Commercializing Conventional and Advanced Liquid Biofuels from Biomass

Task 39 IEA Bioenergy

Inside This Issue

From the Task	*1*
SEforALL and below50	4
Feature on China	*7*
In the News	***16***
Meetings/Conferences	*19*

From the Task

By Susan van Dyk, Jack Saddler and Jim McMillan

Since the publication of our last Newsletter, IEA Bioenergy Task 39 has continued its work in promoting the commercialization of sustainable, low carbon liquid biofuels from biomass. The Task held a business meeting in Gothenburg, Sweden on 15 May 2017, attended by representatives from most of its member countries. (See photo below of country representatives and visiting speakers). The Task continues its work on various deliverables, most recently completing a report on Biofuels in Shipping (still under embargo; later this year it will become publicly available for download on the Task website (www.task39.org)). Another report on Advanced Biofuels in Advanced Engines has been drafted and is currently under review. The Task also completed an update of the advanced biofuel demoplant database which can be accessed at http://demoplants.bioenergy2020.eu/. The Task is also progressing its work on updating its Drop-in biofuels report, with an updated report to become available during 2018.

Task 39 members also participated in the Advanced Biofuels Conference held on 17-19 May in Gothenburg, Sweden.

Task 39 Members - ExCo* and Country Leads+ and Task Representatives

Australia
Mark Brown*
Les Edye
Steve Rogers

Austria
Theodor Zillner*
Dina Bacovsky

Brazil
Miguel Ivan Lacerda de Oliveira*
Paulo Barbosa
Antonio Maria Bonomi
Eduardo Barcelos Platte

Canada
Alex MacLeod*
Jack Saddler
Warren Mabee
Steve Price

Denmark
Jan Bunger*
Claus Felby
Michael Persson
Henning Jørgensen
Anders Kristoffersen

European Commission
Kyriakos Maniatis*
Luisa Marelli
Jacopo Giuntoli

Germany
Birger Kerckow*
Franziska Müller-Langer
Nicolaus Dahmen

Japan
Takahisa Yano*
Shiro Saka
Satoshi Aramaki

Netherlands
Kees Kwant*
Timo Gerlagh
Johan van Doesum

New Zealand
Paul Bennett*
Ian Suckling

South Africa
Thembakazi Mali*
Emile van Zyl

South Korea
Kwon-sung Kim*
Jin Suk Lee
Kyu Young Kang
Seonghun Park

Sweden
Asa Forsum*
Tomas Ekbom

United States
Jim Spaeth*
Jim McMillan

Image Source: esf.edu.com

Since publication of our last Newsletter, several interesting biofuels developments have taken place arround the world.

The US Renewable Fuel Standard (RFS), administered by the US Environmental Protection Agency (EPA), has been one of the strongest policies for support of biofuels development. The RFS sets increasing renewable fuel volume obligations (RVOs) for different biofuels categories, which historically have been the basis for continued investment in the industry. Oil refiners have argued that these RVOs should be reduced. The EPA did this for 2014, 2015 and 2016, specifiying volumes below the RFS's statutory levels. The EPA argued that it had the power to do so under the law based on "inadequate domestic supply." However,in a recent court decision from the US Court of Appeals (Americans for Clean Energy *et al. v.* EPA), the Court vacated EPA's decision to reduce the total RVO requirement in 2016 and remanded the rule to EPA for further consideration. The court agreed with the petitioners that the EPA erred in how it interpreted and used the "inadequate domestic supply" waiver in the RFS law in lowering RVOs for 2014-2016. U.S. Circuit Judge Brett Kavanaugh concluded that the EPA isn't allowed "to consider the volume of renewable fuel that is available to ultimate consumers or the demand-side constraints that affect the consumption of renewable fuel by consumers." (Read more and here) The EPA thus can not use arguments based on the so-called blend wall or infrastructure limits (flexible fuel cars or high blend compatible fueling pumps) to justify reduced RVOs. This is seen as a victory for the biofuels industry as it prevents oil refiners from blocking biofuels deployment simply because some fueling stations can not supply higher blends. (Read more)

Aviation biofuels expansion continues, with more airlines having regular commercial flights using biofuel blends, and additional airports in Sweden and Norway now offering biojet fuel blends. A study by NASA demonstrated that biofuel blends in jet fuel reduce exhaust soot particles, although further study is required. (See Page 13). A Canadian-based study performed by Air Canada under the CAAFCER project is also investigating emissions from aeroplanes using biojet fuel blends. Read more about the project funded by the Green Aviation Research and Development Network (GARDN) here.

We welcome your feedback. Please direct your comments to Susan van Dyk

Task 39 Management:

Operating Agent (Agency):	**Alex MacLeod** (Natural Resources Canada)
Task Leader (Agency):	**Jim McMillan** (National Renewable Energy Lab)
Co-Task Leader (Agency):	**Jack Saddler** (Univ. of British Columbia)
Subtask Leaders:	
(Biochemical conversion, N. America)	**Jim McMillan (NREL, USA)**
(Biochemical conversion, EU):	
(Link to Advanced Motor Fuels IA):	**Franziska Mueller-Langer** (DBFZ, Germany)
(Policy issues, EU):	**Michael Persson** (Denmark)
(Policy issues, North America):	**Warren Mabee** (Queen's U, Canada)
(Implementation Issues):	
Task Coordination:	**Susan van Dyk** (Univ. of British Columbia)

Biofuels Digest provided an update on the latest developments on cellulosic ethanol deployment. (Read more)

Further developments in the biofuels arena are provided in the "In the News" section starting on Page 15.

In spite of developments in biofuel use in aviation, a recent report by The International Council on Clean Transportation (ICCT) shows increased emissions from aviation in North America. International aviation emissions of greenhouse gases (GHGs) from airline carriers based in Canada and the United States increased from 36.2 to 60.2 million tonnes (MtCO2e) per year from 1990 through 2015—and they are projected to keep growing by 2.6% per year through 2035. (Report) This is due to growth in air traffic and in spite of on-going emission reductions through optimization and technology improvements. This is a clear demonstration of the importance of biojet fuel in achieving emission reductions from aviation. Indications are that even higher emissions increases due to growth in the sector are occurring in Asia (4.6%).

