3RD EDITION OF GLOBAL CONFERENCE ON

BIOFUELS & BIOENERGY

INTERNATIONAL ENERGY FUTURE CONFERENCE

17-19

SEPTEMBER, 2026

NH Villa Carpegna

Via Pio IV, 6, 00165 Roma RM, Italy

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GLOBAL CONFERENCE ON

BIOFUELS & BIOENERGY

&

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HYBRID EVENT

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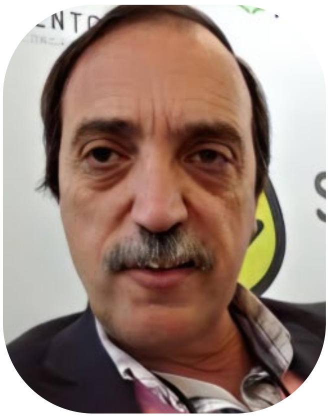
Keynote Speakers



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Vladimir Chigrinov
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Welcome Message

Alexey Mikhaylov

Financial University Under the Government of Russian Federation, Russia

Dear congress participants,

It is a distinct privilege to extend my warmest welcome to this esteemed gathering. As we convene to discuss the future of energy, it is clear that the intersection of innovation and sustainability has never been more critical. My research, presented here, rigorously explores the optimization of hybrid biomass and solar energy systems, integrating cutting-edge computational techniques like multi-objective genetic algorithms to evaluate the most efficient pathways.

Our comparative analyses reveal that not all biomass technologies are created equal. The results show that a pyrolysis-based system significantly outperforms its counterparts, offering a 17% reduction in the cost of energy compared to gasification and an impressive 38% reduction versus direct combustion. Beyond mere economics, these findings demonstrate substantial environmental benefits, with lower emissions and higher energy conversion efficiency. This work simplifies a complex decision-making landscape, providing a clear directive for researchers and policymakers alike. By conclusively demonstrating the superiority of pyrolysis in this hybrid context, we lay a foundational framework for more decisive and high-performing renewable energy systems, paving the way for a cleaner and more resilient energy future.

Thank you for your attention, and I look forward to our fruitful discussions.

Welcome Message

Arindam Chakraborty

Natures Principles, India

Dear congress visitors, it is an honour and pleasure to write a few welcome notes.

The bioplastics industry is currently undergoing a paradigm shift as we move away from food-based feedstocks that create unnecessary environmental and economic burdens. Through Mixed Culture Fermentation (MCF), we are introducing a decentralized, flexible alternative that utilizes 1G and 2G unrefined feedstocks, such as brewers' spent grain and agro-industrial residues.

This approach offers a competitive edge in the global market:

- **Operational Efficiency:** By bypassing energy-intensive sterilization and GMO strains, we significantly reduce production overhead.
- **Carbon Profitability:** Our technology reduces COemissions by ~50% compared to conventional lactic acid methods, offering a clear climate advantage over fossil-based plastics like PET and PP.
- **Circular Economics:** We are transitioning from linear to circular value chains, valorising low-grade waste streams to strengthen domestic bio-based sovereignty.

As the demand for polymer-grade lactic acid grows, achieving a cost-effective and scalable downstream process is the key to consistent success. Nature's Principles is committed to this trajectory, aiming for an annual production potential of 200 kton of PLA by 2035.

Organo-Transgenic Agriculture, integrated with advanced industrial fermentation, will be the future basis for success.

Welcome Message

Dai-YeunJeong

Asia Climate Change Education Center, South Korea

Dear Participants and Visitors of IEFC 2026 and Biofuels 2026,

It is an honor and pleasure to warmly welcome you to these important international conferences.

As we know, human civilization has been started to be transited from agricultural to industrial society from the 18th century. Industrialization is giving humans two conflicting faces. One is to improve material affluence, and the other is to pollute and/or destroy the original quality and structure of nature. The latter being termed environmental problem has emerged in the process of exceeding the carrying capacity of nature for the former in terms extracting natural resources and discharging human-induced wastes to nature. It is known that energy occupies about 80% among the total impacts of human activities as the cause arising environmental problem. Therefore, a lots of conferences on energy are organized with different profiles of energy at a domestic and international level.

In this context, IEFC 2026 provides a valuable platform to explore the future of energy through innovative technologies, efficient systems, sustainable utilization, and solutions to environmental challenges.

Biofuels further emphasizes the role of renewable energy in restoring nature and fostering harmonious coexistence between humans and the environment. In such sense, the theme of this conference, Biofuels and Bioenergy, is not merely confined to an agenda of technology-based sustainable energy, but an agenda of technology-based approach to achieving a society where nature and humans coexist through restoring the original quality of nature.

Through knowledge sharing and international collaboration, let us take meaningful steps toward a cleaner, more sustainable energy future.

I warmly welcome you all and look forward to your valuable contributions.

Welcome Message

Deinar Agudelo Ortiz
Natural Motos sas, Colombia

I am honored to participate in the International Energy Future Conference (IEFC 2026) in Rome. This event brings together global leaders, experts, and innovators committed to building a sustainable and inclusive energy future.

