas. Some of the driving factors in the country's move toward biogas were the increasing prices of natural gas and electricity, faulty transmission lines as well as the large number of mountain dwellers and isolated farms. Kyrgyzstan also has a large amount of resources for biogas, including more than 7 million tons of manure, which is enough to produce 200 m^3 of biogas and biofertilizer. The Ministry of Agriculture made the decision to implement the government's policy of modernizing agro-technology so the biogas sector could be developed and yields of animal husbandry and field crops could be improved. The process of installing these plants began in 2005 and now there are around 25 digesters across the country. However, the regulatory framework in the country is not adequate, which made it difficult to install plants that could produce both biogas and biofertilizer. Additional challenges are: lack of programme for biotechnologies, lack of information about biogas technologies and awareness raising and lack of financing for the rural population of rural areas.

Mr Kornél Kovács (Hungarian Biogas Association) gave an overview of Hungary's experience with biogas. There are 40 biogas plants using agricultural substrates and another five are in the planning phase. Currently, 20 MW of electricity are being generated from these plants but by 2020, the plan is to expand to 100 MW. In Hungary's national renewable energy plan, biogas does not currently play a large role but by 2020, it could potentially make up 5 percent of the mix. The issues that still need to be solved are: lack of a guaranteed long-term support system; low investment security and financing; uncertain economic background; low level of subsidies in comparison to other countries in the European Union; public acceptance; and training for biogas operators. Hungary is currently undertaking research and development on a number of biotechnologies, which should help make them viable and cost effective.

Ms Adrienn Nagy (Pilze-Nagy Zrt) discussed the specific example of a mushroom to biogas complex in Hungary. The Pilze-Nagy Ltd. is in the business of oyster mushroom substrate production, growing and trade. The company is the country largest oyster mushroom producer and exporter. The company is also considered one of Europe's largest oyster mushroom growers based on plant size and annual revenues. Pilze-Nagy Ldt. established a biogas power plant with 330 kW electric and 400 kW thermal capacity utilizing agricultural residues. Not only does the plant utilize spent mushroom substrate but also poultry manure, food processing wastes and other biomass. In this complex mushroom growing agrisystem, biogas production and agricultural crop production work in close cooperation. All organic wastes from mushroom production are utilized in a biogas plant in order to decrease the environmental footprint of the production and serve the sustainable economy.

Mr Marcelo Alves de Sousa (CIBiogás-ER) participated remotely through a video presentation that outlined CIBiogás' experience with biogas for domestic and industrial purposes. Brazil is one of the largest meat exporters in the world and wants to take first place by 2025, but the country must find a way to prevent tons of animal waste from polluting watersheds across the country. CIBiogas has the only biogas laboratory accredited in Brazil by Inmetro and with its resources, the company can go to any region and analyze the biogas potential of domestic or industrial farms. In fact, the company has worked with domestic and industrial farms in Parana and Uruguay where they set up biodigesters that can generate electricity, thermal energy or biomethane. The remaining biofertilizer is used on the farms. The benefits received depend on the type of animals raised, number of animals and the characteristics and needs of each farm.

Mr Guido Bezzi (Italian Consortium Biogas - CIB) explained how to develop a biogas system, specifically the requirements, logistics, regulations and economics of biogas plants in Europe. Biogas is a growing energy sector in Europe with more than 17 000 plants and 8 339 MWe of installed capacity

at the end of 2014. The growth in biogas in Europe differs from country to country and Germany and Italy are the principle players in the biogas sector. Agriculture provides the most important feedstocks for these biogas plants. Furthermore, 1.8 billion m^3 of biomethane produced mainly in north Europe. Biomethane also has good growth potential but it is hindered by the lack of legislation in some countries. Jobs in these sectors are increasing an average of 5 percent per year unlike other renewable energies that have been declining. European biogas systems have huge potential beyond renewable electricity. It is a decentralized and domestic source of methane that can contribute to local and rural development, promote high greenhouse gas savings and will be a key factor in the European Union reaching its 2020 and 2030 objectives.

