BIO ENERGY
Renewing Energy-Restoring Earth

PRISM

2nd INTERNATIONAL CONFERENCE ON

BIOENERGY AND BIOFUELS

RENEWING ENERGY–RESTORING EARTH

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ABSTRACT BOOK



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DAY – 1

Plenary Talk

Next-Generation Algal Biorefinery: Recent Developments and Emerging Opportunities

Pau-Loke Show

UCSI University, Malaysia

Abstarct : Liquid Biphasic System (LBS) can give a high recovery yield and high purity in a single step. The LBS shows characteristics of high selectivity and is easy to scale up. Therefore, LBS offers an attractive alternative that meets the requirements of the high demand in industry processes, and it is also beneficial in terms of economic and environmental protection. The discussion also touches upon the potential challenges and ethical considerations associated with the widespread adoption of AI in microalgae biorefineries, highlighting the need for responsible and inclusive development practices. The abstract concludes by emphasizing the pivotal role of AI in advancing Microalgae Biorefinery Technology for Circular Bioeconomy, paving the way for a more sustainable and resilient future. This presentation aims to share on the recent literature works in the development of different type of LBSs and their applications in novel separations and purifications of biomaterials. Hopefully this presentation will be able to build solid research collaborations among industry players and researchers.

Plenary Talk

Sustainable Fuels and Chemicals from Waste

G. K. H. Goh a*

*A Institute of Sustainability for Chemicals, Energy and Environment (ISCE 2), Agency for Science, Technology and Research (A*STAR), 1 Pesek Rd, Singapore 627833, Republic of Singapore.*

Abstarct: The current market lacks scalable, cost-effective low carbon technologies to increase the supply of synthetic fuels and valuable chemicals for the hard to decarbonize sectors such as aviation. New research has shown the generation of valuable hydrocarbons such as fuels and chemicals from waste sources such as biomass and plastic waste. The transformation of waste into valuable products that are required by society such as sustainable aviation fuel (SAF) should be explored. However, the key challenges lie in obtaining selectivity towards desired products with lower energy consumption, less waste generation, and enhancing the process cost-efficiency, before the waste hydrocracking technology enters the market. The scalability of most lab based hydroconversion technologies also pose as a barrier for further translation to pilot scale demonstrations. In addition, developed technologies should display potential as a low emission technology. The project aims to develop cost-efficient catalytic systems towards the selective hydroconversion of waste to generate products of commercial potential (aviation/diesel/gasoline fuel and gas fuels) under mild conditions. Scalability of the developed technologies are explored in parallel to unlocking potential new feedstock sources to produce synthetic fuels and chemicals in consideration to supply chain logistics, renewable energy sources and complementary partnerships and strengths.

Plenary Talk

Flying the Future: Advances in Avistion Fuels at the Joint BioEnergy Institute

Blake A. Simmons

Lawrence Berkeley National Laboratory, USA

Abstract : **TBA**

Keynote Talk

Liquid Triphasic System for Biofuels Production from Microalgae Resource

Chew Kit Wayne

United Arab Emirates University, Al Ain, Abu Dhabi, United Arab Emirates

Abstarct: Microalgae have received much interest as a biofuel feedstock in response to the uprising energy crisis, climate change and depletion of natural sources. The high-value co-production of biomolecules through the extraction of a fraction of algae can be performed to improve the economics of a microalgae biorefinery. To promote the sustainability of this process, an innovative microalgae biorefinery structure using liquid triphasic system (LTS) has been implemented to investigate the production of multiple products from a single microalgae source. LTS is a multiphase system that comprises of three phases as a result of two immiscible liquid mixtures consisting of a combination of alcohol and salt phase, where lipids are separated to the top, proteins present in the intermediate and the remaining carbohydrates and contaminants in the bottom phase.

The LTS represents a simple and quick method for extraction, purifying and concentrating biomolecules and can be used directly with crude suspensions. Integrating the technology with pretreatment procedure such as microwave have also established higher quality products with better desired compound recovery. The incorporation of pretreatment steps with LTS can contribute to cell disruption of microalgae, leading to the rapid release of valuable biomolecules. This shows the prospects of LTS as a potential rapid downstream processing for the extraction and purification of multiple products from microalgae.

Keynote Talk

Biomass Gasification and Synthesis of Green Hydrogen-Based Fuels

Ming Zhao,[abcd]*

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[c] *Beijing Laboratory of Environmental Frontier Technologies, School of Environment, Tsinghua University, Beijing, 100084, China*

[d] *Institute for Carbon Neutrality, Tsinghua University, Beijing 100084, China*

Abstarct: Organic solid waste remains on one hand a key challenging environmental issue but also possesses big energy potential with carbon-neutral nature. Hydrogen and hydrogen-based fuels (ammonia, methanol, methane, jet fuel, etc.) serve as energy carriers for hydrogen energy strategy and are critical pathways to achieving carbon peak and carbon neutrality goals. Currently, renewable energy sources like wind and solar can only supply green electricity, which is used to produce green hydrogen through water electrolysis, but there is a lack of "green carbon" to synthesize higher-value fuels such as "hydrocarbon-ammonia-alcohol" that are more suitable for transportation and use. Biomass gasification technology can convert low-value, disorganized biomass waste into high-value syngas (mainly H2 and CO), which can then produce pure hydrogen or hydrogen-based fuels through mature chemical processes. The presenter's team have developed an innovative gasifier with "double oxidation layers" enabling super high carbon atomic conversion ratio (~99%) and low tar yield (less than 100 mg/Nm3). This has been regarded as breakthrough in history of the fixed-bed gasification that used biomass as feedstock, i.e. the field that suffered from tarring and slagging. This presentation will share the principle, pilot trials and commercialization of this new technology.