My keynote will highlight how productive small-scale mobility powered by CNG and LPG can accelerate the energy transition while generating social impact, economic opportunity, and cleaner cities - particularly in emerging economies.

I look forward to sharing insights, learning from fellow speakers, and contributing to meaningful dialogue on practical solutions that balance sustainability, energy security, and development.

I am confident that IEFC 2026 will inspire collaboration and concrete actions toward a

resilient, equitable, and low-carbon future for all.

Welcome Message

Delia Teresa Sponza
Dokuz Eylul University, Turkey

Dear meeting visitors,

It is an honor and pleasure to write some welcome sentences. Biofuels help reduce the carbon footprint of transportation and other industries, by making the most of our planet's carbon cycle. Every gallon of biofuel that replaces a gallon of fossil fuel helps reduce greenhouse-gas emissions. Biofuels work best when they make carbon reduction a priority, meaning the carbon intensity of the processes needed to make them and deliver them to market is recorded and carefully tracked.

Welcome Message

Enrico Paris

Council for Agricultural Research and Economics (CREA), Italy

Welcome to the 3rd Edition of the Global Conference on Biofuels and Bioenergy. At a time when global dialogue is being tested, science must act as a vital catalyst for unity and progress. We are gathered here to address the most crucial challenges of our era: the climate crisis and the urgent need for sustainable development models. No significant breakthrough in the field of bioenergy can be achieved without synergetic research that brings together the most brilliant minds from every nation. Therefore, I invite you to approach these days with a spirit of openness, exploring scientific fields beyond your usual expertise. The cross-pollination of ideas is the true engine of change. I wish you an inspiring conference, confident that the connections for ged here today will becomethe solutions of tomorrow. I wish you all a productive and successful event!

Welcome Message

Jorge Antonio Hilbert

Energy and Environmental Consulting Services,
Argentina

Dear colleagues, distinguished speakers, and members of the global bioenergy community,

It is a pleasure and an honor to welcome you to this new edition of the Global Conference on Biofuels & Bioenergy. We gather at a moment when the world urgently needs clarity, scientific rigor, and fairness in how we evaluate the sustainability of our energy systems. Few topics illustrate this need more clearly than the ongoing debate around indirect land use change, or iLUC.

For years, iLUC factors have shaped the environmental perception of biofuels, often through default values that are highly uncertain, model dependent, and disconnected from real production practices. In countries like Argentina—where producers invest heavily in sustainable agriculture, degraded land recovery, and efficient supply chains—these predetermined penalties fail to reflect reality. They create asymmetries, discourage innovation, and obscure the true environmental performance of biofuels that could meaningfully contribute to global decarbonization.

This conference offers an invaluable space to rethink these assumptions. By grounding our assessments in direct, verifiable data, and by acknowledging the diversity of agricultural systems worldwide, we can build sustainability frameworks that are both scientifically sound and globally equitable. The transition to low carbon fuels, including Sustainable Aviation Fuels, depends on our ability to align policy with evidence, and ambition with fairness.

I look forward to the discussions ahead, to the exchange of ideas, and to the collective effort to strengthen the scientific foundations of our sector. Together, we can transform complexity into opportunity and ensure that bioenergy continues to be a pillar of climate action, rural development, and technological progress.

Thank you, and welcome.

Welcome Message

Mustafa Ergin Şahin

Karadeniz Technical University, Turkey

Dear congress visitors,

It is an honor and pleasure to write a few welcome notes. Renewable energy and energy storage is very important and fast progress in last years. This opens new opportunities to adapt modern energy sources to climate change, to achieve higher productivity and to introduce intelligent, differentiated method. The important topic is instead of energy production related energy saving. The interruptible renewable energy sources made indispensable energy saving to be used every time.

There are more challenges to use and storage the renewable energy uninterruptible. Instead of energy saving the reserve the environmental and nature also important. The new technologies and methods are will investigate and succeed for micro grids and network in my speech.

Welcome Message

Sabine Rode
University of Lorraine, France

Dear congressvisitors,

I am pleased and honored to write a welcome note. Most current CO_2 emissionsoccur at at mospheric pressure. Rapidly and significantly reducing these emission is a major challenge for the near future, and carbon capture and storage is one of the key strategies for achieving this goal. Among the available capture technologies, chemical absorption in packedcolumnsis the most advanced and the one most of ten considered for industrial implementation. Physical absorption islessenergy-intensive, but due to hydrodynamicconstraints, it cannot be carried out at atmospheric pressure in gravity-drivendevices. Hollow-fiber membrane contactors (HFMCs) offer a promising alternative for overcomingthis obstacle, as they enablecarbon capture at atmospheric pressure throughphysical absorption, with energy consumption that can be reduced by a factor of threecompared to chemical absorption.

