ANNEX 2 – STAKEHOLDERS COMMENTS

Andritz Overview

Andritz is one of the largest machine and technology suppliers in the pulp and paper, hydro power, separation, environmental industries.

We have intensified the activities in the pre-treatment and enzymatic hydrolysis area in the last 8 years, and have developed pre-treatment systems for steam-explosion, advanced steam-explosion, auto-hydrolysis, dilute acid hydrolysis, beside our activities in the thermo-chemical area with gasification, biomass boilers, solid-liquid separation, etc.

Commercial Scale Equipment

At the stage in the development of different options to convert biomass into biofuels there are aspects of each process design that require further optimization. However, that is not the case for the equipment associated with these process strategies. The equipment for the material handling, pre-treatment and liquid solids separation operations for lignocellulosic biofuel can be easily transferred from other industries where scale-up to viable commercial plants is well known. Large commercial scale equipment exists in the pulp and paper, fiberboard and chemical industries that can be directly used for lignocellulosic ethanol production. The pulp and paper and fiberboard industries are handling large quantities of biomass every day so there is little risk associated with equipment scale-up. The equipment is already designed and operating at huge commercial production rates in excess of 7,200 dry tons/day of feedstock and can be easily adapted to the lignocellulosic ethanol industry.

The application of this existing equipment to lignocellulosic biofuel such as traditional pulping digesters can be a viable option for bio-reactors for pre-treatment systems, both for dilute acid hydrolysis stages as well enzymatic hydrolysis. Andritz is building small, medium size and very large reactors, along with feeding and washing equipment. Our currently largest reactors are designed for up to 3h retention time and capacities of over 7,500 dry ton/day feed of wood chips.

Similar applies for bio-mass feed systems into reactors, where machines such as plug feeders, impressafiners and rotary valves nowadays mainly used for mechanical or chemical pulping systems are also being used for feeding various biomass feedstock into 2nd generation biofuel pre-treatment systems or thermo-chemical reactors such as gasifiers.

Since many of the 2nd generation biofuel processes require special alloys for a higher corrosion resistance, Andritz is building – and has built units in higher alloys when it is needed (e.g.: duplex, hastelloy or zirconium).

Andritz is already providing the pre-treatment equipment for commercial scale projects worldwide with references for cellulosic ethanol production.

Pre-treatment process development

Our latest delivered pilot plants as well as the commercial systems incorporate an advanced steam-explosion process developed by Andritz. In this concept hemicellulose is extracted at a controlled, elevated temperature, prior to steam-explosion, but while the biomass is continuously kept under pressure. This minimizes the creation of inhibitors otherwise common for single-stage steam-explosion and provides the potential of a separate value stream at the same time. Since this concept is a closed 2-stage process, steam consumption is not higher than conventional pre-treatment.

CAMELINA

Camelina [*Camelina sativa* (L.) Crantz] is an herbaceous annual oilseed plant with short cycle (85 to 100 days from sowing to harvesting) with low watering (rainfall) and fertilizers needs. Its grains contain from 36% to 42% of oil and 27% to 32% of protein. Sowing and harvesting are carried out with conventional farm machinery used on soybean and wheat crops, needing only an appropriate adjustment. The culture of camelina requires no phytosanitary treatment during its cultivation and has some allelopathic characteristics with positive feedback when grown in rotation with cereals and legume.

Trials conducted in Brazil since 2010 by BIOECA Brasil showed that camelina fits in the states of MT, MS, PR and SP as a second crop after the soybean harvest and the sowing deadline date of off-season ("safrinha") corn. Camelina also fits in the RS, SC and PR as an alternative winter crop. Camelina could fit in the states of MA, PI, TO, BA and GO (must be tested) as a rotation crop, and could also fit in the northeastern states (must be tested), in marginal areas.

These characteristics make the camelina stand out as a non-food crop with low cost and high potential for reducing greenhouse gases (GHG). In addition, camelina fits into a window of opportunity in the agricultural calendar in consolidated areas of agriculture that does not compete with food production, and can rapidly grow your production area.

Native from Europe and Central Asia, from the Brassicaceae family, known and cultivated since the Bronze Age, camelina was rescued from nearly oblivion for nearly 20 years by the high content of Omega-3 fatty acids in your oil. Then began to be cultivated in North America, initially in the USA and then in Canada, in marginal areas where agriculture had not traditionally being done, in the states of Montana, Wyoming and the Dakotas, in the USA, and in the southern provinces of Alberta and Saskatchewan, in Canada.