Mr Georgiy Geletuka (Bioenergy Association of Ukraine - UABio) described Ukraine's experience with biogas. The bioenergy sector replaces 3 billion m^3/year of natural gas in Ukraine. About 5 000 MW thermal from biomass is operational, including 2 500 MW in private houses, 500 MW in public sector and 2 000 MW in industry. The most valuable residues are animal waste, sugar beet pulp, sunflower oil extraction cakes, sunflower husks and flour production by-products. There is a regulatory framework for biogas that is taking shape in Ukraine. The National Action Plan on Renewable Energy through 2020 sets the task of achieving total gas replacement by biomass on 7.2 billion m^3/year in 2020. Furthermore, Law 514-VIII (in force from July 2015) has removed most of barriers for development of renewable energy power projects and settings of "green tariffs" for them. The market is open and projects are mostly feasible in the following areas: heat production from biomass for private buildings; heat production from biomass for public, industrial and commercial consumers; heat production and combined heat and power from biomass in the district heating sector; power production from biomass; and large scale biogas projects with existing heat consumption.

Mr Sambalkhundev Khas-Ochir (Ministry of Energy, Mongolia) spoke about biomass resources and potentials in Mongolia. The majority of the country's energy is generated from combined heat and power plants. Mongolia does not have much experience in biomass usage but feasibility studies have been done in several areas. As a result, the research shows that the country has a high potential to use biomass in the near future, particularly forest, crop wastes, animal husbandry residues and industrial and domestic wastes.

Field visits

Participants had the opportunity to visit either Pilze-Nagy Ltd or Budapest Sewage Works Ltd.

The field visit at the **Pilze-Nagy** farm gave the opportunity to participants to learn about the production cycle of the mushroom farm and its biogas production system. The farm is located about 1.5 hours north of Budapest, in an alluvial plain. The area is a major agricultural region and crops produced include grains and oilseeds, while dairy farms are also very abundant. The mushroom farm is conveniently located in this landscape and it exploits the vast availability of cropping residues (i.e. wheat straw) as substrate for the cultivation of several varieties of oyster mushrooms. A 10 kg wheat straw bale is moisturized up to the point it doubles its weight. The bale is then sealed and inoculated with spores of the mushrooms. Every 30 days, the blooms produces about 2 kg of mushrooms. Every bale can produce two blooms (total 4 kg) before the substrate is spent.

The farm produces 3,000 tonnes of spent substrate per day. The massive volume of spent substrate (i.e. partially decomposed wheat straw) has significant disposal costs for the farm and therefore an alternative path for the use of such material was researched. Thanks to a partial contribution from the European Union, a project for the construction of a biogas plant was initiated in early 2000s. The spent mushroom substrate is mixed with manure collected from the dairy farms surrounding the farm and the mixture is fed to the biodigester. The biogas plant has a capacity of 300 kW and the electricity is used on farm and partially sold to the grid. The digestate produced by the biodigester is then picked up by the farmers that use it in their fields as an optimal organic fertilizer that returns valuable nutrients to the soil.

This field visit offered the opportunity to gain specific insights on the production of an added value food product such as the oyster mushrooms and to learn about how to integrate in the food-energy system the residues from both components of the system in an highly sustainable manner.

The field visit at the **Budapest Sewage Works** gave the opportunity to participants to learn about the technology of the South-Pest Wastewater Treatment Plant. It is the most modern wastewater treatment plant in Hungary. It continuously receives and treats the wastewaters of about 300.000 inhabitants from four Southern districts of Budapest and from the companies operating in these districts.

The plant area is 17 hectares with a total number of 70 employees. The quantitative parameters of the plant are as follows:

- quantity of treated wastewater – the wastewater treatment capacity of the plant is 80,000 m3/day, 22 million m3/year:
- quantity of wastewater sludge produced – one of the side products of wastewater treatment is dewatered sludge, the amount of which at the plant is 27,500 tons/year. Electrical and thermal energy is generated form the 5.9 million m3 biogas produced every year form the anaerobic sludge processing, which covers almost all the energy needs of the plant; and
- quantity of the produced technological waste – the quantity of the non-organic waste produced during wastewater treatment reaches 700 m3/year.

The plant is self-sufficient since nearly 90% of its electric energy demand and 100% of its heat energy demand is produced from sewage sludge and organic wastes.