Welcome Message

Saim Memon

Sanyou London Pvt Ltd, United Kingdom

Dear colleagues,

It is a great pleasure to welcome you to the International Future Energy Conference 2026 in Rome, a city where history, culture and innovation meet. Over the three days from 17–19 September 2026, we will gather as researchers, industry leaders, policymakers and students to confront the central challenge of our time: delivering affordable, secure and sustainable energy systems at real scale. I hope this meeting becomes a space for honest interdisciplinary dialogue, where fundamental science, advanced engineering and market deployment are discussed together, not in isolation. Please use every session, corridor conversation and informal discussion to test ideas, build new partnerships and imagine practical pathways from laboratory to pilot to global rollout. I am confident that the insights and collaborations formed here in Rome will accelerate the transition to a cleaner, smarter and more resilient energy future for all.

Welcome Message

Professor Stanislaw Dzwigaj

Sorbonne University, France

Dear Conference Attendees,

It is my great pleasure to welcome you to the 3rd Edition of Global Conference on Biofuels and Bioenergy (Biofuels-2026). It is my honor and great pleasure to write a few welcome notes to you. Through centuries people were fascinated with the possibilities of synthesis of new materials with extraordinary properties. New materials are practically needed in all domains of life. Design and synthesis of new materials is one of the most important and interesting part of material sciences. Particularly a synthesis of new active and selective catalysts is a very important challenge. Our main aim concentrates on the new methods of the synthesis of single-site hierarchical porous zeolite catalysts with acid-base and redox properties. Such zeolite catalysts with active sites formed by incorporation of hetero elements in their framework are perspective of protection of environment and bio feedstock conversion into valuable chemicals. We look forward to your active participation and the meaningful discussions during Conference that will follow.

Welcome Message

Vladimir Chigrinov

Hong Kong University of Science and Technology, Hong Kong

Dear congress visitors,

It is an honor and pleasure to write a few welcome notes. Opto electronics and nanotechnology today make sun precedence progress, and Liquid crystal devices (LCD) are used in almost all electronic devices and information systems. This outstanding success was achieved mainly via an enthusiasm of physicists, chemists and engineers who not only studied unique properties of liquid crystals but also thought about their optimization providing technical privileges of liquid crystal devices. Photo alignment and photo patterning materials based on a zodyen ano layer scan be effectively used in LC alignment and patterning for new generations of LC devices that provide extremely high resolution and optical quality of alignment both in glass and plastic substrates, photonics holes etc. New liquid crystal photonics devices include optically rewritable E-paper, fields sequential color ferro electric liquid crystal {FLC) projectors, photo-patterned quantum rods and 100% polarizers, q-plates, sensors, switchable lenses, windows with voltage controllable transparency, security films, switchable antennas, light controlling elements in fibers, holographic displays. Iwish the Conference tobe a success.

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About Magnus Group

Magnus Group, a distinguished scientific event organizer, has been at the forefront of fostering knowledge exchange and collaboration since its inception in 2015. With a steadfast commitment to the ethos of Share, receive, grow, Magnus Group has successfully organized over 200 conferences spanning diverse fields, including Healthcare, Medical, Pharmaceutics, Chemistry, Nursing, Agriculture, and Plant Sciences.

The core philosophy of Magnus Group revolves around creating dynamic platforms that facilitate the exchange of cutting-edge research, insights, and innovations within the global scientific community. By bringing together experts, scholars, and professionals from various disciplines, Magnus Group cultivates an environment conducive to intellectual discourse, networking, and interdisciplinary collaboration.

Magnus Group's unwavering dedication to organizing impactful scientific events has positioned it as a key player in the global scientific community. By adhering to the motto of Share, receive, grow, Magnus Group continues to contribute significantly to the advancement of knowledge and the development of innovative solutions in various scientific domains

About
CPD Accreditation

Biofuels-IEFC 2026 is officially accredited for Continuing Professional Development (CPD) by the CPD Group (UK), a globally recognized provider of continuing education certification. CPD accreditation ensures that professionals continue to enhance their knowledge, skills, and competencies through structured learning activities.

At Biofuels-IEFC 2026, participants can earn **1 CPD credit for every hour of attendance** in conference sessions. These credits formally recognize the time spent in professional learning and support ongoing professional development across clinical, academic, and research fields.

Earning CPD credits demonstrates a commitment to maintaining high professional standards and staying updated with the latest developments in ophthalmology. CPD participation can also **support career advancement, license renewal requirements, and academic or professional portfolios,** depending on the policies of individual institutions or regulatory bodies. In addition to educational value, the conference provides opportunities to engage with experts, researchers, and peers from around the world, encouraging knowledge exchange and professional networking.

Attending Biofuels-IEFC 2026 not only offers a high-quality scientific learning experience but also provides internationally recognized CPD credits that reflect participants' dedication to continuous professional growth.

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KEYNOTE PRESENTATIONS

Alexey Mikhaylov

Financial University under the Government of the Russian Federation, Moscow, Russia

Biography: A research leader with 15+ years of academic and applied research management. Lead large-scale, multi-stakeholder initiatives — Head of 10+ funded research projects, managing teams of up to 15 researchers, budgets exceeding ₽15M per project, and cross-border collaborations (Russia, China, Brunei, UAE). Authored 200+ peer-reviewed publications on financial forecasting, AI, and energy markets; consistently ranked in Stanford's World's Top 2% Researchers (2020–now). Led a 3 year international research team (Russian Science Fund & BRFFR) — project Mathematical models and computer technologies of production and energy scheduling in conditions of economic uncertainty (2023–2025).