The crushing of the grains of camelina in a cold pressing produces a meal with a content of residual oil which is used as animal feed, and oil began to be used initially as a feedstock for biodiesel production.

Since 2007, initiatives of civil and military aviation set as its goal the introduction and use of renewable fuels in aviation. Camelina oil has since been the main raw material used for biokerosene production by a process first developed by UOP (a division of Honeywell) of hydrogenation and cracking of vegetable oils and animal fats. This biokerosene was widely tested in turbines and certified by ASTM in mid-2011. This process of producing bio-kerosene is known by the abbreviations HEFA, HRJ or Bio-SPK.

The use of camelina meal as animal feed for poultry and pigs was approved by the FDA in the USA in 2009 and also by the European Commission in June 2011.

Great Plains Oil & Exploration (the Camelina Company), in the USA and Canada, is the world leader in growing camelina, with years of field experience, know- how and own registered varieties. BIOECA in Spain made a joint venture with Camelina Company in 2010 and created Camelina Company España, leader in growing camelina in Europe. BIOECA Brazil became Camelina Company Brazil in late 2013.

GOL Airlines has been supporting the key efforts for the implementation of the Brazilian Biojetfuel Platform, with a special focus on the Plataforma Mineira de Bioquerosene, the Plataforma Pernambucana de Bioquerosene and the Plataforma Gaúcha de Bioquerosene.

Since the historic RIO+20 low carbon flight between Sao Paulo and Rio, as the last leg of ICAO Secretary General's journey into RIO+20, GOL has performed the first commercial flight in Brazil during the Aviator's Day, October 19th, 2013 using HEFA, and has flown 350 low carbon flights with a 4% blend during the 2014 World Cup in Brazil. IDB, Boeing, BR Aviation and partners were supporters of these flights. It is GOL's intention to promote continuous SIP flights in Brazil following the ANP publication of the Resolution 20/2013 with the SIP update.

Since feedstock diversification and sustainable production of biomass are key to a competitive biojetfuel value chain, GOL has also been supporting since 2011 R&D efforts for Jatropha and Macauba in Brazil. Special consideration is being given to the Macauba commercial plantations in Minas Gerais, following a successful domestication program conducted by the Federal University of Vicosa, under the sponsorship of Petrobras.

A Jatropha follow-up program is being reviewed with ABPPM and Embrapa Agroenergia, based on the encouraging results of the Embrapa Jatropha domestication program and concrete advances of JOIL and SGB.

Introductory Camelina trials being addressed by EPAMIG and Camelina Company Brazil.

The use of sustainable soy oil is also being addressed for the Rio Grande project.

LanzaTech

Brazil is a rapidly growing market with strong experience in renewable fuels over a long period, as well as, highly committed aviation and government sectors, making it attractive for research, development and commercialization of sustainable jet fuels.

LanzaTech is revolutionizing the way the world thinks about waste carbon by treating it as an opportunity instead of a liability. LanzaTech's novel gas-to-liquid technology has opened up vast new sources for making low-carbon chemicals and fuels that displace petroleum without the environmental concerns associated with crop- and land-based bioproducts.

LanzaTech's bioprocessing platform offers an economically robust route to carbon capture and re-use enabling the monetization of local gas sources with minimal capital investment, giving off-grid communities access to clean, cost competitive and reliable energy. The patented process uses a biological microbe to convert waste gas containing CO or CO_2 (from industrial sources like steel mills and processing plants) or syngas generated from any biomass resource (e.g. MSW, organic industrial waste, agricultural waste) into fuels and chemicals.

LanzaTech has adopted a rapid commercialization plan that has seen the technology evolve from lab scale gas-to-ethanol technology to a fully sustainable integrative gas to fuels and chemicals platform, proven at scale, that can be deployed globally. LanzaTech, a company founded in New Zealand is now a global organization with headquarters in USA, and facilities in New Zealand, Europe, China, Taiwan and India. Full commercial operation is targeted for 2015.

In 2013, LanzaTech and its partners received RSB sustainability certification for their joint venture's Chinese facility that converts waste steel mill gases to sustainable biofuels. The RSB is a global sustainability standard and certification system for biofuels and biomaterials production. The facility, which uses LanzaTech technology, is the first RSB-certified biofuel plant in China, and the first anywhere to receive this key certification for fuels from industrial carbon capture and utilization.