The qualitative parameters of the plant are as follows:

- multiple step mechanical and biological wastewater treatment also combined with the living machine technology to ensure the quality of the treated water discharged into the Danube;
- the plant ensures the environmentally friendly treatment of the side products of wastewater treatment, such as sludge and mechanically removed pollutants as well as their preparation for storing in landfills and recycling;
- the plant treats the delivered waste containing organic compounds and transforms it into green energy; and
- odors are removed during the technological processes.

Round table 1 – Technology development and private sector experiences for development opportunities in the region

This round table session, moderated by *Mr Gianluca Sambucini* (UNECE), focused on speakers' experiences and lessons learned concerning technologies used towards the development of bioenergy opportunities in Eastern Europe and Central Asia.

Mr Giuliano Ghiglione (Beta Renewables) spoke about Beta Renewables' experience. The company began building the Energochemica ethanol plant in Slovakia in 2014. The primary feedstocks is wheat straw and it has an ethanol capacity of 55 000 MT/year. In general, Beta Renewables has found that there are a number of opportunities and few challenges for bioenergy development in the region. The opportunities are: optimal biomass availability and cost; no strong competition for straw with existing industries; unused land for energy crop cultivation; strategic areas for future export to the European ports; lower CAPEX and OPEX; local key investors with long term perspective strategies on the future of biofuel; and availability of structural funds at the European Union level for project deployments. The challenges foreseen are: collection of biomass is not yet a common practice in agriculture; lack of typical equipment for collection and relevant investment; lack of political support from authorities for the deployment of advanced biofuels; no mandates for advanced biofuels in place; and specifically in Central Asia the 1G industry has not yet taken off yet and therefore the 2G industry could not benefit from existing know-how.

Mr Gerard Ostheimer (Sustainable Energy for All - SE4ALL) spoke about Below50, which is a new initiative that aims to unite companies around the world in scaling-up the development and use of sustainable fuels. Any company that produces, uses and/or invests in fuels that are at least 50 percent less carbon intensive than conventional fossil fuels can join Below50. Companies must publicly commit to the campaign, show evidence that supports their claim, and disclose their progress towards achieving this goal. This campaign will not focus on the technology but rather the solution/message – CO_2 reduction – to reframe these fuels and reach new customers and markets. The goals are to: increase the number of companies choosing low carbon fuels; demonstrate low carbon fuels makes good business sense; and address barriers to source renewable fuels.

Mr Paolo Corvo (Clariant) spoke in-depth about Clariant's sunliquid process and its route to commercialization. The company is currently focusing on areas in six countries in Eastern Europe and Central Asia, specifically Bulgaria, Czech Republic, Hungary, Poland, Romania and Slovakia. These were chosen based on feedstock availability, major feedstock suppliers and complementary assets. Some of the lessons learned through this process were that technology validation is key and there must be value chain security as well as support from the local community. The current constraints center around the lack of advanced biofuels mandates and national legislation that allows for the valorization of bio-products.

Mr Jeroen van Campen (DuPont) began by discussing DuPont's 2G ethanol plant in Nevada. The technology to produce biofuels is mature but policy is still wavering, which makes it difficult to transform our current system of having large, centralized oil refineries to a new system of decentralized small sites where everything is produced locally. Policy uncertainty is what leads to investment uncertainty, while participatory approaches of local communities were highlighted as key.

Mr László Keresztury (MOL Hungary Zrt) described MOL's experience. MOL Group is an integrated, international oil and gas company based in Budapest, Hungary. It has also launched and continues to work on a series of R&D projects, which are designed to reduce the life-cycle emissions of its products. The company has a focus on advanced biofuels. There are a number of policy drivers both at the European Union level and Hungarian level. Some of the company's current constraints are related to feedstock availability (volume, quality and seasonality), blending wall and the proliferation of renewable fuel regulations across the European Union.

Mr Zoltán Reng (Hungrana Kft) explained that Hungrana turns corn into ten different products and invests in products, as well. The industry needs to continue doing its job sustainably and pursue more outreach activities to show people what they do. It is not about price competition but rather rural development, saving greenhouse gas emissions and greening the processing industry. Once that happens, investments will come. The message is that bioenergy production is here for the long run but it needs long-term stable policy to continue to grow.

Mr James Cogan (Pannonia Ethanol Zrt) said that Pannonia Ethanol contributes 500 million euros to Hungary's gross domestic product while also supporting 2 000 jobs and 1 000 farmers. The company's plant produces 450 million litres of corn ethanol, 325 000 tons of protein feed and 10 000 tons corn oil. The main lesson learned through the development of this plant was that it can be done and done quickly.