Invited Talk

Current Status and the Challenges of the Production of Sustainable Aviation Fuels (SAF)

Arnaldo Cesar da Silva Walter

University of Campinas, Brazil

Abstract: It is estimated that greenhouse gas (GHG) emissions from civil aviation account for 2.5% to 3.0% of total emissions, but with a significant growth trend expected in the coming decades. With the aim of at least keeping emissions constant, and ideally initiating a process that could lead to significant reductions, there are initiatives at the international level and in major countries. In the short and medium term, reducing GHG emissions will require the production and use of alternative fuels, which need to be recognized as sustainable. The production of Sustainable Aviation Fuels (SAF) has been growing steadily, but there are many challenges to overcome, such as the low availability of feedstock, the risk of negative impacts from land-use change when planting dedicated biomass, high production costs, compliance with certification requirements for the fuel produced, etc. The presentation will address recent advances in the production of SAF (Sustainable Aviation Fuel) and the challenges for the necessary significant growth in this production. Regarding the challenges, the focus will be on

developing countries, particularly those with significant potential. The author has been working on assessing the potential production of SAF in Brazil and other Latin American countries.

Invited Talk

A Solvent-Mediated Biocatalysis for Improved Lignin Conversion in One-Pot Design: Effect of Aprotic and Protic Solvents on Multicopper Oxidoreductase.

Dr. Rokesh Radhakrishnan

Galgotias University, India

Abstract: Globally, billions of metric tons of lignocellulosic from agro-industrial and domestic sources are accumulated, their valorization has been gaining significant attention as it has dramatically impacted the circular economy. The solvent-mediated biocatalysis is gaining a pivotal role in present times for its role in sustainable biotechnological solutions. Among these, laccase viz., multicopper oxidoreductase as biocatalyst has gained wide applications in solvent-based biorefineries for their properties in improved conversion of aromatic biomacromolecules. Based on this interest, the influence of different concentration of aprotic polar organic solvents and non-conventional solvent i.e., 1-Ethyl-3-methylimidazolium acetate (EmimOAc) for the dissolution of lignin spent were determined. Post this, a ternary composition of EmimOAc were optimized with the combination of aprotic polar organic solvents; the lignin dissolved were studied for the biotransformation to value-added materials with laccase. Initially, the studies were performed with commercial laccase, Trametes versicolor the influence of extremophilic laccase viz., Thermus thermophilus (TtL) and copper efflux oxidase (CueO) in non-aqueous media were elucidated. The TtL and CueO were overexpressed and purified based on the affinity tags. The purified enzyme was tested for its influence with varied concentration of organic solvents and EmimOAc. The effect of increasing concentration of solvents on the catalytic activity was compared with the commercial TvL. Aside from this, the thermal unfolding for TtL and CueO in solvents were revealed. Consequently, the extremophilic multicopper-oxidase followed a same pattern of thermal unfolding. The CueO, was further utilized to improve their catalytic activity via directed evolution targeting the indirect surface catalytic site which are exposed to the solvents. A plate-assay were developed for the initial pre-screening of the active variants. A high-throughput screening was established with suitable solvent concentrations at their denaturation concentration. Within the single round of directed evolution the variant showing an improvement of ~1.5 in the organic solvent, which when applied for lignin biotransformation would yield higher conversion rates. Altogether, this study establishes the prerequisite for laccase engineering for their suitability in non-conventional solvent media for the improved value-addition of lignin via biocatalysis for its application in one-pot process design.

Invited Talk

Biofuels for Transportation: From Innovation to Implementation

Derek Wong Sun Soon

Surbana Jurong Infrastructure Pte. Ltd, Singapore

Abstract: Biofuels can play an important role in decarbonising transport, particularly in sectors where electrification and other alternatives remain constrained by energy density, operational requirements or infrastructure. However, successful innovation alone does not guarantee deployment at scale.

This presentation examines the journey from technical innovation to commercially viable and repeatable low-carbon fuel systems. It highlights four conditions that must come together: sustainable and reliable feedstocks, scalable and proven technologies, enabling infrastructure, and viable markets supported by appropriate policy, certification and investment frameworks.

Drawing on the needs of road transport, aviation and maritime applications, the presentation considers how these elements must be integrated across the complete value chain, from feedstock supply and conversion through fuel production, storage, distribution and end use. It also explores the importance of collaboration among technology developers, fuel producers, infrastructure providers, transport users, financiers and policymakers.

With a particular focus on Asia, the presentation considers how regional resources, infrastructure capabilities and transport demand can be connected to accelerate implementation. The central proposition is that the next challenge for biofuels is not simply to demonstrate that technologies work, but to create integrated, bankable and replicable systems capable of delivering meaningful decarbonisation at scale.

Invited Talk

Engineering Crops to Replace Fossil Carbon

Karine Chenu

The University of Queensland, Australia

Abstarct: Replacing fossil carbon with renewable carbon derived from plant biomass is a key strategy for decarbonising fuels, chemicals, and materials. However, the industrial conversion potential of plant carbon to valuable products and second-generation biofuels is limited by plant cell wall composition. Overcoming this bottleneck requires coordinated advances in plant genetics, crop design, and bioconversion technologies. The ARC Research Hub for Engineering Plants to Replace Fossil Carbon is addressing this challenge through an integrated program spanning plant genomics, biomass engineering, chemistry, and bioconversion, with a focus on high-biomass crops such as sugarcane and sorghum. Genomics, spatial transcriptomics, quantitative genetics and mutagenesis approaches are being used to identify and target key genetic determinants of cell wall composition. New biomass feedstocks with

tailored cell wall compositions are being developed and evaluated in parallel with engineered enzyme bioconversion systems to maximise the recovery of plant- derived carbon converted into renewable fuels and other high-value bioproducts while reducing processing costs and environmental impacts. By integrating advances from gene discovery to bioconversion, this research aims to accelerate the development of sustainable plant-based feedstocks for a low-carbon bioeconomy.