Comparative analyses and optimizations of hybrid biomass and solar energy systems based upon a variety of biomass technologies

The escalating global energy demand, coupled with the pressing need to mitigate climate change, has intensified the search for sustainable and economically viable power solutions. While fossil fuels have historically dominated the energy landscape, their finite supply and severe environmental repercussions—ranging from greenhouse gas emissions to ecological degradation—have necessitated a paradigm shift. Concurrently, the plummeting costs of renewable energy technologies have made hybrid systems increasingly attractive. Among these, the integration of solar photovoltaics (PV) with biomass conversion processes stands out as a particularly promising strategy, offering a synergistic approach that leverages the intermittent nature of solar power with the dispatchable reliability of biomass. This study rigorously evaluates the techno-economic and environmental performance of a PV/biomass Hybrid Renewable Energy System (HRES), specifically comparing three distinct biomass utilization pathways: pyrolysis, direct combustion, and gasification.

To optimize the complex interplay of components and objectives, the hybrid system is modeled using a Multi-Objective Genetic Algorithm (MOGA), a robust evolutionary computational technique capable of navigating a vast solution space to identify Pareto-optimal configurations. The selection of the most superior layout is governed by a balanced set of critical criteria: maximizing the fraction of renewable (green) energy generation, minimizing harmful emissions, and reducing both the Cost of Energy (COE) and the Net Present Cost (NPC) over the project's lifetime. The comparative analysis reveals a clear performance hierarchy. The system employing biomass pyrolysis significantly outperforms its counterparts. Specifically, the COE for the pyrolysis-based system is 17% lower than that of the gasification-based scenario (Scenario 1) and 38% lower than the direct combustion scenario (Scenario 2). Furthermore, the economic advantages extend to capital expenditure, with the pyrolysis configuration exhibiting a 17% and 65% reduction in NPC, alongside a 15% and 37.5% decrease in total system costs, respectively, compared to the same scenarios.

These findings underscore the distinct operational and economic benefits of pyrolysis, which produces valuable bio-oil and syngas with lower emissions and higher energy conversion efficiency than direct combustion or gasification for this specific application. By systematically comparing all essential aspects—from economic viability and emission profiles to energy yield—this research conclusively demonstrates that the HRES incorporating biomass pyrolysis emerges as the most cost-effective and environmentally preferable option. This insight is pivotal; it not only provides a clear directive for system designers but also contributes a foundational framework for future research. By identifying pyrolysis as the foremost biomass power production technology for hybridization, this study simplifies the complex decision-making process, enabling researchers and policymakers to more confidently design and deploy decisive, high-performing HRES that utilize biomass as a principal, sustainable energy source. Ultimately, this work advances the practical implementation of integrated renewable systems, paving the way for a cleaner and more resilient energy future.

Arindam Chakraborty

Nature's Principles, India

Biography: Arindam Chakraborty is the Vice President of India Operations at Nature's Principles, leading the strategic deployment of the company's lactic acid platform, focusing on scaling fermentation processes and agri-waste valorization. With nearly 20 years of experience, Chakraborty has become a key figure in India's bioenergy landscape, having previously held senior leadership roles at TKIL Industries (previously thyssenkrupp Industries India) and Mectech Process Engineers. Notably, at Fortum & Chempolis, Chakraborty spearheaded a first-of-its-kind bamboo-to-biofuel project from concept to commissioning. This career is built on a high-pedigree foundation in heavy engineering and EPC, including nearly a decade at Fluor Corporation and Engineers India Limited (EIL), managing multi-billion dollar energy and wastewater infrastructure projects. A Chemical Engineer and MBA, Chakraborty is dedicated to bridging the gap between traditional process engineering and the future of green molecules and decarbonization.

Mixed Culture Fermentation (MCF) for sustainable lactic acid production for Polylactic Acid (PLA)

This abstract outline an innovative approach to producing lactic acid for polylactic acid (PLA), addressing the limitations of conventional methods that rely on food-based feedstocks and create environmental burdens. Developed by Nature's Principles,

Mixed Culture Fermentation (MCF) offers a flexible, decentralized alternative that can use both first- and second-generation (1G and 2G) unrefined feedstocks, such as agro-industrial residues and brewers' spent grain. This method bypasses the issues of food competition and high costs associated with traditional production.

A key challenge is the Downstream Processing (DSP) of the complex fermentation broth, which contains variable concentrations of salts, colorants, and other organic acids. An inefficient DSP process risks negating the economic gains of low-cost fermentation. The success of this technology hinges on developing a cost-effective, sustainable, and scalable DSP that can consistently produce polymer-grade lactic acid.

This approach offers significant environmental and economic benefits:

Climate Impact: By utilizing its patented MCF technology, lactic acid production can reduce CO_2 emissions by ~50% (0.5 kg CO_2/ton) compared to conventional methods. This technology offers a significant climate advantage over fossil-based plastics like PET and PP, potentially saving 1.6-2.1 kg of CO_2 per kilogram of plastic produced. Over the next decade, two to three new lactic acid facilities in India could save an estimated 59,000 metric tons of CO_2 annually.