This issue of the Newsletter includes a short brief on two initiatives that have been started that are poised to play an increasingly important role in future development and expansion of bioenergy and biofuels: The Sustainable Energy for all (SEforALL) and below50 initiatives. We thank Gerry Ostheimer of the World Business Council for Sustainable Development for providing this article.

This Newsletter's feature article is on biofuels developments in China. We thank our colleagues in China for providing their input for this article. Task 39 is tentatively planning to hold its first business meeting of 2018 in Beijing in mid-April, 2018.

We always appreciate your input and feedback. Please send us by email any ideas or suggestions for increasing the value of this newsletter. And thanks for reading and participating in the larger IEA Bioenergy Task 39 network.

Jim, Jack and Susan

SEforALL & below50 - New Actors and Approaches to Promote Low Carbon Fuels

Gerard J. Ostheimer, World Business Council for Sustainable Development (WBCSD)

A WINDOW OF OPPORTUNITY FOR BIOFUELS

2015 was a remarkable year for international environmental policy. Essentially, all governments in the world agreed that they wanted a sustainable, low carbon future, as shown by two landmark agreements: The United Nations Sustainable Development Goals (link), and the more widely known Paris Agreement on combatting climate change. Since reaching agreement, the emphasis has shifted to implementation. How will we achieve the SDGs? How will we de-carbonize the global economy? And what institutions need to be revamped or created to realize these goals?

International technical agencies, such as the International Energy Agency and the International Renewable Energy Agency (IRENA), have communicated very clearly that de-carbonizing transport is necessary for global warming to remain below 2°C and that Low Carbon Fuels will be required to do so. In addition, IRENA, IEA Bioenergy and the UN Food and Agriculture Organization (FAO) are attempting to highlight how bioenergy, including biofuels, can contribute to the SDGs. In stark contrast to the perceived wisdom of bioenergy's critics, the global bodies responsible for Energy Security ***and*** Food Security see numerous advantages to the use of sustainable bioenergy for heat, electricity, chemicals and fuels, including

- Improving the agriculture sector for sustainable food and feed production in developing countries;
- Revitalizing the agriculture and forestry sectors in developed countries; and
- Helping countries meet their SDG and climate change mitigation targets.

The global focus on reducing emissions is encouraging diverse actors to revisit the use of biofuels and has created a window of opportunity to re-engage policy makers, consumers and investors regarding the benefits and opportunities of sustainable biofuels production and use. Nonetheless, scaling-up the use of biofuels will not happen spontaneously, and will require committed proponents. Certainly, numerous trade groups like the Renewable Fuels Association (U.S.), Growth Energy (U.S.), ePure (EU), UNICA (Brazil) and ABBI (Brazil) have been advocating for better biofuels policy long before the Paris Agreement, but the new international landscape for climate and energy has created the space for additional actors to contribute. Two of these actors are Sustainable Energy for All and below50.

SUSTAINABLE ENERGY FOR ALL

In support of the overall goal of eradicating poverty, Sustainable Development Goal 7 seeks to "Ensure access to affordable, reliable, sustainable and modern energy for all". The overt inclusion of energy in the Sustainable Development goals was a success for Sustainable Energy for All that is a multi-stakeholder partnership between governments, the private sector, and civil society. Launched by the UN Secretary-General in 2011, SEforALL has three interlinked objectives to be achieved by 2030:

- Ensure universal access to modern energy services;
- Double the global rate of improvement in energy efficiency; and
- Double the share of renewable energy in the global energy mix.

SE4All leverages the global leadership and unprecedented convening power of the United Nations and the World Bank to assemble an unparalleled network of leaders from all sectors of society into a partnership that can transform the world's energy sector and achieve Sustainable Development Goal 7.

SEforALL works to mobilise stakeholders around best practices, supports the adoption of innovative solutions and is creating the conditions that will enable a massive scale-up of private investment in energy access and clean energy. As of 2017, SEforALL has connected Development Agencies, Development Finance Institutions, Civil Society Organizations and Multilateral Institutions, such as the International Renewable Energy Agency, into a powerful collaborative network capable of facilitating Renewable Energy projects in developing countries across the globe. Importantly, the SEforALL community recognizes that only by harnessing the capabilities of the private sector will renewable energy be deployed at the scales necessary to impact the global energy mix.

SEforALL SUSTAINABLE BIOENERGY ACCELERATOR

In response to the UN Secretary General's call for the Private Sector to partner with SEforALL, the global biotechnology company Novozymes catalyzed the creation of an open, voluntary partnership of likeminded stakeholders committed to promoting sustainable bioenergy solutions so as to assist SEforALL in reaching its goals of universal energy access and doubling the use of renewable energy. The SEforALL Sustainable Bioenergy Accelerator (SBA) was launched in May 2015 during the 2nd Annual Sustainable Energy for All Forum. The Founding Members are Bloomberg New Energy Finance, Carbon War Room, IEA Bioenergy, KLM/SkyNRG, Novozymes, Roundtable on Sustainable Biomaterials, UN Food and Agriculture Organization and UN Foundation. The UN Food and Agriculture Organization (FAO) and Roundtable on Sustainable Biomaterials (RSB) currently co-chair the SBA Steering Committee. Among our founding members, the Carbon War Room, SkyNRG and RSB are particularly active in promoting Sustainable Aviation Biofuels.