LanzaTech and Sustainable Aviation Fuel

LanzaTech provides a strategically important route to drop-in hydrocarbon fuels including alcohol to jet fuel (ATJ). Low cost alcohol and 2,3 BDO produced using LanzaTech's technology is converted into jet fuel together with conversion partners. Jet fuel produced from LanzaTech's ethanol has been shown to meet key physical and compositional properties laid out in the ASTM D7566 standard for aviation turbine fuel containing synthesized hydrocarbons. The company is collaborating with aviation industry partners Virgin Atlantic and Boeing along with the ASTM Alcohol to Jet fuel task force to modify the existing aviation turbine fuel standard to include the ATJ pathway.

LanzaTech been awarded a $3 million grant from the U.S. Federal Aviation Administration (FAA) and a $4 million grant from the US Department of Energy to accelerate the development of alcohol-to-jet (ATJ) fuel pathways, with multiple partners including Swedish Biofuels, the Pacific Northwest National Laboratories, and Imperium Aviation Fuels. LanzaTech is working in partnership with Virgin Atlantic to produce the world's first low carbon aviation fuel derived from waste gases.

Few things are certain in life, but one constant remains: a finite supply of fossil fuels cannot sustain the needs of a world population of 7 billion people. The need for biofuels is rapidly evolving at a global scale.

At Life Technologies, we are partnering with the industry's most forward-thinking organizations and employing the most innovative, rigorous, and robust tools on the market to provide comprehensive solutions to the biofuel industry to develop, optimize, and mass produce new, renewable energy sources.

We believe that a key point to improving the development of these new solutions for aviation biofuels in Brazil will be the partnership between excellent research centers, biotech companies, and the companies focused on the production of feedstock, refining or bioconversion processes. These companies will generate the needs, which the research centers will work to address using the state-of-the-art technologies developed by the biotech companies. This collaboration can contribute to speed the processes of plant breeding and modify highly complex pathways to generate optimized host for end products used for aviation biofuel production.

Life Technologies is one of those biotech companies. Life Technologies offers a comprehensive portfolio of Synthetic Biology tools and services designed for metabolic engineering, enabling a more effective approach to optimizing organisms and bio-production pathways, empowering the development of biofuels, energy crops, safe bio-based chemicals, and CO_2 sequestration methods.

MOUNT RUNDLE FINANCIAL

Brasília, Brazil and Calgary, Canada

www.mountrundle.com

Biokerosene Fuel Economics and Financing

The Roadmap For Sustainable Aviation Biofuels For Brazil (SABB) represents an important step in moving towards the development of a viable supply chain for "drop-in" aviation biofuels.

The studies completed and developed through the roadmapping process have demonstrated significant capabilities and viability in a number of areas, including agricultural feedstock development, logistics, transformation and distribution.

It is clear, however, that significant challenges remain to the establishment of a sustainable, financially and economically viable supply chain, primarily due to the relatively high cost to transform raw biofuel feedstock into specification biokerosene. In this regard, fundamental chemistry and energy balances create the challenge to discover economically viable processes relative to the cost of existing conventional fuels.

Supply chain issues are also key in that, at least to start, the establishment of parallel supply chains to handle biofuels will represent additional costs right up to, and in fact through, airport-based fuelling systems. These can, however, likely be addressed by transitional government support policies.

While government policies to insure the full social costs of the use of conventional hydrocarbons will play a role, ultimately the challenge will rest on the ability to develop economically viable transformational technologies. The SABB process created an important inventory of the current options, of which there are many.

This is simply a matter of time and effort, and initiatives such as the SABB process are important steps to support the continuing development of these solutions with a focus on Brazil.

JATROPHA WILL ENABLE BRAZIL TO BECOME A NET EXPORTER OF AVIATION BIOFUELS

Brazil has approximately 200 million hectares of degraded pasture land that can be converted to productive agriculture with innovations and technology. Given that Brazil is a net exporter of food and forestry products, energy crops present a unique opportunity to leverage this enormous area of degraded pasture lands for the production of sustainable bioenergy, including aviation biofuels.

Jatropha is one of the standout energy crops that can grow in the climatic conditions offered by the degraded pasture lands within the Cerrado transition areas of Brazil. Studies conducted by SG Biofuels in Guatemala since 2010 indicate that Jatropha hybrids deliver biomass yields that position the crop as an economic alternative to benchmark ligno-cellulosic and oil-seed bearing species, as well as emerging energy crops that are under domestication.