Resource Efficiency and Circularity: MCF's feedstock flexibility enables the valorization of low-grade agricultural waste streams that would otherwise be used for ethanol production. This supports a more circular and resilient bio-based economy by reducing reliance on high-grade refined sugars. The process also avoids the use of GMO strains and energy-intensive sterilization. Any gypsum produced as a byproduct is of high quality and suitable for reuse in building and agricultural industries. The final PLA product is biodegradable, decomposing within 6–24 months under industrial composting conditions, which helps to improve soil structure and reduce water contamination risks.

Economic and Societal Benefits: By using alternative biomass sources, the technology can make domestic lactic acid production in India profitably, reducing reliance on sugary feedstocks. This strengthens India's bio-based sovereignty and creates value from underutilized streams. The project also has the potential to create new revenue streams for operating companies and support job creation in the circular economy.

From Linear to Circular Value Chains: Our technology introduces a circular value chain for PLA where:

- Bio-based (2G) raw materials are used in production.
- CO_2 emissions are reduced to 99% L-lactic acid.
- Production and distribution chains are localized through integration.

The PLA and bioplastics market are rapidly growing addressable market that Nature's Principles is targeting with its MCF technology. Production of lactic acid based on Nature's Principles technology is estimated to reach 250 kilotons of lactic acid per year by 2035. With an output ratio of~1 ton of PLA per 1.2 tons of lactic acid, the annual potential for PLA production is 200 kton of PLA, resulting in the reduction of more than 100 kton of CO_2 emissions when compared to the production of fossil-based plastics and conventional plastics.

Dai-Yeun Jeong

Asia Climate Change Education Center, South Korea

Jeju National University, South Korea

Biography: Prof. and Dr. Dai-Yeun Jeong is presently the Director of Asia Climate Change Education Center and an emeritus professor of environmental sociology at Jeju National University in South Korea. Jeong received BA and MA degrees in sociology from Korea University (South Korea), and a PhD in environmental sociology from the University of Queensland (Australia), and was a professor of environmental sociology at Jeju National University (South Korea) from 1981 to 2012. Past major professional activities include a teaching professor at the University of Sheffield in UK, the president of Asia-Pacific Sociological Association, a delegate of the South Korean Government to the United Nations Framework Convention on Climate Change (UNFCCC) and OECD environmental meeting, and a member of the Presidential Commission on Sustainable Development Republic of Korea, etc. Jeong has published 60 environment-related research papers in domestic and international academic journals and 13 books including Environmental Sociology, and has conducted 100 unpublished environment-related research projects funded by domestic and international organizations.

Why should nature be conserved?

Nature can exist without humans, but humans can't survive without nature. In this sense, nature is a house where humans live, and we define nature as a human environment determining the existence mode of humans. This is the base of why the original quality and structure of nature should be conserved for both nature and humans.

Lots of activities are being carried out to conserve nature in the name of environmental policy, research and conference on environment, and environmental movement, etc. The theme of this conference, IEFC 2026, is also a technology-based means for conserving nature through reducing the impact of energy use on nature.

In the above context, this paper aims to explain why nature as a human environment should be conserved. In order to achieve the objective, this paper will be composed of three parts below.

Part 1: The terminology, environment, is used in many fields such as academy, government, industry, and even citizen in everyday life. Nonetheless, it has been quite rare to define the concept of environment. Therefore, Part 1 will explain what environment is. The explanation will be composed of firstlywhat concept is and secondly the kinds of concept. Based on the two, the concept of environment will be defined. Finally, environmental system which exists as an integrated reality being composed of many conceptual components of environment will be explained.

Part 2: The Mutual Relationship between Humans and Nature will be explained. The mutual relationship will be approached from two angles. One is how nature as a human environment determines the existence mode of humans, and the other is the mechanism of the original quality and structure of nature being polluted and destroyed by human activities.

Part 3: As the concluding remarks, Part 3 will examine and discuss two issues. One is the current status of nature as a human environment and the carrying capacity of nature. The other is to examine the two contradictory faces inherent in industrialization having improved material affluence and caused nature being polluted and destroyed.

Dai-Yeun Jeong

Asia Climate Change Education Center, South Korea

Jeju National University, South Korea

Biography: Dr. Dai-Yeun Jeong is presently the Director of Asia Climate Change Education Center and an emeritus professor of environmental sociology at Jeju National University in South Korea. Jeong received BA and MA degrees in sociology from Korea University (South Korea), and a PhD in environmental sociology from the University of Queensland (Australia), and was a professor of environmental sociology at Jeju National University (South Korea) from 1981 to 2012. Past major professional activities include a teaching professor at the University of Sheffield in UK, the president of Asia-Pacific Sociological Association, a delegate of the South Korean Government to the United Nations Framework Convention on Climate Change (UNFCCC) and OECD environmental meeting, and a member of the Presidential Commission on Sustainable Development Republic of Korea, etc. Jeong has published 60 environment-related research papers in domestic and international academic journals and 13 books including Environmental Sociology, and has conducted 100 unpublished environment-related research projects funded by domestic and international organizations.