Several types of bioenergy projects are being promoted, including on-farm bioenergy production to boost agricultural yield and reduce post-harvest losses; distributed electricity production using sustainable biomass from forestry and agriculture coproducts; electricity and fuels from municipal solid waste (MSW); ethanol for clean cooking and transportation; and sustainable aviation biofuels. The SBA is actively collaborating with members of the SEforALL community, such as IRENA and the Regional Hubs, to up-scale bioenergy development through Knowledge enhancement and information sharing, Policy support and Deployment support. Additionally, the Accelerator is developing novel means of financing sustainable biomass power projects and renewable fuels projects across the globe.

below50: GROWING THE GLOBAL MARKET FOR THE WORLD'S MOST SUSTAINABLE FUELS

below50 (link) is a unique global collaboration that seeks to de-carbonise transportation by growing the use of sustainable fuels that reduce GHG emissions by greater than 50% as compared to conventional fossil fuels. below50 is up-scaling the production and use of these fuels by:

- Driving a global campaign that communicates the availability and benefits of below50 fuels;
- Creating regional hubs to tailor the below50 campaign to regional and national contexts; and
- Creating inter-sectoral business-to-business (B2B) opportunities across the below50 fuel value chain to increase the number and diversity of companies choosing below50 fuels.

below50 is a public-private partnership between the SEforALL Sustainable Bioenergy Accelerator and the World Business Council for Sustainable Development (WBCSD). The WBCSD (link) is a global, CEO-led organization of over 200 leading businesses working together to accelerate the transition to a sustainable world. WBCSD member companies come from all business sectors and all major economies, representing a combined revenue of more than US$8.5 trillion and with 19 million employees. SEforALL and the WBCSD collaborate with international partners like IEA, IRENA and the BioFuture Platform to highlight the necessary role for Low Carbon Fuels to de-carbonise transport, particularly in aviation, shipping and trucking. To further its global campaign below50 participates in major international events, including the IRENA General Assembly, SEforALL Summit, Clean Energy Ministerial, EU Sustainable Energy Week, NYC Climate Week and the UNFCCC COP.

below50 was created by WBCSD and SEforALL to convert the global momentum for combatting climate change - as embodied in the Paris Agreement - into concrete actions at the national and sub-national level. To realize this ambition, below50 is creating regional hubs that are led by local partners with strong experience and interest in that market. Regional hosts of the below50 campaign will lead the way in tailoring the goals of below50 to regional circumstances and work overcome local challenges to deploying below50 fuels such as improving consumer acceptance, financing project development and recruiting local energy intensive industries to use below50 fuels. In 2017, below50 created hubs in Australia, Brazil, Europe and North America. Stakeholder engagement is currently on track to develop below50 hubs in China, Japan, Mexico and the Philippines in 2018.

BEYOND MANDATES: CREATING DEMAND FOR BIOFUELS

The overarching ambition of below50 is to augment the policy driven demand for low carbon fuels created by various national renewable fuel use mandates by recruiting novel direct demand from corporate fuel buyers. Corporate fuel buyers include both direct users of fuels like airlines, delivery companies (e.g. DHL, UPS) and shipping, and all companies that rely on transportation of people and goods. As such, the below50 campaign brings together companies that span the entire transportation fuel value chain including feedstock producers, fuel producers, fleet operators, technology providers, investors and infrastructure providers and governments to create novel business-to-business opportunities. At both the global and regional level below50 works to encourage corporate fuel buyers to commit to using low carbon fuels. These off-take agreements should facilitate investment in below50 fuel production and accelerate de-carbonization of the transport sector. To strengthen these recruitment efforts below50 has joined the We Mean Business network of companies committed to reducing their GHG emissions. In summary, below50 seeks to reframe the discussion of low carbon fuels, recruit new customers and, as a result, create new markets for below50 fuels.

By bringing together leading global institutions via SEforALL and leading global companies via WBCSD, below50 leverages the new high-level momentum from the Paris Agreement and SDGs to realize the global potential for sustainable biofuels to de-carbonize transport and foster sustainable economic development.

For further information, contact:
Gerard J. Ostheimer, Ph.D.
Global Lead for Sustainable Bioenergy, Sustainable Energy for All and Senior Advisor, below50
Email: ostheimer@wbcsd.org

The Status of Biofuels in China

Susan van Dyk, IEA Bioenergy Task 39 and University of British Columbia

Introduction

China is the world's largest energy consumer and also the largest net importer of petroleum and other oil based liquids. China also has the largest population and a rapidly growing economy. To supply China's energy needs, coal has been the major feedstock (comprising nearly 66% of energy mix in 2012), followed by petroleum and other liquids (accounting for nearly 20% of the country's total energy consumption). Hydroelectric sources (8%), natural gas (5%), nuclear power (nearly 1%), and other renewables (more than 1%) represent the balance but make up a relatively small share of China's energy consumption. As a result of its high coal consumption, China is also the world's leading energy-related CO2 emitter, releasing 8,106 million metric tons of CO2 in 2012 (US EIA, 2015).

China is strongly committed to reduce its emissions and ratified the Paris Agreement in 2016 (UNFCCC COP21). China has reiterated its commitment to climate change mitigation following the US's announcement that it intends to withdraw from the Paris accord, and is making good progress decarbonising its energy production. According to the Climate Action Tracker, China has reduced its coal use for 3 years in a row and appears to have already reached its peak emissions (10 years before the target of 2030) (http://climateactiontracker.org/countries/china.html).

China led global investment in renewables-based generation in 2015 ($90 billion) (IEA, WEO, 2016) and is the world's largest renewable energy market with over 27% (545 gigawatts) of the world's installed renewable energy capacity and over 40% of the world's renewable energy workforce.

Recent heavy pollution in urban areas of China have led to the adoption of stricter fuel specifications to lower sulfur emissions from gasoline and diesel use.

Biofuels

Biofuels form part of the country's basket of measures to reduce emissions and domestic air pollution. The country currently produces about 3 billion litres of ethanol and about 1.14 billion litres of biodiesel per year, which makes China the world's third largest ethanol producer country after the United States and Brazil. However, it remains unclear how China will meet the ambitious ethanol and biodiesel production targets set in its 13th Five Year Plan (announced on October 24, 2016). China aims to expand ethanol production through newly implemented processor subsidies and import restrictions (USDA, 2017). Unlike stationary power, which can be derived from multiple sources including solar, hydro and wind, transportation has limited options available for decarbonisation. Although biofuels can potentially alleviate energy security concerns and make important contributions to reducing transportation-related emissions and air pollution, the most recent policiies of China's central government are primarily focussed on the development of "new energy vehicles" (electric and hybrid vehicles).

