



EU-India Conference on Advanced Biofuels

7th - 8th March 2018



Session 1: Opening

- **Welcome by Mr. Sandeep Poundrik, Joint Secretary (Refinery), MoP&NG**
- **Opening speech by Mr Christopher Jones, Deputy Director General, Directorate for Energy, European Commission**
- **Opening speech by Mr Tomasz Kozlowski, Ambassador of the EU to India**
- **Film on Biofuels development in India**
- **Address by Mr. K. D. Tripathi, Secretary, Ministry of Petroleum & Natural Gas**
- **Inaugural speech by Mr. Dharmendra Pradhan, Hon. Minister of Petroleum and Natural Gas; Minister of Skill Development and Entrepreneurship**
- **Vote of Thanks by Mr. Kyriakos Maniatis, Principal Administrator, EC, DG ENER**

Welcome Address



➔ **Mr. Sandeep Poundrik,**
Joint Secretary (Refinery),
MoP&NG

- This joint conference on advanced biofuels was conceptualized a year ago in a meeting with the EU, since India has great potential in biofuel market and EU nations have required technology and experience
- Conference focuses on establishing synergy between Indian and European companies in the field of biofuels
- Presently there is focus on higher blending of ethanol in petrol and biodiesel in diesel which is currently not possible due to non-availability of biofuels
- Objective of India is to produce more biofuels to reduce import dependence on fossil fuels, increase income of farmers, environment considerations and energy security

Opening Speech

► **Tomasz Kozlowski**
Ambassador of the EU to
India

- EU and India has agreed on a long term part cooperation in areas such as political security, economic growth and bilateral trade
- India is an important partner in climate change and mutual co-operation between Europe and India will be key in meeting climate change commitments
- EU is partnering India in certain key projects like designing offshore wind project in Gujarat, Solar Wind farm projects, solar roof-top projects and energy efficiency projects
- EU India partnership, to provide significant opportunities for developing our economies, and working towards clean energy transformation
- Invited universities, research institutions, SMEs for participation in research projects titled horizon 2020

Opening Speech



Christopher Jones

Deputy Director General,
Directorate for Energy,
European Commission

- Thanked the Minister for having facilitated the organization of this conference.
- Clean energy partnership between India and EU has started to bear fruit – in terms of concrete work
- This event showcases the significant technology progress made by Indian and EU companies over last few years
- EU has been at forefront of climate negotiations; and has agreed to reduce emissions by 40% by 2030
- Advanced biofuels are a solution to challenges of emissions in transport segment
- EU is putting a new legislative framework together to promote biofuels
- Creating economies of scale, system to collect raw material will play a key role in promoting biofuels by bringing down costs

Address



Mr. K. D. Tripathi,
Secretary,
Ministry of Petroleum &
Natural Gas

- Highlighted the need to focus on Advanced Biofuels, apart from conventional biofuels such as 1G Ethanol, grain based ethanol, biodiesel considering commitment to address climate change
- EU and India have more than 50 years of diplomatic relations and have collaborated in many areas such as technology, R&D, trade etc.
- This conference will pave a way forward for collaboration in areas of alternative energy
- India is committed to produce biofuels and has decided to setup 12 2G ethanol plants, and both indigenous & foreign technologies are being explored to setup the plants
- Indian companies have also signed MoUs for production of bioCNG
- Conference aims to strengthen EU India relationship in field of advanced biofuels and provide a platform for various stakeholders to share their technical know how

Inaugural Address



Mr. Dharmendra Pradhan,
Hon. Minister of Petroleum
and Natural Gas & Minister
of Skill Development and
Entrepreneurship


- Congratulated EU & MoPNG for organizing this conference on Advanced biofuels and for expediting the deployment of Advanced Biofuels in European Union and India
- For India, around 95% of demand for transport fuels is met by fossil fuels; To reduce dependence on import of fossil fuels; it becomes imperative to enhance use of biofuels in transport sector
- Research institutions in India have been exploring technologies for advanced biofuels production
- Advanced biofuels as a emerging segment faces a number of challenges & requires support from various ministries and departments in India
- MoP&NG is preparing a new policy to promote biofuels in India
- Govt is incentivizing companies to convert any waste to biofuels ~ Waste to Wealth; similar efforts are being made by state governments as well
- EU and India collaboration will create a new pathway for energy security by utilizing the potential of advanced biofuels

Vote of Thanks



Mr. Kyriakos Maniatis,
Principal Administrator,
EC, DG ENER

- Highlighted EU and India can play a key role by coordination
- Thanked the EU participants & Indian delegates for taking out time for attending the conference