Ms Francesca Ettorre (Turboden) stated that Turboden is a leading company in the development and production of Organic Rankine Cycle (ORC) turbogenerators and today the company has more than 320 plants in 34 countries accounting for more than 400 MW installed. The company has built plants across Eastern Europe and Central Asia. The best conditions prevail in these regions due to: huge biomass potential; low biomass cost; food and forest industry; thermal energy needed (district heating); and strong government commitment in renewables. The barriers that have been encountered are related to lack of policy framework, financing opportunities and public understanding of bioenergy.

Round table 2 – Raising awareness on project financing opportunities for the development and deployment of bioenergy projects in Eastern Europe and Central Asia

The aim of this round table discussion, moderated by *Mr Pjotr Schade* (Everest Energy Group), was to analyze and discuss the necessary steps to best develop and finance bioenergy projects in Eastern Europe and Central Asia.

Mr Giorgi Ghambashidze (Ministry of Agriculture, Georgia) spoke about three of Georgia's project financing opportunities for bioenergy. The first is about co-financing for agro-processing and storage enterprises. The project was initiated by the Ministry of Agriculture of Georgia and is implemented by the Agricultural Projects Management Agency, with financial support from the state budget. The second is the 'Produce in Georgia' programme, which is implemented by The Ministry of Economy and Sustainable Development of Georgia and the Ministry of Agriculture of Georgia. The goals of the programme are to facilitate the development of industries focused on production as well as facilitate the establishment of new enterprises and extension/upgrade of existing ones. Under the programme the volume of one loan/lease must not be less than 600 000 USD and must not exceed 2 000 000 USD or its equivalent in GEL. In case of requesting more than 2 000 000 USD or its equivalent in GEL the decision on funding will be made by the Government of Georgia. The final project is the preferential agro credit project. The purpose of the project is to improve the processes of primary agricultural production, processing, storage and sale by providing farmers and entrepreneurs engaged in agriculture with cheap, long-term and preferential funds.

Mr Nihad Harbas (GIZ, Bosnia and Herzegovina) discussed project-financing opportunities for the development and deployment of bioenergy projects in Bosnia and Herzegovina. There are a few financing models available in the country, including capital/budget, grants, ESCO and commercial. There are also feed-in tariff and feed in preimum support schemes. However, the latter two are only for electricity generation. Some of the lessons learned from GIZ's experience developing a biomass cogeneration district heating system through the formation of a public-private partnership were: feed-in tariffs were insufficient for significant for renewable energy investment which necessitates the introduction of incentives for district heating systems; specific models for supporting district heating systems need to be created; feed-in tariffs for biomass should be updated and increased to attract ESCO companies; and new community based models should be introduced.

Mr Sumeet Manchanda (EBRD) explained that the EBRD offers a range of products and services. The bank does offer financial products tailored to each client, meaning it could offers direct financing through loans, equity investments and guarantees to promote trade as well as offering assistance through intermediaries to small and medium enterprises. Thirty percent of EBRD's investments go to green sectors. For instance, a Romanian oil seed group has received long-term support, Victoria Group in Serbia has received assistance in the replacement of natural gas with waste boilers for molasses and straw and a start-up biogas facility has also benefited from EBRD's help. The challenges that still need to be addressed in Eastern Europe and Central Asia are: security of feedstock supply, cost-effectiveness of logistics, licensing for fermenting, and lack of knowledge among feedstock users.

Mr Dzenan Malovic (World Bank Group) focused his presentation on the work of the International Finance Corporation (IFC) of the World Bank Group. The IFC has formulated a Climate Implementation Plan and its objectives are to: scale climate investments to reach 28 percent of IFC's annual financing by 2020; catalyze USD 13 billion in private sector capital annually by 2020 through mobilization, aggregation, and de-risking products; maximize impact through greenhouse gas emissions reduction and resilience; and account for climate risk—both the physical risk of climate impacts and the carbon asset risk. The identified obstacles to this work have been categorized into three fields: renewable energy developers, local banks and regulations. The IFC has a number of either ongoing projects or projects in the pipeline related to bioenergy in Eastern Europe and Central Asia. Through these projects, the IFC has taken away key lessons learned, such as the need for detailed resource mapping and step-in rights.