SGB established Jatropha hybrid trials in 2012 in the states of Mato Grosso do Sul (pictured on the right), Mato Grosso and Minas Gerais in order to demonstrate yield and production cost economics specifically within transitional and degraded pasture lands in Brazil. The trials include evaluations of hundreds of unique hybrid genotypes as well as production agronomy systems. Initial results demonstrate that breeding and innovations in production agronomy systems will deliver the tecnological advances to enable deployment of Jatropha plantations at large commercial scale.

With adequate technology, availability of credit and supporting public policies, it is reasonable to assume Brazilian growers can scale Jatropha plantations ranging from 2 – 10 million hectares within the next 15 years. At this scale, Jatropha will enable Brazil to become a net exporter of aviation biofuels within the next 15 years, a scenario which would generate the following production and sustainability parameters:

Jatropha Annual Production & Emission Reductions Potencial		
Jatropha Planted Area (million ha)	2	10
Jatropha Oil Production (million Mt)	4 – 6	20 – 30
HEFA Jet Fuel Production (million Mt)	3 – 4.5	15 – 23
CO_2 Emission Reduction (million Mt)	8 – 12	40 – 60

Key Assumptions

*** 2 – 3 tons per hectare range of annual Jatropha oil yield**
*** 75% conversion efficiency from feedstock to final fuel product using HEFA production pathway**
*** 75% emissions reductions when using Jatropha based aviation fuel (Bialis, et al. 2013)**
*** 3.5 grams of CO_2 emissions per every gram of fossil Jet Fuel consumed**

About Solazyme, Inc.

Solazyme has pioneered an industrial biotechnology platform that harnesses the prolific oil-producing capability of microalgae. Their technology creates a new paradigm that enables the creation and optimization of novel oil profiles that cannot be achieved through existing oils alone. Solazyme's tailored oils offer enhanced value as compared to conventional oils, and enable Solazyme's customers to enhance their product performance, reduce processing costs and/or enhance a products' sustainability profile. Solazyme's oils are among the most sustainable oils in the world and are drop-in replacements such that they are compatible with existing production, refining, finishing and distribution infrastructure in all of their target markets.

Through standard industrial fermentation equipment, the main production process used to commercially grow Solazyme's algae for oil production, Solazyme can efficiently scale and accelerate microalgae's natural oil production time to merely a few days. By feeding their proprietary oil-producing microalgae plant-sugars in these dark fermentation tanks, Solazyme is utilizing "indirect photosynthesis" opposed to traditional open-pond approaches typically associated with algae growth.

By the end of 2013, Solazyme will commission it's first commercial renewable oil production facility in Brazil with it's joint venture partner, Bunge. This plant will have an annual nameplate capacity of 100,000 metric tons of output oil, or roughly 30 million gallons.

Solazyme's platform is extremely feedstock flexible and can utilize a wide variety of renewable plant-based sugars, such as sugarcane-based sucrose, corn-based dextrose, and sugar from other sustainable biomass sources including cellulosics.

About Solazyme Jet Fuel: Solajet

What is Solajet™ – Solajet™ is the trademarked name for the renewable, end-use aviation fuel refined from Solazyme's proprietary algal oil. It is the world's first microbially-derived jet fuel to meet key industry specifications for use in commercial aviation and is compatible with existing infrastructure.

Fully compliant with specifications — Solajet™ derived from Solazyme's renewable algal oil fully complies with the specification for Synthetic Paraffinic Kerosense from Hydroprocessed Esters and Fatty Acids that specifies bio-based fuels intended to be blended with commercial jet fuel (Jet-A).

Additional Uses – Solazyme's propriety algal oil can additionally be refined to meet a range of other jet fuel specifications (e.g. HRJ-5, HRJ-8).

Benefits – According to the US Navy, Department of Agriculture and Department of Energy Roundtable held on 5/18/12 in Washington, DC, as reported by Biofuels Digest, Solajet's fuel properties when tested in US warplanes exhibited the following benefits while in use: allowed for a faster, farther, greater payload; reduced wing heat stress; made flying at a higher altitude possible; enhanced stealth (low smoke); provided greater pilot reaction time; was a less flammable / safer fuel; was better for the environment; provided a storage life in years vs. months and ultimately lowered maintenance costs.