Session 2: Decarbonising Transport, National policies

- ▶ **Session Chair: Dr. Anil Kakodkar**, Chairman, Scientific Advisory Committee, MoPNG
- ▶ **Adam Brown**, IEA Renewable Energy Division, "The IEA Bioenergy Roadmap and the key role for advanced biofuels"
- ▶ **Kyriakos Maniatis**, EC, DG ENER, "Transport and renewable energy policies in the EU"
- ▶ **Sandeep Poundrik**, Jt. Secretary (Refineries), "Transport and renewable energy policies in India"
- ▶ **Riku Huttunen**, Ministry of Economic Affairs and Employment "Advanced Biofuels playing a key role in Finland's Energy & Climate policy"

Session 2:

The IEA Bioenergy Roadmap and the key role for advanced biofuels



Adam Brown

IEA Renewable Energy
Division

- Emphasized on global focus of carbon emission reductions and requirement of effort in technology innovation and diversification to achieve targets
- Bioenergy can provide some 17% of cumulative carbon savings to 2060 in the 2DS(2 degree scenario) and around 22% of additional cumulative reductions in the B2DS
- IEA projects demand of transport services to more than double by 2060; biofuels, strong growth in electricity complements final energy demand
- Four key action areas required to increase biofuels consumption:
 - short term deployment of mature options, new technology developments, feedstock sustainability and international collaboration

Session 2:

Transport and renewable energy policies in the EU



Kyriakos Maniatis
EC, DG ENER

- EU relies heavily on oil, around 94% of its energy needs for transport sector
- Focus on increasing the share of low carbon and renewable fuels in transport through an EU blending mandate
- Emphasized on scale of production for achieving competitive market price of biofuels with lower investments
- Key successes of EU in biofuels production are:
 - commercial plant on ethanol from lignocellulosics at Crescentino, Italy
 - Large scale algae production facilities are under development
 - EMPYRO pyrolysis oil plant of BTG in the Netherlands and Fortum's plant in Joensuu in Finland are commercial bio-oil plants
 - conversion of black liquor to bio-dimethyl-ether by CHEMREC Bio-DME project
- In EU, technology developers have achieved significant and are close to commercialisation; however lack of long term policies and financial instruments fail to give confidence to investors

Session 2:

Transport and renewable energy policies in India



Sandeep Poundrik
Jt. Secretary
(Refineries), Ministry
of Petroleum &
Natural Gas

- India's GDP and energy consumption to grow at a robust rate in future; however the per-capita energy consumption is still one-third of global average
- India is largely dependent on traditional fossil fuels and inching towards gas economy; rising import dependency is an area of concern
- 3 pronged approach for biofuels – Bio-diesel blending, 1st generation ethanol and Advanced biofuel
- Government has framed various policies and provided incentives for bio-diesel, 1st Gen. Ethanol and advanced bio-fuels
 - Biodiesel procurement qty by OMCs increased from 11 Million litres (2015-16) to 43.5 Million litres in 2017-18 (till Jan,18).
 - Government offering enhanced price to Ethanol Suppliers
 - For 2G ethanol; Govt. has allowed procurement of Ethanol produced lignocellulosic route, for the purpose of Ethanol blending in Petro; PSUs to setup 12 plants across India
- VGF schemes are also under consideration by Government to promote biofuels

Session 2:

Advanced Biofuels playing a key role in Finland's Energy & Climate policy



Riku Huttenen,

Ministry of Economic
Affairs and Employment,
Finland

- Finland has a high energy consumption due to colder climate and energy intensive industry
- Fossil fuels are not dominant in primary energy mix; share of renewables and nuclear is constantly growing
- Finland's long-term objective is to be a carbon-neutral society;
 - 80-95% reduction of greenhouse gas emissions from 1990 level by 2050
 - carbon emissions and sinks planned to be equal by 2045
 - 50% of final energy consumption to be covered by renewables in 2030
 - At least 30% share of renewables in transport sector by 2030 (biofuels blending)
- Biofuels are the most effective way of reducing carbon emissions; demand can be increased by increasing domestic production, ensuring feedstock supply and investments in advanced technologies



Session 3:

Availability of biomass resources in India

- ▶ **Session Chair: Ramakrishna Y B**, Chairman, Working Group on Biofuels, MoP&NG
- ▶ **Ashok Kumar**, ICRISAT "Bio Mass Availability in India"
- ▶ **Monish Ahuja**, PRESPL, "Bioenergy: Sustainable Biomass supply chain Management"
- ▶ **Vikram Ahuja**, Zamindara Farm solutions, "Crop residues – Farmer perspective"

Session 3:

Bio Mass Availability in India



Ashok Kumar

Principal Scientist
International Crops
Research Institute for the
Semi-Arid Tropics (ICRISAT)

- Sorghum, Pearl millet, Finger millet, Chickpea, Pigeon pea and Groundnut are the six mandate crops of ICRISAT
- Biomass resources in India are very thinly spread; Only 4% cropped area is under fodder/biomass and no scope for expansion
- Crop residues are the major source of biomass for tapping for biofuel -82 million tons of surplus in cereal straw
- Last 20 years, significant area around 35 Million Hectare, is cultivable waste, which is not being put to use
- Sugar mills are a good entry point for efficient biofuels production by increasing capacity utilization
- Improved biomass hybrids like ICSSH 28 surpassed all the available sorghum hybrids for biomass yield and sugar content
- For sustainability of 2G biofuel plants, it is essential to have sustainable crop intensification, rotation and farmers training & locating plants in ecologies with adequate rainfall

Session 3:

Bioenergy: Sustainable Biomass supply chain Management



Monish Ahuja

Managing Director,
Punjab Renewable
Energy Systems Pvt Ltd
(PRESPL)

- PRESPL is the only and largest organized player in biomass supply chain in the market
- In order to develop biomass supply chain to projects utilizing biomass - identification and training of rural youth is done to develop them as “Village Level Entrepreneurs” (VLEs)
- PRESPL estimates India has about 234 Million MT of surplus agri-residues with corresponding power potential of about 23,000 MW
- Discussed about feedstock collection system, pre & post harvest
- Feedstock supply model for a given biomass power plant will depend on many factors, including feedstock availability, task to be achieved, preferences and constraints of the biomass power plant, application and site
- Cost of transportation of feedstock is critical for success of biomass plant

Session 3:

Crop residues – Farmer perspective



Vikram Ahuja

Director, Zamindara Farm solutions

- Challenges for farmers about bio-mass are: Awareness, availability of residue management machines, affordability of machines, additional cost of collection disposal of biomass and short working window
- Opportunities presented by biomass for farmers are: Additional revenue, reduction in input costs, rejuvenation of soil health, Make in India – manufacturing of new machines, employment generation, digital platform, innovative financing/leasing models.

Invited Presentation:

The challenging role of biofuels in aviation



Srinivas Duvvuri

Director, Strategy &
International Cooperation,
Airbus

- Huge growth happening in Asia Pacific region in global aviation traffic; Indian domestic air traffic growing at an average rate of around 20%
- The aviation growth raises more environmental challenges; Sustainable fuels are a key pillar to reduce GHG emissions from aviation
- Airbus has formulated sustainable fuel strategy & priorities under the strategic heads of: Engagement with airlines, Policies & standards, fuel approval (new sustainable fuel pathways) and innovation & R&D
- Change in aviation industry is being driven by – Safety & performance, Economics (fuel cost around 30% of OPEX), Environmental considerations and energy security; providing opportunity for sustainable fuels to replace traditional fuels



Session 4:

Lignocellulosic ethanol (part 1)

- ▶ **Session Chair: Nour Armani, Novozymes**
- ▶ **Dario Giordano**, Expert, "Progress on Cellulosic Ethanol"
- ▶ **Markus Rarbach**, Clariant, "Unleashing India's Untapped Potential with sunliquid – Cellulosic Ethanol from Agricultural Residues"
- ▶ **Gisle Lohre Johansen**, Borregaard AS, "Lignin first: The Borregaard approach to cellulosic sugars and bioethanol"
- ▶ **Vasudeo Joshi**, Praj Industries, "Accelerating Commercialization of 2nd Gen Integrated Biorefinery"
- ▶ **Arvind Lali**, DBT-ICT Centre for Energy Biosciences, "DBT-ICT Technology Platforms for Advanced Biofuels"
- ▶ **G. Sriganesh**, HPCL, "Technical perspective on 2G Biofuels and the way forward"

Session 4:

Progress on Cellulosic Ethanol



Dario Giordano,
Expert

- Each step of production of cellulosic ethanol presents a different challenge
 - Feed handling: Availability of clean biomass without contaminants is a challenge; cleaning of feed essential to prevent mechanical issues
 - Pre-treatment: can be the most expensive process in conversion; Keeping the configuration simple & innovative designs
 - Enzymatic Hydrolysis: converts lignocellulosic biomass to fermentable sugars;
 - Fermentation: In biomass deconstruction, a trade-off exists between to release all fermentable sugars at minimal process costs & to minimize generation of compounds that compromise yeast performance
- Localization & Integration: Bio-mass supply chain, lignin valorization, waste water management and re use, key for the biofuel industry key for cellulosic ethanol production

Session 4:

Proven Solutions for Advanced Biofuels in India



Markus Rarbach
Head of Biofuels &
Derivatives, Clariant

- Clariant providing solution for integrated enzyme production by sunliquid® process
- Clariant sunliquid cellulosic ethanol projects at various stages of implementation in Germany, Romania and Slovakia
- Technical issues in advanced biofuel industry are: Costly & inefficient enzymes, equipment used for pre-treatment, biomass transportation within plant, process steps not harmonized to each other; Clariant provides specific solution for each technical issue
- Sunliquid® ethanol being used as car and truck fuel in various markets
- Untapped potential in India is 140 million tons of residue surplus yearly for bioenergy production; potential to produce 28 million tons biofuel ethanol yearly

Session 4:

Lignin first: The Borregaard approach to cellulosic sugars and bioethanol



Gisle Lohre Johansen,
Senior Vice President, R&D,
Business Development and
Fine Chemicals,
Borregaard AS,

- Borregaard a major producer of Lignin; highly efficient bio-refinery in Norway
 - Sarpsborg sulphite mill produces cellulose, bioethanol, vanillin and lignin
 - External sulphite mill produces lignin
 - Bali plant produces lignin and cellulose; BALI is a biorefinery concept developed by Borregaard for production of cellulosic sugar and ethanol and lignin performance chemicals; high yield of sugar and ethanol due to low level of inhibitors

Session 4: Accelerating Commercialization of 2nd Gen Integrated Bio-refinery



Vasudeo Joshi

Vice President (Biofuels
& Chemicals),
Praj Industries

- Praj has established a Integrated Bio refinery Demonstration Plant of 1 MLPA Ethanol production capacity with multi feedstock processing capability
- Praj is working with OMCs on 2G demonstration plants
- Rolling out of VGF policy and differential pricing for 2G ethanol will accelerate commercialization of 2G plants
- Sugar mills attached distilleries can be used for ethanol production
- Smart bio-refineries can operate on multiple feedstocks and produce multiple products

Session 4:

DBT-ICT Technology Platforms for Advanced Biofuels



Arvind Lali

DBT-ICT Centre for Energy
Biosciences,

- DBT-ICT platforms convert complex carbon sources to combinations of simple sugars, lignin monomers, CHO-molecules
- Waste to fuel innovations of DBT revolve around:
 - Lignocellulosic sugars production
 - DBT-ICT 2G-alcohol technology has six novel processing segments
- MoUs with HPCL and BPCL for 2G bioethanol plants
- 3 pilot scale projects to be operational by 2018
- Spoke on various new technologies and upcoming plants of DBT-ICT for efficient biofuels production

Session 4:

Technical perspective on 2G Biofuels and the way forward



G. Sriganesh

Executive Director, HPCL

- Over years many companies setup demo-2G scale plants globally, however some companies closed down operations due to higher OPEX
- 2G ethanol plant development & commercialization is progressing at a slow pace due to higher OPEX & CAPEX, inherent process difficulties and challenges in establishing supply chain
- Way forward for indigenous 2G technologies development requires – multidisciplinary scientific breakthroughs, focus on biocatalysts, use of C-5 sugars and oil industry expertise
- HP green R&D centre is focusing on research in areas such as Biomass pretreatment, enzyme production etc.



Session 5:

Lignocellulosic ethanol (part 2)

- ▶ **Session Chair: Andrew Murfin, Shell**
- ▶ **Thomas Schroeder**, Novozymes, "Two decades of 2G development globally: accelerating deployment in India"
- ▶ **Angelica Hull**, Swedish Biofuels, "Production of jet fuel from ethanol and its perspectives"
- ▶ **S K Puri**, IOCL, "DBT-IOC Integrated technology for 2G Ethanol"
- ▶ **Subramani Ramachandrappa**, Richcore Lifesciences, "Integrated enzyme production strategies for lowering the cost of cellulosic ethanol"

Session 5:

Two decades of 2G development globally: accelerating deployment in India

► **Thomas Schroeder**
Novozymes

- Decarbonizing transport sector is a major challenge; India gasoline consumption is expected to double in the medium term
- Novozymes is a global leader in industrial enzymes and leadership spans across all elements of enzyme value chain
- More than Euro 2 billion investment made in full scale cellulosic ethanol plants across 3 continents
- Focus on increasing efficiencies and optimize process cost by development of technology
- Future of bio-refining offers many benefits to India, in terms of job creations, increasing revenues for farmers, decrease oil imports, decarbonize transport sector, export technology options and develop a bio-economy

Session 5:

Production of jet fuel from ethanol and its perspectives



Angelica Hull
Swedish Biofuels

- Producing Jet A-1 fuel from ethanol to replace fossil fuels
- Jet A-1 fuel is much safer as compared to fossil fuels, with lower smoke point, and has high octane number
- Swedish biofuels is carrying out a project for production of biojet fuel from sustainable biofuels
- Pilot plant based out of Stockholm has produced more than 12,000 litres of jet fuel and it complies with commercial fuel specification

Session 5:

DBT-IOC Integrated technology for 2G Ethanol

► S K Puri

Chief General Manager
(Bio-Energy) IOCL

- 2nd/3rd generation biofuels technologies from alternate raw materials required to meet 20% bio-fuels blending mandate of India National Biofuel policy
- 4 research centers working on 2G ethanol technologies in India
- DBT-IOC's efforts dedicated to reduce cost and process time across lignocellulolistic biomass value chain
- DBT-IOC has produced enzymes which costs 50% less
- IOC has planned to carry out studies and technology work for a 10TPD plant, which will be scaled up upon successful demonstration

Session 5:

Integrated enzyme production strategies for lowering the cost of cellulosic ethanol

➔ **Subramani
Ramachandrappa**
Richcore Lifesciences

- A biotech company focused on creating enzymes and recombinant proteins
- Enzymes are not one of the major problems related with advanced biofuels productions
- Key cost drivers in enzyme manufacturing are downstream losses, upstream productivity and packaging & transport
- Enzymes should be produced onsite to reduce costs

Session 6: Gasification and Pyrolysis

- ▶ **Session Chair: Didier Masy, Leaf**
- ▶ **René Venendaal**, Biomass Technology Group, "Fast pyrolysis based advanced biofuels"
- ▶ **Andreas Hornung**, Fraunhofer Institute, "Renewable transportation fuels from solid waste biomass"
- ▶ **Jean-Christophe Viguié**, IFPEN, "BioTfuel : 6 partners for one advanced technology"
- ▶ **S Dasappa**, CGPL, IISc, "Bengaluru- Pyrolysis State of the art technology and scaling challenges"
- ▶ **R R Sonde**, Thermax Ltd, "Pune – high fly ash Coal gasification"
- ▶ **D D Maheshwari**, Alchemy Enersol International, "MSW Plasma gasification"

Session 6:

Biomass Technology Group, “Fast pyrolysis based advanced biofuels



René Venendaal
Biomass Technology Group

- Thermal cracking of organic material in the absence of oxygen
- Talked about the advantages of the process, namely decoupling biomass resource from location and scale of application, works with variety of biomass feedstocks, yields advanced biofuel which is a sustainable alternative to fossil fuels. Has an overall efficiency – 85%
- Commercial demo plant started in 2015 with a plant capacity of 120 tonnes input/day
- Plant feedstock – wood residues
- Plant Output per year

Oil	20 million litres
Electricity	2,200 MWh
Steam	80,000 tonnes
CO ₂ - eq. reduction	24,000 tonnes
- Plants can be scaled up very easily
- Fast pyrolysis bio-oil finds its applications in bio—based materials, biofuels, bulk chemicals, commodity chemicals and power and heat generation
- Requires minimum modification at the refiners, low cost route (low capex and low opex)

Session 6:

Energy and fuels from Waste and waste biomass

The Biobattery



→ **Andreas Hornung,**
Fraunhofer Institute

- Optimize the pyrolysis stage for the feedstock
- Thermo Catalytic Reforming – advantages – utilization of residues, high potential, no big units necessary, short logistic ways and nutrients available again through the utilization of coal locally
- Products – Bio-Oil, Syngas, Char with input of sewage sludge
- Bio-char finds its application as charcoal substitutes and as a fertiliser at a later stage
- Energy carrier from biomass & recycling of composites
- Thermochemical Gasification - Char from Sewage Sludge treated by TCR has been applied, no tar formation in up-draft gasification, the phosphate rich ash stays as a powder.
- Plants can take up 80% of this phosphate without further treatment of the ash.