Invited Talk

SAF technology options: Current status, learnings, choices and implementation

Tine Høj Andersen
Topsoe, Denmark

Abstract:

The presentation will introduce:

- Why we need SAF (sustainable aviation fuel)
- Current status on SAF deployment
- What technologies are currently being used and implemented
- Which technologies are still being developed.
- Guidance on which technology to choose depending on feedstock and resource availability.
- What it takes to make a SAF project bankable?

Invited Talk

Building a Circular Bioeconomy Ecosystem

Mary Blanchard

Wisconsin Energy Institute Madison, USA

Abstarct: Major economic, environmental, and social advantages can accrue from the conversion of abundant renewable and waste resources into food, fuels, chemicals, medicines, and everyday materials. First, technology innovations have the potential to increase the value of forestry, non-food agricultural, and waste materials, providing new income streams to farmers and other producers. Second, existing industries, such as plastics manufacturers, could

reach new markets with novel bio-based and/or biodegradable materials, growing their economic impact and job base. Third, newly created industries would likely be located near rural sources of renewable and waste resources, promoting rural economic development. Maximizing the value of these resources could be a nationwide game changer for rural communities now under economic strain and help decarbonize the industries and products of tomorrow. Fourth, novel technologies that enable the conversion of organic materials into valuable products could keep excess manure and other organic materials off the landscape and out of waterways, reducing algal blooms and improving the water quality of rivers, lakes, and underground aquifers.

This presentation will discuss the results of workshops and conferences held over the course of several years that brought together innovation/start-up networks, industry, government, non-governmental organizations, investors, and other stakeholders to facilitate knowledge sharing and local partnership development to advance a circular bioeconomy ecosystem. The workshops explored gaps and opportunities to enable a circular bioeconomy that is distributed across agricultural and forested landscapes with diverse raw material inputs and end products. These events and learnings together helped build shared understanding and strengthen stakeholder networks critically necessary to achieve a robust circular bioeconomy.

Invited Talk

Breakthrough Production Technology for Sustainable Aviation Fuel (SAF)

Tat Chuan Goh

Aether Fuels, Singapore

Abstarct: Aether Fuel is revolutionizing sustainable fuel production to help hard-to-abate industries like aviation and ocean shipping achieve their decarbonization goals. Our breakthrough Aether Aurora™ technology platform converts a broad range of low-cost waste and carbon-based feedstocks—including biogas, industrial off-gases and agricultural/forestry residues—into sustainable fuels such including SAF. The scalable solution addresses the core requirements of next-generation sustainable fuels by increasing production yields and reducing capital costs, while utilizing a diverse range of feedstocks.

Invited Talk

Success Stories of Unilever Replacing Fossil Fuel with BioMethane & Upcoming Fossil Fuel Replacement Projects for Toyota & Others

Raghunath K R

Asian Biogas & Biofuels Association, Singapore

Abstarct: TBA

Invited Talk

Interpretable Machine Learning for Environmental Fate: From Small Molecules to Polymers

Huichun (Judy) Zhang

Case Western Reserve University, USA

Abstarct: Predicting environmental fate is difficult because chemical space is vast and environmental conditions vary widely, limiting the transferability and mechanistic value of many traditional QSARs. This talk presents an end-to-end workflow that integrates rigorous data curation, physics-guided feature engineering, and interpretable machine learning to build system-aware predictive models. Two applications are highlighted. For small molecule reduction, we harmonized a comprehensive dataset for Fe(II)-associated reductants by unifying free, complexed, sorbed, and structural Fe(II) into one modeling matrix, achieving high accuracy for organics ($R^2 = 0.83$) and recovering classic Hammett/LFER trends through model interpretation. For polymer biodegradation, we addressed sparse, inconsistent macromolecular data by combining literature meta-analysis, targeted experiments, and synthetic "failure-mode" data, yielding $R^2 = 0.66$, capturing non-linear behaviors and identifying thermal decomposition temperature as a key proxy for recalcitrance. Model interpretation analysis confirms mechanistic consistency and enables large-scale virtual screening (e.g., ~38% of DSSTox), supporting safe-by-design chemicals and materials with reduced environmental persistence.

Invited Talk

Asia Biofuels Development and Outlook

Wei Jun Chua

S&P Global, Singapore

Abstarct: TBA

DAY – 2

Plenary Talk

Biofuels Reimagined: From Biomass and Waste to the Fuels of Tomorrow

Rafael Luque, ECOTEC University, Ecuador

Abstarct: Biofuels are entering a new era in which biomass, waste and emerging technologies converge to redefine how sustainable fuels are produced. In this lecture, we will explore how green chemistry, advanced catalysis and process intensification are transforming today's biofuel landscape while creating new pathways toward the fuels and energy carriers of tomorrow. Drawing on recent developments in biomass and waste valorization, multifunctional catalytic systems and intensified processing, the presentation will showcase strategies for converting agricultural residues, lignocellulosic resources, organic and plastic wastes, and other underutilized feedstocks into valuable liquid fuels, fuel precursors and hydrogen. Particular emphasis will be placed on catalytic approaches that enhance carbon efficiency, selectivity and scalability while reducing energy and resource demands. Beyond conventional biofuel production, the talk will discuss the emerging convergence of circularity, waste valorization, renewable carbon and low-carbon energy systems. By connecting technological advances with real-world opportunities for deployment, this lecture will highlight how biofuels can evolve from an established renewable-energy option into a key component of a more circular, resilient and sustainable global energy system.