Bioethanol

China's biofuels policies have mainly focused on ethanol production, with about 99% of the ethanol produced in China based on conventional starch-based feedstocks. Current ethanol production has been developed within a highly regulated environment as no facilities can be built without government approval. Ethanol production and

distribution is controlled by state-owned oil companies. Only state-approved companies can carry out blending and receive incentives and subsidies. An E10 mandate is in place in twelve provinces and 34 cities as shown in Figure 1.

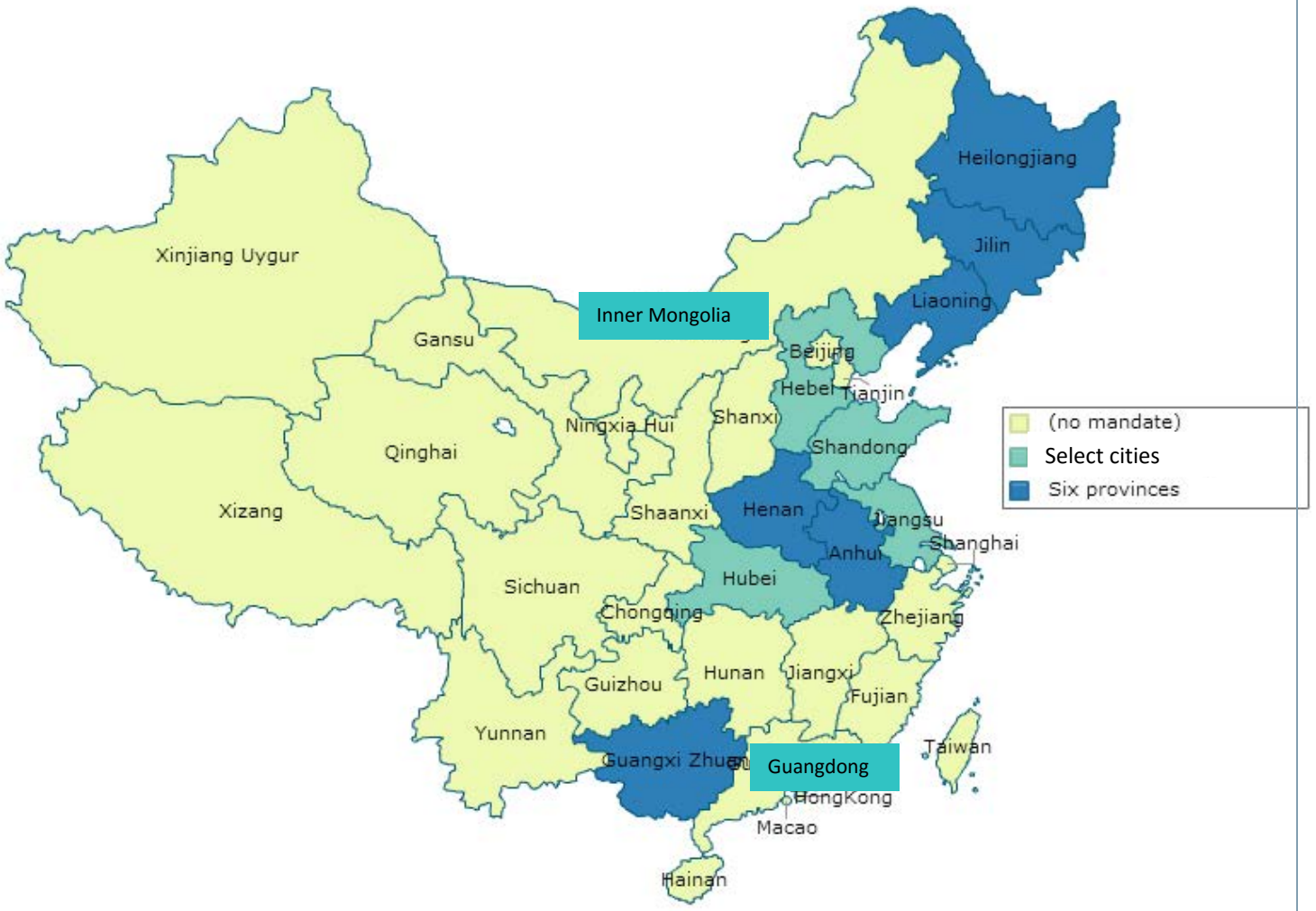

Figure 1. Locations in China with an E10 mandate

In 2003, the first of four government-approved ethanol production facilities became operational. The following year, the government expanded pilot projects for mandatory E10 blending to six provinces (Heilongjiang, Jilin, Liaoning, Henan, Anhui, and Guangxi), plus 27 cities in four other provinces (Hebei, Shandong, Jiangsu and Hubei) (Figure 1). These projects are now further expanded to 12 provinces in China (including Inner Mongolia and Guangdong) where E10 is available; fuel distributors cannot blend or sell E10 outside these areas.

After the initial development of ethanol production facilities based on using stale grain reserves in 2007, the government banned further bioethanol production from grains. Instead they encouraged the production of so-called "generation 1.5" non-grain feedstocks such as cassava, sweet potato and sweet sorghum. A further two ethanol facilities were supposed to be developed based on cassava and one based on sweet sorghum. These 1.5 generation crops were supposed to be predominantly grown on marginal lands. However, this approach has had limited success, with land and water availability proving to be significant challenges, with these alternative biofuels feedstocks still competing with food production.

The commercial development of so-called second generation/advanced biofuels based on cellulosic feedstocks has so far been limited to only small volumes. Currently there is only one demonstration/commercial scale facility using corn cobs as the feedstock. However, there is considerable potential for further cellulosic ethanol production based on a wide range of agricultural residues that could be used as feedstocks. Use of such agricultural residues is probably the best opportunity for China to expand its ethanol production while also addressing its climate change mitigation and emission reduction targets for transport.