Session 6:

BioTfuel : 6 partners for one advanced technology

▶ **Jean-Christophe Viguié**
IFPEN

- Advanced bio fuel – Bio-chemical route and **thermo-chemical route**
- Partnership with various companies for developing biofuels from R&D stage to marketing to field to wheel
- Project started in 2010
- 2 core technologies -
 - Gasification – dry powder feed, direct water quench, compact system with low plant investment
 - FT Synthesis - Licensed by Axens
- Flexible to the widest range of feedstock
- Superior drop-in fuels (lowers particle emission)
- Economically and environmentally competitive

Session 6:

Thermo-chemical conversion of biomass –a route for liquid fuels



S Dasappa,
Combustion, Gasification
and Propulsion Laboratory
(CGPL) IISc

- Increase Hydrogen to carbon ratio : how much more hydrogen we can add into the process
- Biomass conversion process through 1. **Bio-chemical conversion platform** and 2. **Thermo-chemical conversion platform** to Fuels, Chemicals and other by-products
- Establishing a National Facility for Methanol generation by thermo-chemical conversion of biomass

Session 6:

Pune – high fly ash Coal gasification



R R Sonde

Executive Vice President
(Research, Technology &
Innovation) Thermax Ltd

- Govt. of India – 2 approach – biofuel to biodiesel/bioethanol and Coal to oil and gas
- India has high ash coal
- By gasification process coal can be converted to syngas – the latter is a starting molecule for fuel energy, CNG, Methanol and others
- Thermax looks at both Coal and Biomass
- Learnings – MSW needs to be converted into RDF and then can be gasified.
- Fluidized bed gasifier with fly ash char
- NITI Aayog promoting conversion of high ash coal to methanol

Session 6:

MSW Plasma gasification



D D Maheshwari
Founding Director,
Alchemy Enersol
International

- Plasma-gasification route – biomass to syngas – ethanol, methanol
- Integration of 2 different technologies to facilitate the process
- Technology tested on all kinds of biomass, hazardous waste, pet coke, toxic waste and others – can process in the absence of any one kind of feed – hence advantageous to the customer
- Third party testing of being beneficial to environment
- No residue left due to conversion through plasma
- Staged gasification used 10% of plasma energy – allows more carbon conversion to syngas
- Flour's patented technology – Mixed Alcohol Synthesis



Session 7: Novel Concepts, Renewable Fuels and CCU

- ▶ **Session Chair: Anjan Ray, CSIR-IIP**
- ▶ **Sean Simpson**, Lanzatech, "CCU-Now: fuels and chemicals from waste"
- ▶ **Eelco Dekker**, Conker, "E-Fuels, the power to move!"
- ▶ **Heli Antila**, FORTUM, "Biomass from waste and environmental problem to valuable products"
- ▶ **Armin Günther**, Air Liquide, "Challenges and opportunities of advanced and bio-fuels for transport sector decarbonisation – an industry perspective"
- ▶ **Laxmi Narasimhan**, Shell India Marketing P Ltd– "Drop in fuels"
- ▶ **Subodh Kumar**, IOCL, "Agri-Residue to Bio Gas/ Bio-CNG"
- ▶ **Julesh Bantia**, Eco Green Fuels, "UCO to Biodiesel"

Session 7:

'CCU-Now: fuels and chemicals from waste'

▶ Sean Simpson, Lanzatech

- Waste Carbon streams as a Resource for Gas Fermentation
- Extreme extent to demonstrating technology at scale in real world to overcome various challenges associated.
- Demonstration plant in China
- Other commercial projects – Indian Oil – Panipat Refinery Offgas, Biomass Syngas project in California and Ferroalloy off-gas in South Africa, Arcelor Mittal in Europe.
- Provides 2x more returns from ethanol than from power
- Recycling Gases: Environmental, Economic and Social Benefit
- Ethanol is low carbon fuel – 70% lesser emissions
- From Waste to Wing – Ethanol to Jet Fuel



Session 7:

E-Fuels, the power to move!

➔ **Eelco Dekker**
Conker

- E-fuel opportunities for India to help reduce emissions, store increasing supply of renewable energy, broaden fuel mix, reduce oil import and provide energy security and create new export product
- E- fuel known as Power-to-X (PtX), or Renewable Fuels of Non-Biological Origin (RFNBO)
- E-fuel - Can be integrated in existing production processes
- Operational choice has to be made in terms of the source of carbon – Fossil or Renewable
- Electrification – not enough and will take a long time to take place, hence essential to produce a higher value added product from electricity since there are practical challenges in storing electricity in batteries
- Examples of Audi (Conversion of electricity to hydrogen) – reducing carbon emissions by 80%
- India – Use of Methanol as Alternative fuel

Session 7:

Biomass from waste and environmental problem to valuable products



► **Heli Antila,**
Chief Technology
Officer, FORTUM

- Traditionally utility company- production of power, heat etc.
- Projects in India include - 4 solar power plants in India, Fortum charge & drive – electric vehicle charging in Delhi and off-grid solar
- Biowende – Biomass fractioning will disrupt fossil-based industry in similar way as solar and wind technology development is disrupting power markets
- Flexibility of raw materials
- With regard to India – potential of 100 refineries in the 3 states around Delhi (due to pollution caused by crop burning) – covering over half of world's cotton production.
- Bio2x turning Biowende into feasible business