Ms Anikó Biczó (Hungarian Export Import Bank) talked about the general factors that are taken into consideration when the Hungarian Export Import Bank is deciding whether or not to finance a bioenergy project. For instance, when it was deciding to provide financing to a bioethanol plant it looked at the following criteria: plant location (will it be located near the feedstock and railway station?), chosen technology (Is it a reputable technology supplier? How efficient is it? What is the yield?), participants, management structure, equity and collaterals.

Mr Dadan Kusdiana (Palm Oil Estate Fund, Indonesia) spoke about the financial support schemes available in Indonesia to help the bioenergy sector develop, particularly the Indonesia Estate Crop Fund for PalmOil (IECF). This group recently established SAWIT, which is a fund with an annual budget of USD 700 million, to promote and support sustainable palm oil, small farmers welfare and food security. Part of this programme focuses on providing support for biofuels by funding research and development projects for palm oil based fuels as well as promoting the utilization of palm oil for biofuels. The research project covers R&D on biogas, next-biofuel generation, gasification, torrefaction and pelletizing

Mr Piero Cavigliasso (BioChemtex Group) described one private sector experience from the point of view of BioChemtex, which is an engineering firm that builds cellulosic ethanol plants. It was suggested that the availability of project financing options varies between the different stages of the project lifecycle. For instance, in the piloting phase BioChemtex found that grants were readily available. However, support subsidies and grants only improve the business plans and in many cases they do not solve the main issue of access to debt and related risk assessment. Loan guarantees have proven to be the most efficient tool to mobilise investment. Some barriers related to risk management still remain, including conversion efficiency improvements, access to large amounts of biomass and lack of a market for biobased products.

Mr Attila Kovács (Első Magyar Biogáz Kft) explained that the company raises awareness of project financing opportunities through its broad experience in preparing technological concepts, business plans and feasibility studies for biogas projects. It has also provided expert opinions upon appointments of banks engaged in financing biogas investments. The lessons learned from this experience are: the development of the biogas industry has been and will remain fully dependent on the support policies of the Governments; the support schemes must be long-term, trustworthy, transparent and objective; retroactive changes in the support schemes must never occur – such changes destroy the trust of financial institutions with a long-lasting effect; support schemes must acknowledge the special feastures and benefits of different renewable energy sources; and non-returnable investment subsidies are not sufficient for enabling successful biogas investments, financial incentives are also needed in relation to operations.

Conclusions – Main messages of the Bioenergy Week

Mr Zsolt Feldman (Ministry of Agriculture, Hungary) and *Ms Maria Michela Morese* (GBEP Secretariat) provided concluding remarks that summarized the week's presentations highlighting several main messages.

Despite having differing economic, social and political situations, the countries of Eastern Europe and Central Asia all have vast potential to develop bioenergy due in large part to the availability of solid biomass and animal waste. However, this potential remains largely untapped as most countries are only in the nascent stages of development. One area where this was particularly evident was heating both in household cookstoves and district heating systems. Participants repeatedly mentioned how cookstoves and district heating systems are being run inefficiently on traditional biomass or fossil fuels, contributing to air pollution, greenhouse gas emissions and debt. Several presentations throughout the week showed how much these systems could benefit from a transition to bioenergy. Another area that would improve with increased production and use of bioenergy is energy security, as many of the countries mentioned that they were reliant on imported oil and/or natural gas (some are even net importers).

Barriers to the further development of bioenergy sectors in these regions exist along all points of the various value chains. First, participants stressed the need for a long-term policy framework both within the country and at the regional level to stabilize the market and foster favourable market conditions. Second, there is a lack of awareness of the available technologies and capacity to deploy them. Third, there was a discussion about how there is a need for additional investment volume but that financing opportunities needed to be structured better. The risk appetite of commercial banks to provide debt also needs to be increased. Lastly, public-private partnerships were recognized as a key approach, however with the need to be better structured in order to emphasize cooperation.

Many challenges and opportunities were identified during the event, which concluded on a positive note by stressing the incredible potential these regions have to produce and use bioenergy. All of the exchanges of lessons learned and best practices that occurred during the fourth Bioenergy Week will aid in increasing awareness and fostering an enabling environment in Eastern Europe and Central Asia.