The commercial ethanol facilities currently operating in China (Table 1) have all had to be government approved, and this requirement potentially restricts access of new entrants into the market. Several of China's current ethanol production plants are shown in Figure 2.

Table 1. China's commercial scale operational ethanol plants

Name	Province	Year	Capacity		Feedstock
			tonne/y	M L/y	
COFCO Bio-energy Co. Ltd.	Heilongjiang	2001	280,000	354.9	Corn
Jilin Fuel Alcohol Co. Ltd.	Jilin	2003	600,000	760.5	Corn
Anhui BBCA Biochemical Co. Ltd.	Anhui	2005	500,000	557.7	Corn
Henan Tianguan Group	Henan	2005	500,000	633.7	Wheat, Cassava
Guangxi COFCO Bio-energy Co. Ltd	Guangxi	2008	200,000	253.5	Cassava
ZET Energy Ltd.	Inner Mongolia	2012	100,000	63.4	Sorghum
Longlive Biotechnology Co. Ltd	Shandong	2012	50,000	63.4	Corncob
China National Petroleum Corporation (CNPC)	Zhejiang	2013	30,000	38.0	Cassava

Source: data obtained from QIBBT (2010) and company websites.

COFCO (Zhaodong), Heilongjiang province

Jilin bioethanol Co. Ltd, Jilin province

Henan Tianguan Co. Ltd, Henan province

COFCO biochemistry Co. Ltd, Anhui province

Figure 2. Some of the ethanol production facilities in China using conventional feedstocks

COFCO biofuels Co. Ltd, Guangxi province

ZET, Inner Mongolia

Shandong Long live Co. Ltd, Shandong province (corncobs)

Figure 3 Ethanol production facilities in China using non-conventional generation 1.5 feedstocks.

In addition to the commercial biofuel facilities summarised in Table 1, a number of advanced biofuel facilities are operating or planned at the pilot, demonstration and small commercial scales (Table 2).

Table 2. China's advanced ethanol production plants (*italics* refer to announced facilities not yet constructed yet)

Name	Province	Year	Capacity	Feedstock
			M L/y	
COFCO Biochemical Energy (Zhaodong) Co., Ltd.	Heilongjiang	2007	0.6 (2007); 63 (2013)	Corn stover
Tian Guan Fuel Ethanol Co., CNPC	Henan	2007	6 (2007); 12 (2012)	Straw
Beijing Shougang Lanzatech New Energy Technology Co.	Beijing, China	2013	0.38 (2012); ***95***	Steel flue gas
LanzaTech Baosteel New Energy Co. Ltd.	Shanghai, China	2012	0.38 (2012); ***40***	Steel flue gas
White Biotech (WBT)	Kaohsiung	2014	100 kg/day	Steel flue gas

Source: Data from F.O. Lichts' database and Lanzatech's website.

In April 2015, China Steel Corporation announced a US$46 million investment into Lanzatech to develop a facility with an annual production capacity of 17 million gallon (64 million litres), with construction to begin in 2015. The intention was to scale up to 34 M gallons (128 M litres) sometime in the future (Lanzatech, 2015; Lane, 2015). In July 2015, DuPont announced a licensing agreement with Jilin Province New Tianlong Industry Co., Ltd., (NTL) to begin the development of China's largest cellulosic ethanol manufacturing plant to be located in Siping City in Jilin Province. This agreement will allow NTL to license DuPont's cellulosic ethanol technology and use DuPont™ Accellerase® enzymes to produce renewable biofuel from from Jilin Province's corn farm biomass residues (DuPont, 2015). Beta Renewables also reports that the M&G Group has entered into a JV with the Chinese Guozhen group to produce bioethanol from wheat straw and corn stover. Their planned facility will be located in Fuyang (Anhui Province), with construction to begin in 2016, with the fuel grade ethanol produced to be sold locally to a Chinese oil company (Beta Renewables). Previously, in 2010, Novozymes announced signing a Memorandum of Understanding (MOU) with COFCO and Sinopec for the construction of an advanced cellulosic ethanol demonstration facility. The current status of these projects remains unclear, however they are likely not advancing as fast as originally planned owing to the on-going low oil price and increased emphasis on electrification of transport.

Biodiesel

China's FAME biodiesel industry is largely unregulated. It has developed slowly and is dominated by small-scale private businesses. No mandate for biodiesel blending exists, except for a small trial in two counties in Hainan province. There are also limited incentives to carry out biodiesel blending. The vast majority of the biodiesel that is produced is used by industry, with only about 30% used for transport (USDA, 2016). Market penetration for biodiesel has been quite limited as state-owned oil companies own 90% of the gas stations and they have not encouraged biodiesel use.

Virtually all of the biodiesel that is produced is based on used cooking oil as the feedstock. Although fairly large volumes of so-called "gutter oil" (illicit used oils) are available in China, competition from their illegal re-use in food applications has resulted in supply availability challenges. The central government's strategy of developing generation 1.5 oilseed-bearing trees and crops such as *Jatropha* as the feedstocks has had limited success to date.

Indications are that compressed natural gas vehicles, particularly for heavy duty transport, may be preferentially developed ahead of FAME biodiesel (or renewable/green diesel) as a lower carbon alternative to diesel.

Shijiazhuang

Hainan

Figure 4. Biodiesel facilities in China.

Other biofuels

Very little information is available on production of biofuels other than bioethanol and FAME biodiesel. However, the Chinese government has been encouraging the production and sale of natural gas vehicles, with the 12th Five-Year Plan targeting that by 2015 natural gas should account for 8% of transportation energy demand (Clean Energy Compression, 2014).