Keynote Talk

Unlocking a Biomethane Industry in Australia

Erik Vandenberg, Growth & Energy Transition Verbrec Ltd, Australia

Abstarct: Australia has the resources to develop a substantial biomethane industry. Agricultural residues, food and organic wastes, wastewater and other biogenic feedstocks are widely available; much of the gas infrastructure needed to transport the resulting energy is already in place; and there is a large industrial market looking for practical ways to reduce emissions. What remains less developed is the commercial and policy framework needed to turn that opportunity into a repeatable pipeline of investable projects.

Experience emerging across New South Wales, Queensland and Western Australia points to a relatively simple lesson: biomethane projects do not succeed on feedstock availability alone. They need a reliable feedstock catchment, an anchor customer, a practical route to market and sufficient value across the whole project to justify the cost of aggregation, processing and connection. Gas sales are only one part of that equation. Renewable gas certificates, biogenic CO_2, digestate and nutrient recovery can all contribute to project economics, while BioCNG and BioLNG provide alternative routes to industrial, mining and transport customers where pipeline injection is impractical or too expensive.

This creates an opportunity that extends well beyond the traditional concept of a standalone biogas plant. Regional biomethane hubs can bring together agriculture, waste management, energy infrastructure and industrial demand. Crop residues and organic wastes can become additional sources of income; digestate can return nutrients and organic carbon to agricultural land; and renewable gas can displace conventional natural gas or diesel in applications that are difficult to electrify.

The challenge is that these projects are inherently local. The economics can change materially with haulage distance, feedstock composition, storage requirements, connection costs and the quality of the available offtake. A large theoretical biomass resource does not necessarily translate into a viable project. Development therefore needs to begin with the catchment, logistics and customer, rather than with plant capacity. Long-term feedstock arrangements, sensible aggregation distances, sustainable residue removal and secure offtake are likely to matter more to investment decisions than headline estimates of the available resource.

There is also a further opportunity in the biogenic CO_2 separated during biomethane upgrading. Rather than treating this stream simply as a co-product or venting it to atmosphere, it can be combined with low-emissions hydrogen through methanation to produce additional renewable methane. Integrating hydrogen production and methanation into a modular process offers the potential to improve heat and mass integration, reduce balance-of-plant requirements and lower the cost of e-methane production. It also creates a pathway to extract considerably more energy value from the original biogenic carbon while producing a gas that can use existing pipeline infrastructure.

Australia therefore does not need to choose between electrification and gas infrastructure. There are parts of the economy where electrification will be the most efficient answer, and others where a transportable, storable and dispatchable renewable molecule will remain valuable. Biomethane and, increasingly, e-methane can serve that second group without requiring an entirely new energy delivery system.

Unlocking the industry will require credible renewable gas certification, clearer and more durable demand signals, workable gas-network connection arrangements and targeted support for the first commercial projects. Just as importantly, developers will need to build projects around real regional supply chains and contracted customers rather than resource potential in isolation.

If those pieces can be brought together, Australia's existing gas infrastructure can progressively change from a system built around conventional natural gas into one capable of carrying renewable molecules. That would preserve the value of infrastructure already in the ground while creating a new market for agricultural residues and organic wastes, supporting regional industry and providing another practical pathway for the decarbonisation of Australia's harder-to-electrify energy demand.

Invited Talk

From Sugars to Sustainable Aviation Fuel Precursors: Building an Escherichia Coli Cell Factory for High-Level Free Fatty Acid Production

Sung Kuk Lee, Ulsan National Institute of Science and Technology, South Korea

Abstarct: Microbial free fatty acids (FFAs) are promising intermediates for sustainable fuels and oleochemicals because they can be produced from renewable resources and converted into a wide range of value-added products, including sustainable aviation fuel (SAF) precursors. In this work, we redesigned Escherichia coli into a high-performance microbial cell factory capable of producing FFAs at exceptionally high titers through integrated metabolic and process engineering. The development of this production platform followed a stepwise engineering strategy. First, we improved the release of FFAs from the native fatty acid biosynthetic pathway by engineering the thioesterase 'TesA. A mutant variant, $'TesA^{R64C}$, functioned as an efficient release valve for FFA production. Second, we increased malonyl-CoA availability, a key precursor for fatty acid biosynthesis, by expressing methylmalonyl-CoA carboxyltransferase (MMC). Third, membrane transporter engineering strategies were applied to improve FFA secretion. These individual approaches were subsequently integrated into a unified metabolic engineering platform, resulting in high-level FFA production from

glucose. As FFA titers increased during fed-batch fermentation, several process-related bottlenecks became increasingly significant, including plasmid instability, insufficient reducing power supply, and unfavorable carbon flux redistribution. To further improve production performance, fed-batch fermentation conditions were optimized to support stable and efficient FFA production. To address the remaining limitations, we developed plasmid stabilization and expression-tuning strategies, enhanced NADPH supply, and applied multiple global transcription factor engineering (MgTFE) to adjust the cell's broader regulatory network. These integrated strategies enabled more efficient redistribution of cellular resources toward FFA biosynthesis. Overall, this work demonstrates how integrated metabolic and process engineering can systematically overcome multiple bottlenecks limiting microbial FFA overproduction. The resulting platform provides a promising route toward the sustainable bioproduction of FFAs and other oleochemical-based fuels and chemicals.