Green management of enterprises as a response to climate change

Since industrialization was promoted in the 18th century, the enterprises focused on maximization of profit without considering nature being polluted and/or destructed in the process of resource extraction, production and distribution of goods and services. This is termed traditional management that has resulted in the enterprises to be a major contributor to environmental problems, in particular to climate change. However, the enterprises are in a paradox in that they are contributors to and victims of environmental problems. In order to solve the paradox, enterprises are inevitable to shift their management system from traditional to new one termed green management focusing on maximization of profit with imposing less ecological cost to nature for their survival through contributing to the reduction of environmental pollutions.

In such a context, this paper will present Green Management of Enterprises as a Response to Climate Change, covering the following themes.

1. Why should enterprise management be green? This theme will explain the mutual relationship between nature and the activity of enterprises, what has happened to nature by the activity of enterprises in relation to low eco-efficiency and high ecological cost, and the

mechanism of enterprises as a contributor to and the victim of environmental problems.

2. What is green management? This theme will explain the concept of green management, the necessity of green management for the sustainability of enterprises themselves, the promotion strategy of green management, the roles of government for vitalization of green management, and the benefits enterprise can get from green management.

3. What indicators should be used for evaluating green management? This theme will explain the definition of indicator, the roles of indicator in relation to green management, and green management indicators for measuring and assessing the state and level of green management.

Deinar Agudelo Ortiz

Natural Motos, Colombia

Biography: Deinar Agudelo Ortiz is a Senior Strategic Advisor in energy transition and sustainable mobility and CEO of Natural Motos in Colombia. With over 15 years of experience in the energy and transport sectors, Agudelo Ortiz has worked across technical, commercial, and strategic roles promoting cleaner mobility solutions. This expertise focuses on alternative fuels, productive transport systems, and inclusive energy strategies in Latin America. Agudelo Ortiz was recognized as Oil & Gas Woman of the Year 2025 at the She Is Global Forum for leadership in advancing sustainable mobility and energy solutions. This work emphasizes practical pathways toward a just and economically viable energy transition.

Inclusive energy transition through productive small-scale mobility: Natural gas and LPG solutions for two- and three-wheel transport

Across many developing regions, two- and three-wheel vehicles form the backbone of productive mobility, supporting millions of livelihoods through delivery services, passenger transport, and micro-entrepreneurship. However, these vehicles often rely on high-emission liquid fuels that impose significant economic burdens on low-income populations while contributing to urban pollution and climate challenges.

This keynote explores the role of Compressed Natural Gas (CNG) and LPG (Autogas) as practical transition fuels for small-scale transport systems, particularly motorcycles and three-wheel vehicles used as income-generating tools. Drawing from Latin American experience, the presentation analyzes how alternative gaseous fuels can simultaneously reduce greenhouse gas emissions, lower operating costs, improve air quality, and enhance energy affordability for vulnerable populations.

The discussion emphasizes the concept of an inclusive and just energy transition, highlighting how technological solutions must align with socioeconomic realities. By reducing fuel expenses and stabilizing operating costs, gas-powered mobility can increase productivity, support formalization of informal transport sectors, and contribute to poverty reduction through sustainable economic participation.

Furthermore, the presentation examines policy frameworks, infrastructure requirements, safety considerations, and scalability potential for expanding CNG and LPG adoption in small-vehicle fleets. Particular attention is given to the role of these fuels in strengthening energy security by diversifying transport energy sources while leveraging existing gas resources.

The keynote concludes that small-scale productive mobility represents a critical yet often overlooked pathway toward decarbonization. When supported by appropriate regulation, financing mechanisms, and technological innovation, gas-based solutions can serve as an immediate, cost-effective bridge toward cleaner transport systems while ensuring that no segment of society is left behind in the energy transition.

Delia Teresa Sponza*, Rukiye Öztekin

Dokuz Eylül University, Engineering Faculty, Environmental Engineering Dept, BUCA İZMİR, Turkey

Biography: Prof. Dr. Delia Teresa Sponza is currently working as a professor at Dokuz Eylül University, Department of Environmental Engineering. Scientific study topics are; Environmental engineering microbiology, Environmental engineering ecology, Treatment of fluidized bed and activated sludge systems, Nutrient removal, Activated sludge microbiology, Environmental health, Industrial toxicity and toxicity studies, The effect of heavy metals on microorganisms, Treatment of toxic compounds by anaerobic / aerobic sequential processes, Anaerobic treatment of organic chemicals that cause industrial toxicity and wastewater containing them, Anaerobic treatability of wastewater containing dyes, Treatment of antibiotics with anaerobic and aerobic sequential systems, Anaerobic and aerobic treatment of domestic organic wastes with different industrial treatment sludges, Treatment of polyaromatic compounds with bio-surfactants in anaerobic and aerobic environments, Treatment of petrochemical, Textile and olive processing industry wastewater by sonication, Treatment of olive processing industry wastewater with nanoparticles and the toxicity of nanoparticles. Delia has many international publications.