The first, partially bio-jet fuelled flight in China took place in October 2010 as the result of a collaboration between the China National Petroleum Corporation, Air China, Boeing, Honeywell, the China National Aviation Fuel Group and Pratt & Whitney. The Sinopec Corporation, another Chinese national oil company, built a biofuel facility in Southeast China's Hangzhou in 2011 with a production capacity of 6,000 tonnes of aviation bio-fuel per year from used cooking oil. Sinopec also built a blending facility within its Zhenhai Refinery to produce aviation bio-fuel products. Biojet developed by Sinopec was used in a demonstration flight in 2013, and in February 2014 the Civil Aviation Administration of China (CAAC) granted Sinopec China's first biological jet fuel airworthiness certificate (China Finance Corporation, 2014). Sinopec has a cooperative biojet initiative with China Eastern Airlines, while China's top oil and gas producer, China National Petroleum Corporation, has a joint biojet initiative with Air China. The first, commercial passenger flight using biojet fuel took place on March 25, 2015 (Biofuels International, 2015). This was a collaboration between Hainan Airlines, Boeing and Sinopec. Boeing has been involved in biojet fuel development in China and has collaborated with a range of stakeholders including the Commercial Aviation Corp. of China (COMAC) and several research institutions, such as the Chinese Academy of Science's Qingdao Institute of Bioenergy and Bioprocess Technology (QIBEBT). Boeing and the COMAC opened a demonstration facility in 2014 to produce biojet fuel from used cooking oil at a rate of about 160 gallons (650 liters) per day. The project's goal was to assess the technical feasibility and cost of producing higher volumes of aviation biofuels (Schroeder, 2014). Ongoing research on the potential of biojet fuel production is currently carried out at several Chinese institutions.

Trade in biofuels

Starting in 2014, State-Owned Enterprises (SOEs)s in China began importing small volumes of ethanol to examine how supplementing domestic ethanol supplies with imports would change domestic market dynamics. Since 2015, ethanol imports rapidly expanded on strong demand and policy support. In 2016, with higher consumption and competitive prices, ethanol imports into China reached a level of 890 million liters, including 853 million liters of fuel ethanol.

However, in December 2016, China announced that on January 1, 2017, the applied import duty for U.S. denatured ethanol imports will return to the WTO bound rate of 30 percent, a six-fold increase from the previously applied preferential rate of 5 percent. The applied import duty for undenatured ethanol remains unchanged at 40 percent. In

2017, fuel ethanol imports are therefore forecast to fall by nearly two-thirds to 300 million liters as a result of higher applied duties for imported ethanol and growing domestic supplies.

Research and Development

Four Chinese national biofuel research centres have recently been established, with each of these research centres having a different focus: biorefinery, liquid biofuels, non-food biomass feedstocks or biofuels (Table 3).

Table 3. China National biofuel research centres

China National biofuel research centres	Leading institute
National Energy Research Center of Liquid Biofuels	COFCO
National Energy R&D Center for Non-food Biomass	China Agricultural University
National Energy R&D Center for Biofuels	Guangzhou Institute of Energy Conversion (CAS)
National Energy R&D Center for Biorefinery	Beijing University of Chemical Technology

The National Energy Research center of Liquid Biofuels, led by COFCO, is mainly focused on implementing technology. COFCO is one of China's biggest state-owned enterprises and a Fortune Global 500 company. Currently COFCO owns three corn fuel ethanol enterprises, one of the world first cassava fuel ethanol demonstration plants (200,000 t/year), and one cellulose fuel ethanol pilot plant (joint project with Sinopec, Novozymes A/S, GTA) (5,000,000 t/year). The main goals of this research center include providing comprehensive solutions for cellulosic ethanol production, licensing mature technology packages, and providing technical support and engineering services through a specific project's lifecycle.

The National Energy R&D Center for Non-food Biomass, which was jointly established by China Agricultural University, Beijing Forestry University, China Datang New Energy Co., Ltd. and Henan Tianguan Enterprise Group Co., Ltd., has the major responsibility for biomass breeding, cultivation and logistics research. The main goal of this center is to build up a sustainable supply chain for non-grain biomass materials to be used for cellulosic ethanol production.

The National Energy R&D Center for Biofuels is led by the Guangzhou Institute of Energy Conversion within the Chinese Academy of Sciences (CAS). This center is established with the aim of further developing the research and development platform. The overall goal of the center is integration of a wide range of innovative scientific and technological research, including economic and social research, to explore and develop renewable energy and make the lab the innovation base and a talent incubator for China's renewable energy and biofuels research.

Finally, the National Energy R&D Center for Biorefinery led by the Beijing University of Chemical Technology is established with the goal of promoting knowledge and technology transfer from lab scale to industrial process scale. This center will promote the scientific and technological communication and cooperation between the various research centers, enterprises and governments. It also aims to improve technology integration and implementation, as well as develop the bio-economy including the requisite education and training of its workforce.

Sources

Offshorewind (2017) (http://www.offshorewind.biz/2017/06/09/irena-and-state-grid-of-china-to-cooperate-on-energy-transition/)

US EIA (2015) China, International energy data and analysis. https://www.eia.gov/beta/international/analysis.cfm?iso=CHN Accessed 22 June 2016

USDA (2015) Peoples Republic of China Biofuels Annual 2015. USDA Foreign Agricultural Service. Gain Report number: CH15030 and CH16067

Company websites

In the News

Reports and Research

June – The International Council on Clean Transportation (ICCT) published a report on GHG emissions from aviation in North America. International aviation emissions of greenhouse gases (GHGs) from airline carriers based in Canada and the United States increased from 36.2 to 60.2 million tonnes (MtCO2e) per year from 1990 through 2015—and they are projected to keep growing by 2.6% each year through 2035. (Report)

June 21 – NASA showed bio-jet fuels reduce emissions of soot particles from jet engines in flight conditions. However, further studies are needed to prove whether biojet fuels can therefore form thinner, less dense exhaust plume streamers to reduce global warming. (Read more)

June 6 – The International Renewable Energy Agency (IRENA) published a report on biofuel potential in Southeast Asia. (Read more)