Keywords

Free fatty acids; *Escherichia coli*; plasmid stabilization; cofactor engineering; Multiple transcription factor engineering

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Invited Talk

Abiotic and Algal Biocathodes in Mediator-Assisted Microbial Desalination for Brackish Water Treatment and Bioenergy Recovery

Dr. Sandhya Prakasha, Dr. Kalaichelvi Ponnusamyb, Dr. Samsudeen Naina Mohamed*

Department of Chemical Engineering, National Institute of Technology Tiruchirappalli, Tamilnadu - 620015, India

Abstract: Microbial desalination cells (MDCs) offer an innovative approach for simultaneous wastewatertreatment, desalination and bioelectricity generation. However, conventional abiotic cathodes generally rely on chemical catholytes, motivating the development of more sustainable biological cathode systems. In this study, the performance of mediator-assisted abiotic and algal biocathode in a novel patented MDC configuration was evaluated under real brackish-water conditions, with particular emphasis on the role of plant-derived electron shuttles.

Plant-derived extracts from vetiver (Chrysopogon zizanioides) and onion (Allium cepa) peel were investigated as sustainable electron shuttles to enhance electron transfer and overall MDC performance in abiotic and biocathode MDC. The onion peel mediator-assisted abiotic MDC demonstrated a 2.7 – folds increase in power density performance compared to the non-mediated system. The biocathode MDC using the Chroococcus minor as the biocatholyte was

developed to reduce dependence on chemical catholytes. Under real brackish-water conditions, vetiver mediated mixed-culture biocathode MDC exhibited a power density of 6.27 ± 0.13 mW/m2, compared with 3.16 ± 0.06 mW/m2 for the non-mediated system. The mediated biocathode achieved 94.3 ± 1.9% COD removal and 21.5 ± 0.43% desalination efficiency.

Comparison of the two cathodes in the presence of mediators demonstrates that the polyphenolics in the plant-derived mediators can positively influence the electron transfer mechanisms in abiotic and biocathode and hence are sustainable options in large scale systems to enhance the MDC performance. Abiotic cathode provides higher electrochemical power generation, whereas the algal biocathode offers a more biologically integrated and potentially lower-chemical-input approach while maintaining effective wastewater treatment and desalination. The contrasting responses of the two cathode configurations to plant-derived mediators also highlight the importance of mediator–microorganism interactions in designing sustainable bioelectrochemical systems. Overall, the study demonstrates the potential and challenges of transitioning from abiotic to biological cathodes for sustainable water–energy recovery from wastewater and brackish water.

Keywords: Microbial desalination cell, abiotic, biocathode, plant-derived mediators, power density, desalination, COD removal efficiency.

Panel Discussion

Repurposing for Energy Transition and the Next-Gen Biofuel Systems

Panelist : Rafael Luque, ECOTEC University, Ecuador

Panelist : Tat Chuan Goh, Aether Fuels, Singapore

Panelist : Arnaldo Cesar da Silva Walter, University of Campinas, Brazil

Panelist : Jenson Ong, S&P Global Energy, Singapore

Panelist : Edmund Siau, GenZero, Singapore

Keynote Talk

Evolution of Energy Amid Disruptions to Trade and Geopolitics

Annette Hugh, S&P Global Energy, Singapore

Abstarct: TBA

Invited Talk

Energy Security Prompts Accelerated Diversification into Biofuel Alternatives

Jenson Ong, S&P Global Energy, Singapore

Energy security prompts accelerated diversification into Biofuel alternatives

- Sustainable aviation fuel (SAF) takes flight as regional mandates develop
- Renewable production pathways innovate for high-performance future fuels
- Feedstock supply and quality certifications key to securing investments

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Invited Talk

You Can't Drill a Farmer: The Human Side of Innovative Biomass Solutions

James Little, Little Consulting, Singapore

Abstarct : Biomass is not oil, gas or coal. It cannot be drilled or mined by a handful of large corporations. Sustainable biomass is grown and collected by millions of people across agriculture, forestry and sawmilling, spread over vast areas.

The bioeconomy now promises far more than heat and power: sustainable aviation fuel, shipping fuel, chemicals, fertilisers, steel and batteries. Yet many proposals still assume feedstock can be aggregated like crude oil. At TWh scale, that is rarely economic, sustainable or desirable.

Drawing on 20 years in the sector, from founding England's first wood pellet plant to supply-chain work across Southeast Asia, James argues for a decentralised model. It must account for the physical and geographical realities of biomass, and also for the people who produce it. As a psychology graduate, he also looks at why growers and processors behave as they do, and how advanced thermal treatments such as torrefaction, steam explosion, pyrolysis and gasification can densify energy close to source and make decentralisation work.

Invited Talk

Creating Value from Electrons and Pollution: Integrated Electrochemical and Biological Platforms for Biomanufacturing

Justin Panich, Lawrence Berkeley National Laboratory, USA

Abstarct: Electrochemical and biological processes can be integrated to convert carbon dioxide, electricity, hydrogen, and other low-value feedstocks into fuels, chemicals, biomass, and agricultural products. This presentation will describe research at Lawrence Berkeley National Laboratory focused on developing a unified electrochemical-biological platform that combines feedstock generation, synthetic biology, and fermentation process development. Key efforts include improving carbon and energy efficiency, increasing biomass production, controlling the delivery of gaseous and liquid feedstocks, and evaluating operation at larger and more industrially relevant scales. The work demonstrates how coordinated advances in biology, electrochemistry, and process engineering can create productive uses for carbon-containing waste streams, expand domestic biomanufacturing capabilities, and support U.S. leadership in energy and manufacturing technologies.