Biofuel production from waste plastics

The continuous rise in the global energy demand is coupled with increasing environmental pollution and greenhouse gas emissions. The need to minimize plastic waste accumulation has driven research into alternative and renewable fuel sources. Co-processing plastic waste and biomass through Hydrothermal Liquefaction (HTL) has emerged as a promising approach for biofuel production by leveraging the synergistic properties of these feedstocks. This review explores the potential of plastics and biomass for biofuel production, with a focus on recent advances in HTL techniques. The paper delves into the influences of various parameters, such as temperature, pressure, feedstock ratios, and the synergistic potential of combining various plastics with different biomass feedstocks on the bio-oil yield and quality. It also highlights the environmental and economic benefits of HTL, offering insights from life cycle assessments and techno-economic analyses. The review demonstrates that HTL not only unlocks new pathways for renewable energy but also offers an innovative strategy for managing plastic waste, paving the way for a circular and sustainable bio-economy. The integration of biomass and plastic waste through a HTL presents a promising avenue for sustainable biofuel production, addressing both energy demands and environmental concerns. Co-HTL of biomass and plastics leverages the unique properties of these two

distinct feedstocks to enhance bio-oil yields and improve the overall efficiency of biofuel production. HTL, which operates under high pressure and moderate temperatures, offers a versatile and effective means to process wet biomass and various plastic types, thus contributing to waste reduction and the generation of renewable energy. As studies have shown, the ratio of biomass to plastics, the reaction conditions, and the type of catalyst employed all significantly impact the efficiency of the process and the quality of the bio-oil produced. For instance, the synergistic effects observed when plastics such as PE and PP are combined with biomass lead to improved oil yields and higher heating values. This synergy is due to the complementary nature of biomass and plastic feedstocks, where plastics can act as hydrogen donors, promoting deoxygenation and enhancing the energy content of the resultant bio-oil. Moreover, the use of catalysts in the HTL process has been shown to further optimize the yield and quality of the bio-oil. However, current research indicates that the HTL of complex mixed systems is highly challenging, and it is difficult to explain the process clearly from a theoretical perspective. Additionally, current research on its techno-economic aspects remains limited, particularly concerning the co-HTL of biomass and plastics. Looking ahead, future research should focus on refining the co-HTL process to maximize its potential. This encompasses conducting more in-depth kinetic and mechanistic studies to elucidate the synergistic effects of plastic and biomass components in their co-HTL reactions. It also involves exploring novel catalysts, optimizing reaction conditions, and performing an LCA to comprehensively evaluate the environmental and economic impacts of biofuel production from mixed biomass and plastic feedstocks. Furthermore, additional research is necessary to investigate the long-term stability and scalability of HTL systems, especially in areas where the accumulation of plastic waste poses a considerable environmental challenge.

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Biography: Dr. Enrico Paris earned a Ph.D. cum laude in Energy and Environmental Engineering (2022) and an M.Sc. in Analytical Chemistry from Sapienza University of Rome. Since 2022, Paris has served as a Research Technologist at the LASER-B Laboratory, specializing in biomass thermochemical conversion. A member of the Italian Association of Chemists and Physicists, Paris qualified as an Associate Professor (07/C1) in 2024, actively manages national and EU research projects, serves as an editor and reviewer for international journals, and contributes to several scientific committees.

Hydrogen production from contaminated residual biomass: An integrated gasification and SEWGS process study

The restoration of heavy metal-contaminated soils through Plant-Assisted BioRemediation (PABR) represents a sustainable environmental strategy, yet it generates a significant secondary waste stream: contaminated biomass that requires specialized disposal. This study investigates an innovative and sustainable pathway for the energy conversion of such biomass into green hydrogen through an integrated thermochemical process, comparing the performance of contaminated poplar prunings with traditional, non-contaminated poplar samples. The research follows a multi-stage experimental approach, beginning with a comprehensive physicochemical characterization. Both biomass types were analyzed to assess their energy content, structural composition, and, specifically for the PABR-derived samples, the concentration of heavy metal pollutants accumulated during the phytoremediation process. The thermochemical conversion was performed in a 1.5 kW prototype fluidized bed gasification plant operating at temperature of 850°C. Atmospheric air was employed as the gasifying agent to evaluate the baseline composition of the resulting syngas, tar production, and residual ash quality. A key focus of the investigation is the fate of heavy metals during high-temperature gasification. Experimental results demonstrate that the thermochemical process effectively acts as a separation stage: a vast majority of the inorganic pollutants are confined and concentrated within the residual ash, significantly reducing the volume of hazardous material to be managed. Interestingly, the study highlights that the syngas obtained from contaminated poplar is qualitatively comparable to that produced from traditional residual biomass, showing no significant deviation in terms of

primary gaseous pollutants or Lower Heating Value (LHV). To further upgrade the gas quality, the syngas was processed in a Sorption-Enhanced Water Gas Shift (SEWGS) stage. In this phase, conducted at a controlled temperature of 300°C, carbon monoxide (CO) reacts with steam to produce hydrogen (H_2) and carbon dioxide (CO_2). The process utilizes a calcium oxide (CaO) adsorbent to perform in-situ CO_2 capture, shifting the thermodynamic equilibrium toward the products and allowing for the production of a high-purity, H_2-rich syngas stream. The primary objective of this research is to demonstrate a viable, circular economy route for the valorization of dirty biomass. By integrating gasification with SEWGS, the process not only ensures the safe management of heavy metals by concentrating them into a stabilized mineral residue but also promotes the generation of high-value energy carriers. This integrated approach transforms a remediation byproduct into a strategic resource for the hydrogen economy, providing a scalable solution for the dual challenge of soil decontamination and decarbonized energy production.