Policy and Regulatory Developments

Aug 11 – An overhaul of Brazil's biofuels policy, called RenovaBio, is planned, aimed at cutting the country's carbon emissions. Implementation is expected to boost demand for cleaner fuels, stabilize the volatile industry and further accelerate the recent wave of mergers and acquisitions in the sector. The new federal program will give fuel distributors clear targets for reducing emissions, which will force them to gradually increase biofuels volumes, according to policymakers, executives and analysts following discussions of the new law. (Read more)

July 8 – The EPA released its first Renewable Fuel Standard proposal under the Trump Administration with RVO numbers up for ethanol with a 15 billion gallon cap for 2018, but the biodiesel RVO staying the same at 2.1 billion gallons for 2019. The total amount of advanced biofuels for 2018 was slightly lowered to 4.24 billion gallons (down from 4.28 billion gallons for 2017). This EPA report cites as one of the reasons for lowering amounts for 2018 challenges in meeting production targets for cellulosic biofuels and slower than expected development of the cellulose-based biofuels industry. So, while the ethanol industry is generally ok (if not fully satisified) with the EPA report, the biodiesel industry is disappointed that their 2018 RVO targets weren't raised as requested. This EPA document is still a proposal, as the 30 day comment period is still open, so there is still a chance to request changes to it. (Read more and here)

June 15 – Environment and Climate Change Canada is consulting with provinces and territories to develop a clean fuel standard to reduce emissions of greenhouse gases ambitiously by 2030 through increased use of low carbon fuels. A carbon intensity threshold is proposed to limit the import of high carbon intensity corn from the US. (Read more)

June 13 – Norway banned government procurement and use of palm oil-based biofuels and also urged a revision of the EU's biofuel policy, arguing that the production of palm oil-derived biofuels leads to deforestation and indirect land use change. (Read more)

May 5 – The US government is investigating potential tariffs against Argentina and Indonesia for $1.5bn biodiesel exports to the US, which increased the price of soyoil futures. (Read more)

Sustainability

July 17 – In Brazil, the concentration of ultrafine particles less than 50 nanometers in diameter rose by one-third in the air of São Paulo, Brazil, when higher ethanol prices induced drivers to switch from ethanol to gasoline, according to a new study by a Northwestern University chemist, a National University of Singapore economist and two University of São Paulo physicists. (Read more)

July 13 – In Strasbourg, France, a lead negotiator for the European Parliament told members that the European Commission's proposals to further phase-out crop-based biofuels as part of the second Renewable Energy Directive "limits the options to decarbonize transport" and "would probably increase the share of fossil fuels." Instead, he suggested that biofuels that meet strict sustainability standards and produce protein for the animal feed sector should be outside the cap, while the cap that is proposed to shrink down to 3.8% by 2030 should be applied to feedstocks such as palm oil. (Read more) See also here.

July 10 – In France, the environment minister is looking into banning the use of palm oil for biodiesel production in a move welcomed by Europe's largest biodiesel producer, Avril, which primarily uses rapeseed to produce biodiesel and animal feed. (Read more)

April – Crude tall oil can be used as a feedstock for production of biofuels. A recent report by Ecofys evaluated the sustainability of this feedstock and it was concluded that its risk of inducing iLUC was low. (Report)

Industry News

Aug 22 – In California, Vertimass LLC announced completion of intermediate technology validation from the U.S. Department of Energy's Bioenergy Technology Office (BETO), which verified performance against negotiated milestones, provided progress on scale-up, and reviewed Vertimass' estimated cost for their catalytic ethanol upgrading technology. (Read more)

Aug 17 – Bergen in Norway became the 2nd Norwegian airport to make biojet fuel available to airlines. (Read more)

Aug 15 – In Ohio, POET-Marion broke ground Tuesday to expand its production capacity from 70 million gallons per year to 150 million gallons per year. The project will also increase production of dried distillers grains from the current 178,000 tons annually to 360,000 tons. (Read more)

Aug 14 – In Brazil, the corn-only ethanol plant at FS Bioenergia in Mato Grosso was officially opened and will produce 63.4 million gallons of ethanol annually in addition to 60,000MWh of electricity and more than 6,200 metric tons of corn oil. (Read more)

Aug 9 – In Michigan, SynSel Energy plans to begin constructing its $300 million advanced biofuels plant next year at the former Smurfit-Stone Container paper mill in Ontonagon in conjunction with Lost Bowl Development. The facility will be one of two scheduled to begin construction next year. The aim of thes facilities is to produce synthetic gasoline, diesel and aviation fuels from waste wood feedstocks, tying in with local logging industries seeking an outlet for their woody biomass residuals waste. (Read more)

Aug 5 – In Germany, Continental successfully tested its new synthetic oxymethylene ether (OME) fuel in test vehicles. Results showed current diesel engines have no issues using a 15% blend of the OME synthetic fuel. (Read more)

Aug 3 – In Canada, the Prairie Green Renewable Energy (PGRE) plant in Saskatchewan is finally set to break ground in the spring of 2018 with an 18-24 month construction period anticipated. The 196 million liter per year facility will annually consume for feedstock 25 million bushels of barley and five million bushels of peas. (Read more)

July 26 – In Sweden, Air BP has extended its biofuel footprint in the Nordic countries by starting to supply commercial jet biofuel (biojet) to the Halmstad Airport. (Read more)

July 25 – Canadian-based Agrisoma Biosciences Inc., and biorefinery giant UPM from Helsinki, Finland, signed a long-term supply agreement that will expand carinata oilseed production in South America. Under the deal, the two companies will grow Carinata oilseed crops with third-party farmers in Uruguay and Brazil. (Read more)

July 18 – In Canada, Royal Dutch Shell reached an agreement with SBI BioEnergy granting Shell exclusive development and licensing rights for SBI's biofuel technology. Edmonton-based SBI has a patented process that can convert a wide range of waste oils, greases and sustainable vegetable oils into lower carbon drop-in products suitable for blending into diesel, jet fuel and gasoline. (Read more)