Invited Talk

Converting Palm Biomass Waste to Methane

Hans J. Hvide, Straits Bio-LNG Pte Ltd, Singapore

Abstarct: TBA

Invited Talk

Calcium Mediated Strategy for Rapid Acidogenic Sludge Formation with Simultaneous Improvement in Biohydrogen Production

Rokesh Radhakrishnan, Galgotias University, India

Abstarct: To overcome the reliance on fossil fuels, green hydrogen could be served as a potent

sustainable energy source. The demand of hydrogen is expected to surge from 18.8 to 381.3 million tonnes per year by 2050. Hydrogen is tagged as clean, since the combustion generates zero carbon emissions with water as byproducts. The dark fermentation stands to be one of the hydrogen production technologies; among which acidogenic anaerobic sludge bioprocessing (ASB) is explored for their applicability in waste stream processing. However, to kick start ASB, there is requirement of immobilized support or seed sludge from

methanogenic digester, which influence the mass transfer limitation. Thus, based on this, here the formation of acidogenic sludge granules (ASGs) with respect to mixed consortium was evaluated in the influence of calcium salts viz., CaCl 2. 2H 2 O in continuous stirred tank reactor (CSTR) operation with 10% glucose at 37°C. The hydrogen production was improved with Ca 2+ , with ~ 2 L/L; the acidogenic biomass production were higher at 400 mg/L of Ca 2+ . With respect to this, different organic loading rate were studied 0.05 to 0.3 h -1 , where the maximum production rate of 440 mL/L/h was observed at a μ max 0.25 h -1 . However, with the absence of Ca 2+ both hydrogen production rate and μ max was reduced to 360 mL/L/h and 0.2 h -1 , respectively. For the initiation of acidogenic granulation with the CSTR at 0.2 h -1 dilution rate with Ca 2+ for 118 th hour was opted where a pseudo steady state was achieved.

The cellular aggregates collected from the bottom of reactor, when observed with the microscopic snaps and imaging tools showed a higher distribution of flocs in Ca 2+ mediated system. Also, the size of acidogenic flocs attained a maximum of 1.4 to 1.6 mm at 118 th hour with the zeta potential of -16.2 mV. Moreover, enhanced extra polymeric substances were recorded with heightened protein and carbohydrate secretion with the presence of Ca 2+ . Also, microbial biomass was observed as 3.24 g MLSS/L with the ratio of MLVSS/MLSS, 0.74 g/g. Taken together, the calcium one of macro-elements at lower concentration, initiated a four-step rapid flocculation with granulation, adsorption, adhesion and multiplication of acidogens which enhanced hydrogen production. Thus, proposing a process design which simultaneously shortens the startup time and improves the ASGs quality which could be applied to acidogenic reactors for wastewater treatment plants in the near future.

Key words: dark fermentation, acidogenic sludge bioprocessing, Ca 2+ mediated system, rapid flocculation extra polymeric substances

Panel Discussion

Biomass Supply Chains: From Farm to Fuel

Moderator : Ming Zhao, Tsinghua University, China

Panelist : Rajesh Sundaresan, Carbon Impact Capital Pte. Ltd, Singapore

Panelist : Hans J. Hvide, Straits Bio-LNG Pte Ltd, Singapore

Panelist : Erik Vandenberg, Growth & Energy Transition Verbrec Ltd, Australia

Panelist : James Little, Little Consulting, Singapore Panelist

Aniq Ahsan, MOYA Analytics, Singapore

DAY–3 (VIRTUAL)

Keynote Talk

The Impact of Metabolomics Analysis on Bioenergy Research

Edward Baidoo, Lawrence Berkeley National Laboratory, USA

Abstract: Bioenergy research relies on a multi-disciplinary approach to developing the processes necessary to convert biomass, i.e. organic materials, into renewable energy sources such as fuel. This research involves feedstocks development, biomass deconstruction, and fuel synthesis. Metabolomics has become an integral part of these research areas as it enables the direct measurement of substrates from feedstocks, inhibitors and substrates from deconstructed biomass, and metabolic intermediates and products from fuel synthesis processes. This talk will cover the information gained from metabolomics analysis and its impact on bioenergy research. Additionally, recent advancements in metabolomics bioenergy research will be discussed.

Invited Talk

Growing Kelp in Alaska for Potential Biomass Production

Michael Stekoll, University of Alaska Fairbanks, USA

Abstarct: The mariculture of seaweeds is becoming increasingly popular in Alaska. With funds from the ARPA-E MARINER program, we tested different seaweed farm designs, seeding methods and harvest approaches for a scalable solution for the mariculture of *Saccharina latissima* (sugar kelp). Farm designs were based on catenary structures with or without the use of spreader bars with variable spacing of growlines. Initial results show that line spacing can be as short as 1 meter with no adverse effects on yield. There was no statistical difference in the growth of *Saccharina* whether in the middle or the outside of the array. Sagging caused by the weight of the mature fronds resulted in slower growth at depth. We also has some success with a two species idea, co-growing a kelp that hangs down with one that floats. We have experimented with several "direct seeding" methods – spraying or painting both gametophytes and embryonic sporophytes on several different substrates, including the growlines. Some success was demonstrated with the outplanting of directly seeded growlines. Our cooperating farmers tested various approaches for harvesting mature kelps. One innovation that has worked well is the use of large bags for holding the freshly harvested fronds. Although the weight of the fronds on the growlines causes the lines to sink, the bags packed with the harvested fronds float, allowing for easy loading onto the transfer vessel. Another advance in harvesting is a specially built harvest vessel, the *Kelp Buddy*, which was in operation for our last two seasons. We also employed a large seiner that was modified for harvesting the growlines.