Session 7:

Challenges and opportunities of advanced and bio-fuels for transport sector decarbonisation – an industry perspective

▶ **Armin Günther**
Air Liquide,

- Engineering and Construction – design group's industrial gas production units and externally sustainable and competitive technology and process solutions.
- Transport sector contributes 7.5 Gt of CO₂ eq.
- Utilize CO₂ (Liquid) as a process to reduce emission
- Methanol as a promising fuel in terms of usage of all different feedstock, longstanding catalyst cooperation with Clariant, full service portfolio
- Economics of Methanol Production – high influence of CapEx for electrolyzers, high influence on OpEx by electricity price and efficiency, CO₂ tax influence minor, limited scalability for electrolyzers capacity and high onstream time is indispensable to master economics
- CO₂ reduction and independence from conventional energy carriers are the main drivers for new developed biofuels and advanced fuels which are not in competition to the food chain

Session 7: Drop in fuels

▶ **Laxmi Narasimhan**

Shell India Marketing P Ltd

- IH² technology - converts MSW, Agri residue and forestry into hydrocarbon fuels, uses proprietary catalysts, H₂ & heat to remove O as water, exothermic process
- Up to 76% energy recovery and up to 92% lower GHGs
- Physical pre-treatment and no chemical pre-treatment
- Converts Municipal Solid Wastes into On Spec Transport Fuel (Waste to Fuel)
- Technology heart of govt. of India's mission of Swacch Bharat, Energy Security, Green India, Benefits to Agricultural Sector, Make in India, Skill India and improve public health

Session 7:

Agri-Residue to Bio Gas/ Bio-CNG

▶ **Subodh Kumar**
Executive Director
(Alternate Energy &
Sustainable
Development), IOCL

- Production of Bio-CNG can reduce imports of LNG (50% imported)
- Total Bio-CNG potential – 62 MMT – sources being cattle dung, surplus Agri-residue, Sewage Treatment Plant, Municipal Solid Waste, Spent Wash/Press Mud
- In-house inoculums developed by IndianOil
- Plant capacity: 70-200 TPD with Bio-CNG production of 7-20 TPD, retailed through IndianOil Retail Outlets
- Planned 400 Bio-CNG Plants in Punjab
- Bio-Manure – Important bi-product – reduction in chemical fertiliser, increasing crop yield and restore natural soil fertility

Session 7:

UCO to Biodiesel

▶ **Julesh Bantia,**
Eco Green Fuels,

- Eco Green Fuels – 16000 biofuel crops – Carbon sequestration, Oxygen generation causing good clouding conditions, Water conservation and Improved soil fertility
- Biodiesel facility with installed capacity of 5000 MT/Year with a growth rate of 60% YoY
- Catering to farmer and hospitality vertical
- Vendor profiles - Corporates, Bulk RTE mfrs., Caterers, Hotels, Restaurants; legitimised the collection process
- Collected over 3000 MT so far
- Sewage Fat – Sustainable Feedstock
- Potential convertible stock per day - 50,000 kilos. - 18250 tons annually; sources being sewage from homes, hotels and restaurants

Session 7:


Domestic Carbon Resources and Biofuels



Anjan Ray

Director, CSIR-IIP,
Dehradun

- Need about 350MMT domestic carbon to fully replace our carbon imports
- Land limitations in India constrain availability of landfill space and supply-demand economics of urban land planning
- In rural areas, fallow / mono-cropped / under-irrigated land offers upsides on carbon capture through farm activity
- 485 MMT of carbon excluding CO/CO₂/landfill CH₄ - All the carbon we need is available within our borders
- Mobile Pyroformer – Utilize the biomass as it is produced- Pyrolysis of agriculture waste for production of bio oil for stationary applications



Session 8: Co-Processing & Transport sectors

- ▶ **Session Chair: Abhay Damle, Joint Secretary (Transport), Ministry of Road, Transport & Highways**
- ▶ **Dharmesh Mahajan, Honeywell**
- ▶ **Røj Anders, Volvo**
- ▶ **Mathew Abraham, Mahindra & Mahindra, “An OEM's Perspective on Bio Diesel as fuel for Automotive Vehicles –Development Experiences”**
- ▶ **Vinay Srivastava, IROAF, Indian Railways, “Use of Biofuels in Indian Railways”**

Session 8:

Biomass-A Massive opportunity in disguise

▶ **Dharmesh Mahajan,**
Honeywell

- Use locally available biomass and convert Biomass into Bio-crude, transport into the nearby refinery – Spoke and hub model
- Bio-Crude – liquid biomass from non-food, woody waste biomass through Rapid Thermal Processing conversion
- Vision to reduce oil dependence by 10% by 2022, Climate change is a major concern
- Biomass to Bio-crude taking place in six units in US and Canada
- 42MMT bone dry biomass can replace about 10% of fossil crude demand
- Environment & Social, Energy Security, Economics & Technical Merits
- Ecofining - Plant-derived Oils, Animal Fats & Grease, Used Cooking Oil, Algal Oil

Session 8: SUSTAINABLE TRANSPORT SOLUTIONS – GLOBAL OUTLOOK AND INDIA PERSPECTIVES

→ **Urban Lofvenberg,**
SCANIA

- Sustainable transport solution – Low carbon, clean and economical – hence outcompete diesel
- Solutions – Alternative fuels and electrification, Energy efficiency and smart and safe transport
- Transport's fuel use and emissions – broader focus necessary than only city centres
- Different solutions and technologies in the different areas & segments, optimize whole regional transport systems and electrification of heavy duty will only apply in limited segments
- One third of all food produced (1,3 billion tonnes) is lost or wasted in the food chain -95 % ends up in landfills
- Main source for waste to fuel – sewage water, organic solid waste and Landfill gas
- Best case is to use biogas for transport than to produce electricity or heat

Session 8: Fuels for Commercial Vehicles

– Present and Future Challenges and Opportunities

➤ **Röj Anders,**
Volvo

- Increasing sensitivity to fuel quality
- Importance of Fuel Quality - essential part in the engineering process & an integrated part of the quality assurance system
- Fuels for Future
 - Sustainability and sustainable availability
 - Well-to-wheel regulated and unregulated emissions
 - Economy & infrastructure, other considerations
- Volvo Alternatives Fuels - Methane fuels: biogas, natural gas (CBG/CNG, LBG/LNG), DME (dimethyl ether): bio-based or fossil, HVO, Synthetic diesel (GTL, CTL, BTL) and FAME low-blends, long distance LNG -(MethaneDiesel) and DME, Medium distance applications - LNG/CNG and DME and Electricity
- Move to non-fossil fuels will come when profitability levels are viable
- Political decisions will be needed for Long term vision and Short term incentives
- Energy efficiency and GHG

Session 8:

An OEM's Perspective on Bio Diesel as fuel for Automotive Vehicles –Development Experiences

▶ **Mathew Abraham,**
Mahindra & Mahindra

- Main Alternatives - Primary Biodiesel & Advanced Bio-Diesel
- Concerns of Bio-Diesel - Biodiesel ages more quickly than diesel due to the chemical structure, Cold filter plugging point (CFPP) –Low compared to Diesel
- Upto B10 is acceptable of above concerns therefore has potential for implementation more widely. B100 remains a challenge
- Biogas Plant – Methane can be used as a cooking gas, automotive fuel, electricity generation; CO₂ can be recovered and sold as Industrial gas and Slurry can be used as organic manure/fertilizer for cultivation/horticulture
- Sufficient infra structure facilities should be ensured for continuous supply of Bio-diesel to oil companies for a sustained mixing of blends

Session 8:

Use of Biofuels in Indian Railways

→ **Vinay Srivastava**

Indian Railways
Organization for Alternate
Fuel (IROAF)

- To introduce Bio-fuels in Indian Railways
- Since 2001, electricity consumption has doubled although diesel consumption has shown a decline
- Future fuels for Rail Transport – Bio-Diesel, CNG/LNG, methanol, Fuels from renewable sources
- Bio- diesel initiative of IR – Plant in Tondiarpet and Raipur
- Supply chain and Policy issues
- Methanol on mainline locomotives – substituting HSD

Invited Presentation:

The ART Fuels Forum, The forum where the Advanced Biofuels Industry meets

► **David Chiaramonti & Ramakrishna Y B**

- Alternative and Renewable Fuels Forum – supported by EC-DG Energy
- Goal: Market & Policies post 2020 (to 2030).
- ~ 100 participants (Members, Affiliate, Observers, NGO & Think-tanks)
- Industry-led forum
- Along with structured links to US, Canada and India, collaborations and joint actions have been established with IRENA, biofuture platform, IEA, below⁵⁰,ETIP Bioenergy and FlightPath
- AFF work focused on the new EU Directive on Renewable Energies (REDII)
- This Legislative Framework is decisive for the Adv.Biofuels & Low Carbon Fuel industries. AFF endorsed the work by SubGroup on Advanced Biofuels - SGAB
- Food-based (conventional) Biofuels- from 7% at 2020 to 3.8% at 2030
- No-food Biofuels- From 1.5% at 2020 to 6.8% at 2030



Thank You