July 18 – Joule Unlimited (formerly known as Joule Biotechologies), a company that developed a hydrocarbon biofuels production process based on cyanobacteria, carbon dioxide, and sunlight, announced their closure. (Read more)

July 17 – In Finland, St1 is investing in a new hydrogen manufacturing unit, which will be built in the St1 Refinery in Gothenburg, Sweden. This hydrogen manufacturing unit will ultimately enable a 200,000 tons annual capacity of renewable diesel production. (Read more)

July 17 – In Washington DC, U.S. Secretary of Energy Rick Perry announced $40 million in Department of Energy (DOE) awards for establishing four DOE Bioenergy Research Centers (BRCs) intended to provide the next generation of scientific breakthroughs for sustainable, cost-effective bioproducts and bioenergy. (Read more)

July 11 – Alliance Bio-Products will purchase INEOS New Planet Energy JV's 8 million gallon cellulosic ethanol plant. (Read more)

July 10 –In North Dakota, Tesoro is planning to invest $3.5 million to retrofit its 8,000-barrel-per-day diesel hydrotreater at the Dickinson refinery to produce renewable diesel from corn oil or soy oil for supply into the state's B5 market. (Read more)

July 8 – In Italy, Eni signed an agreement with the city of Turin to run city buses on Eni Diesel+, a 15% blend of biofuel made from used vegetable oils collected from residents and businesses in the area. (Read more)

July 2 – In Oklahoma, Velocys reports successful production of finished, saleable Fischer-Tropsch products at ENVIA Energy's GTL plant in Oklahoma City. These products are being fractionated to produce premium, renewable waxes, diesel and naphtha that meet customer product specifications. (Read more)

June 20 – In Norway, Silva Green Fuel, a joint venture formed by Statkraft and Swedish forestry group Sodra, will make a decision this year on investing 50-70 million euro in a hydrothermal liquefaction (HTL)-based pilot plant planned for construction in Toefte, south of Oslo. Wood and other organic waste would be converted to liquid fuels for planes, shipping and trucking in this HTL facility. (Read more)

June 19 – ExxonMobil and Synthetic Genomics, Inc. announced a breakthrough in producing algae-based biofuels. Advanced cell engineering doubled the level of fatty lipids accumulated inside a strain of algae. (Read more)

June 12 – A pilot program launched in the Netherlands, planning to blend 30 percent biofuel to power an inland barge transporting Heineken beer for export. (Read more)

June 1 – The fifteenth A350 flight for Cathay Pacific using a 10 percent biofuels blend departed from Toulouse for Hong Kong, further confirming Total's and Airbus' biofuels production, supply and blending supply chain. (Read more)

June 1 – In Queensland, Australia, the first pilot plant to produce advanced biofuels using a variety of wastes as feedstocks began operations. This plant cost A$16 M (USD 11.9 M) and there are plans to eventually expand it into an A 150 M (USD 112 M) facility with an annual capacity of over 200 M litres of biofuel production. (Read more)

May 26 – In Brazil, Petrobras announced it will terminate biofuel production as part of its efforts to optimize its business portfolio. (Read more)

May 18 – In Sweden, biojetfuel blends became available for the first time at Göteborg Landvetter Airport. (Read more)

May 3 – Singapore airlines launched biofuel flights from San Francisco to Singapore. The biofuel was produced by AltAir Fuels through hydroprocessing of used cooking oils and supplied and delivered by SkyNRG. (Read more)

Upcoming Meetings & Conferences

2017

September

- 2017 Technology Challenges and Opportunities in Commercializing Industrial Biotechnology — September 17-19, 2017 — San Diego, CA
- F.O. Licht's Sugar and Ethanol Africa — September 19-21, 2017 — Nairobi, Kenya
- 6th International Conference on Ethanol from Lignocellulosics (6ICLE) — 27-28 September 2017 — Brussels, Belgium

October

- 7th International Congress on Biofuels and Bioenergy — October 2-4, 2017 — Toronto, Canada
- 10th Biofuels International Conference & Expo — October 4-5, 2017 — Edinburgh, UK
- 2nd Euro Global Summit and Expo on Biomass and Bioenergy — October 12-13, 2017 — London, UK
- Advanced Bioeconomy Leadership Conference on Next Generation Technologies — October 16-18, 2017 — San Francisco, US
- 12th annual Argus Biofuels 2017 — October 17-19, 2017 — London, UK
- Brazilian BioEnergy Science and Technology Conference — October 17-19, 2017 – Campos do Jordao, Brazil
- 9th Carbon Dioxide Utilisation Summit — October 18-19, 2017 — Reykjavik, Iceland
- 2017 American Institute of Chemical Engineering (AIChE) Annual Meeting — October 29 - November 3, 2017 — Minneapolis, MN

November

- World Ethanol & Biofuels — November 7-8, 2017 — Brussels, Belgium
- 2017 International Bioenergy & Bioproducts Conference — November 7-9, 2017 — Norfolk, VA, US
- European Biomass to Power — November 8-9, 2017 — Aarhus, Denmark
- Future of Biogas Europe 2017 — November 15-16, 2017 — London, UK

December

- 8th International Conference on Biofuels, Bioenergy & Bioeconomy — December 4-5, 2017 — San Paulo, Brazil
- Ethanol Latin America — December 5-7, 2017 — Antigua, Guatemala
- 2nd World Biodiesel Congress & Expo — December 6-7, 2017 — Dallas, TX
- 9th International Congress on Renewable Energy and Advanced Biofuels — December 7-8, 2017 — Madrid, Spain

IEA Bioenergy Task 39 Meetings

The following is an abbreviated schedule of Task 39 events and meetings planned over the next 9 months. Please contact us for more detailed information:

- The Task will hold its next business meeting 25-26 September in Brussels, Belgium, in association with the 6th Inter-national Conference on Ethanol from Lignocellulosics (6ICLE) being held in Brussels 27-28 September 2017.
- The Task tentatively will hold its first business meeting of 2018 in Beijing, China, in mid-April 2018.