Invited Talk

Liquid Chromatography and Mass Spectrometry Quantification of Nitrogenous Residues from Volatile Protic Amine Pretreatment of Lignocellulosic Biomass

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Abstarct: Amine-based biomass pretreatment has emerged as a highly effective approach for lignocellulose valorization, leveraging volatile protic amines (such as n-butylamine and dimethylamine) to selectively solubilize lignin via targeted ester cleavage and hydrogen bonding. However, establishing these processes at biorefinery scale requires a comprehensive analytical framework to evaluate pretreatment efficiency, monitor solvent recovery, and chemical transformations.

During pretreatment, residual solvents can remain in the biomass hydrolysates, and amines can react with lignin breakdown products to form stable nitrogenous byproducts, such as phenolic amide conjugates, which can subsequently inhibit downstream microbial fermentation.

To systematically address these challenges and support process optimization, we developed a high-throughput analytical platform using hydrophilic interaction liquid chromatography (HILIC) coupled with high-resolution mass spectrometry (HRMS) to analyze diverse hydrolysate matrices generated from poplar and sorghum biomass processing. The method enables the simultaneous detection, identification, and quantification of six volatile protic amine solvents and four amides, including N-butylacetamide and the phenolic amide conjugates N-butyl-4- hydroxybenzamide and N-butyl-p-coumarylamide, in a rapid 5.6-minute run time.

The analytical method demonstrated good linearity ($R^2 \geq 0.99$) for all analytes, and the linear range of amines was extended ten-fold up to 25 μM when the LC injection needle was held in the sample vial for 1.5 seconds after the sample was drawn, which ensured needle pressure equilibration for accurate sample injection. The method achieved high sensitivity, with LOD/LOQ of 3.58–263.26/11.92–877.53 nM for amines and 6.94–32.29/23.13–107.65 nM foramides.

By precisely quantifying both free residual amines and stable phenolic amide conjugates, this robust HILIC-HRMS platform serves as a vital tool to evaluate deconstruction efficiency, characterize lignin-ester cleavage mechanisms, and monitor fermentability, thereby guiding the design of efficient, closed-loop amine pretreatment systems.

Keywords: Amine-based pretreatment; hydrophilic interaction liquid chromatography (HILIC); high-resolution mass spectrometry (HRMS); residual amines; phenolic amides; deconstruction efficiency; biomass valorization.

Invited Talk

Novel Approach of Integrating Bioenergy for Sustainability and Productivity in the Dairy Industry

Jayant Keskar, Enpro Envirotech Pty Ltd, Australia

Abstarct : The dairy industry faces growing pressure to cut greenhouse gas (GHG) emissions, manage manure sustainably and reduce its exposure to volatile energy and fertiliser costs. This presentation describes an integrated bioenergy approach that turns dairy effluent from a liability into a set of linked revenue streams while improving on-farm productivity.

Using a 3,000-head dairy as the model case, anaerobic digestion of manure and effluent can generate about 9,000 MWh of electricity per year, about 292,000 m3 of liquid digestate, about 1.9 million m3 of carbon dioxide for beneficial use, and about 34,000 t of Australian Carbon Credit Units (ACCUs) per year. Together these provide diversified income and a strong business case for investment.

Sustainability benefits come from capturing methane that would otherwise be emitted, replacing fossil-based electricity, and reducing dependence on chemical fertilisers. Productivity gains come from applying the nutrient-rich digestate, combined with a Soil Rejuvenator, to fodder crops, which can lift production by about 15–24%. This also reduces reliance on external fertiliser supply chains and builds resilience, while the added income supports reinvestment in the business.

Allied solutions for improving sustainability and productivity in the dairy sector are discussed, including nutrient resilience, carbon utilisation and resource recovery options that complete the circular economy loop on farm. Similar integrated model can be adapted to other industries that produce organic residues and rely on energy and nutrient inputs, such as piggeries, poultry, food processing and agribusiness. It offers a practical pathway to a low-carbon, productive and circular rural economy.

Invited Talk

Beyond Green Energy: The Role of ESG Disclosure in Strengthening Transparency and Sustainable Value Creation in the Bioenergy Sector

Intan Salwani Mohamed, Universiti Teknologi MARA (UiTM), Malaysia

Abstarct: The increasing adoption of bioenergy and biofuels for low-carbon development emphasises the importance of responsible and sustainable business practices. As technological advancements drive growth in the renewable energy sector, concerns such as transparency, accountability, and stakeholder trust have become increasingly prominent. As a result, environmental, social, and governance (ESG) disclosures have become a crucial way for organisations to demonstrate their transparency and sustainability efforts. Greater transparency in practices boosts stakeholder trust and helps ensure the long-term stability of the bioenergy industry. Transparent ESG disclosures offer crucial insights for investors, regulators, customers, and communities, promoting responsible resource use and ethical choices. However, heightened scrutiny of greenwashing and the variety of reporting methods have sparked concerns about the reliability, uniformity, and overall credibility of sustainability data. Recent advances in digital technologies, artificial intelligence, and data analytics are opening new possibilities to improve the reliability and traceability of ESG- related information. These innovations are expected to strengthen governance systems and enhance the quality of sustainability reporting. A successful energy transition depends on more than scientific and technological breakthroughs; transparency, integrity, and responsible value creation are essential to ensure that the bioenergy industry provides sustainable economic, environmental, and social benefits for future generations. This study discusses the role of ESG disclosure in strengthening transparency and sustainable value creation in the bioenergy sector

Keywords: ESG disclosure, bioenergy, biofuels, transparency, sustainability, corporate governance.

Invited Talk

Unlocking Australia's SAF Potential: Feedstocks, Regulation and Pathways to APAC Markets

Miro Moss, Haskoning, Australia

Abstract: Sustainable aviation fuel will be essential to aviation decarbonisation, but its successful scale-up depends on more than production technology. Australia has significant potential to produce both bio-based SAF from agricultural residues, municipal waste and other sustainable feedstocks, and e-SAF using renewable hydrogen and eligible carbon sources. However, this potential has yet to translate into large-scale commercial production.

This presentation will examine Australia's emerging SAF opportunity, including available feedstock pathways, renewable-energy advantages and the evolving policy and funding landscape. It will also explore the key barriers facing project developers, including feedstock competition, production costs, sustainability certification, infrastructure requirements, policy uncertainty and the need for long-term airline offtake.

International frameworks such as CORSIA and ReFuelEU Aviation will be considered to illustrate how lifecycle-emissions requirements and certification rules can influence the design and market access of Australian SAF projects. The presentation will conclude by considering how cooperation between resource-rich producers such as Australia and major aviation hubs such as Singapore could support the development of a scalable regional SAF supply chain.

Invited Talk

Invited Talk: Integrating Electro-Assisted Anaerobic Digestion, Combined Heat and Power, and Thermal Energy Storage: Taiwan and Sweden Scenarios

Suraj Negi[1,2,], Jyi-Yong Chai[1], Elisalome Oyefusi[2], Aishwarya Rani[1,2], Justin N.-W. Chiu[2], Shu-Yuan Pan[1,3]*

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Abstarct: Anaerobic digestion (AD) converts organic waste into biogas, however biological variability, digester heat demand, and suboptimal combined heat and power (CHP) operation can limit energy recovery. Our Taiwan–Sweden collaboration therefore investigates an integrated pathway combining electro-assisted AD (e-AD), heat recovery, CHP, and thermal energy storage (TES). Food waste-based e-AD experiments compared conventional AD, an electrode control (0 V), and e-AD at 0.3, 0.6, and 0.9 V. Biogas, methane, chemical oxygen demand (COD), volatile fatty acids, kinetics, and electricity input were evaluated. In parallel, mass- and energy-balance modelling, annual TRNSYS simulation, and preliminary life-cycle assessment examined two-stage AD heat recovery, CHP–TES operation, phase-change-material (PCM) TES, and Sweden–Taiwan scenarios. The 0.6 V condition provided the best performance–energy balance. Inter-stage heat recovery reduced external heating demand by 29%. In the annual AD–CHP–TES model, TES supplied approximately 494 MWh yr^{-1} of digester heat, increased CHP electrical efficiency from 38.3% to 40.2%, and reduced fuel input from 1,610 to 1,535 MWh yr^{-1}. Preliminary assessment identified operational electricity, methane leakage, and storage-material performance as decisive variables. Coupling optimized e-AD with heat recovery and TES can improve waste-to-bioenergy conversion, CHP flexibility, and decarbonization potential. Experimental PCM validation and calibrated life-cycle and techno-economic assessment are the next steps toward scalable deployment.

Keywords: Circular economy; Biowaste valorization; Cost-benefit analysis; Climate change; Net-zero

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Invited Talk

Sustainable Cultivation of Microalgae Biomass for Bioenergy Production

Angela Paul Peter, Taylor's University, Malaysia

Abstract: As the demand for microalgae-based products increases in the market, there is also an urge for researchers to further investigate the cultivation process into large-scale mode in a more sustainable method. Although open pond cultivation is cost saving in terms of energy and materials, closed scale photo bioreactor, PBR has been developed as it has control over the growth conditions and contamination. Moving forward, the challenge in implementing PBR system in large scale is its operating cost that requires a large volume of culture medium as it is associated with modified chemical medium. Hence, in this study the discovery of alternate organic medium from industrial dairy waste powder is focused. Moreover, the research also focuses on the exploration into colour model analysis which is required for future studies in developing digital microalgae growth monitorization. Digitalizing the microalgae monitoring will be useful for engineers, researchers, and industrialist in moving forward the implementation of continuous PBR system. Overall, this thesis focuses on the implementation

of sustainable culture medium for the cultivation of Chlorella vulgaris and the implementation of machine learning and Internet of Things, IoT in microalgae growth monitoring to ease large scale development facilities.

Invited Talk

Microalgae Biotechnology: Deciphering Artificial Intelligence-Enabled Image-Based Digitalization of Microalgae Classification

Kuan Shiong Khoo, Yuan Ze University, Taiwan

Abstarct: This research develops an integrated artificial intelligence (AI) framework combining digital image processing, machine learning (ML), and deep learning (DL) to facilitate real-time classification of Chlorella vulgaris FSP-E, Spirulina platensis, and Chlamydomonas reinhardtii, together with the prediction of C-phycocyanin (CPC) concentration in Spirulina platensis. The findings across multiple studies demonstrate the potential of image-based AI models to serve as alternatives to conventional extraction-based analytical methods. Convolutional neural networks (CNNs) outperformed conventional ML approaches when classification relied exclusively on image features, highlighting the capability of DL for direct visual recognition of microalgal species. Conversely, Support Vector Machine (SVM) and Artificial Neural Network (ANN) models benefited from the incorporation of auxiliary cultivation parameters, including absorbance and cultivation time, indicating that multimodal data integration can further enhance predictive performance.

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