Jorge Antonio Hilbert

Energy and Environmental Consulting Services, Argentina

Biography: Jorge Hilbert is an Agronomical Engineer UBA, with a Master Degree in Farm Mechanization. Hilbert has been National Coordinator of the Bioenergy program (2006-2014) and director of the Rural Engineering Institute INTA (2001-2006), and is presently Director of Energy and Environmental Consulting. In the international area, Hilbert has been a participant of the biogas done right initiative, Co-chair of the biogas committee Global Methane Initiative EPA, and Steering committee member of the Pan American Biofuels and Bioenergy Sustainability Network (RCN). Author of seven books, 81 research papers and 218 articles, Hilbert has participated in several EU projects — Global Biopact, Babethanol, Babetreal5 and Dibicoo — and recently served as auditor, verifier and validator of carbon footprint studies at project, product and organization level.

Rethinking the iLUC factor in sustainable aviation fuels

Today, I present a critical analysis and proposal regarding the elimination of the Indirect Land Use Change (iLUC) factor in the environmental evaluation of Sustainable Aviation Fuels (SAF), with a particular focus on the Argentine context and global implications.

The iLUC factor has long been used to estimate the environmental impact of biofuels, penalizing or weighting certain crops based on assumed changes in land use. However, recent studies and industry experiences in Argentina have highlighted the arbitrary nature of the iLUC values employed by regulatory bodies such as CORCIA. These values are often applied without robust scientific evidence, leading to policies that are not only unilateral and discriminatory but also detrimental to exporters who strive for sustainability.

A detailed examination of the iLUC indicator reveals significant subjectivity. For example, default values for soybean oil biodiesel are typically set at around 75 gCO_2e/MJ. Some proposals suggest that, through advanced agricultural practices and the use of degraded lands, emissions could be reduced by up to 30%, reaching approximately 50 gCO_2e/MJ. Yet, these calculations are highly dependent on the models and historical data used, which vary widely across sources and timeframes. In Argentina, actual values considering production, logistics, and transformation are closer to 25 gCO_2e/MJ, underscoring the disproportionate nature of default assignments.

The core issue lies in the scientific imprecision of the iLUC factor. Its estimation relies on assumptions, market scenarios, and data sources that differ dramatically depending on the chosen model. This variability introduces a level of uncertainty so great that it becomes impossible to objectively distinguish between a biofuel free of iLUC and one with significant impacts. The lack of empirical data and the ongoing need for methodological adjustments mean that the iLUC indicator lacks a solid scientific foundation.

Exporters face an asymmetric position. Despite implementing sustainable practices and optimizing land use, they are forced to accept default iLUC values applied uniformly, regardless of their specific production chains. This results in adverse environmental ratings that may not reflect the true impact of their activities, imposing an unfair and undifferentiated burden that limits the competitiveness of potentially more sustainable products.

Given the absence of consistent empirical evidence and the high variability of results, this proposal advocates for the progressive elimination of iLUC indicators in biofuel environmental assessments. Instead, evaluations should be based on direct, verifiable data regarding land use changes. Such a shift would create a fairer framework, ensuring exporters are not penalized by predetermined values lacking scientific justification.

In summary, while various scenarios attempt to minimize iLUC-related emissions in biofuels, the evidence demonstrates that the models' variability and subjectivity prevent the indicator from being grounded in solid science. This perpetuates an asymmetric situation for exporters, who must accept default environmental impacts without the opportunity to prove their products' true sustainability. Therefore, it is imperative to eliminate these speculative indicators and focus on assessments rooted in direct, verifiable data.

Mustafa Ergin Şahin

Karadeniz Technical University, Turkey

Biography: Mustafa Ergin Şahin was born in 1978 in Trabzon, Turkey. Şahin received a B.Sc. degree in Electrical & Electronics Engineering from Karadeniz Technical University (KTU), an M.Sc. degree from Gazi University in Ankara and a Ph.D. degree from KTU, Trabzon, Turkey, in 2002, 2006 and 2014, respectively, and was a Guest Researcher with the TUBITAK 2219 postdoctoral research program at the Department of Energy Technology, Aalborg University, from September 2018 to September 2019. Şahin is currently an associate professor in the Electrical and Electronics Engineering Department at RTE University, has worked on different projects on low voltage power systems and relay manufacture for power systems, is an active reviewer for scientific journals in the field, and is also a member of the Chamber of Electrical Engineers in Turkey. Main research interests are power electronics and utilization of renewable energy, and Şahin is the author of two books in circuit analysis and measurement, electronics laboratory.

Micro grid of power electronics, renewable energy storage, and collaboration opportunities

In this invited keynote presentation general informations such as; description, types and advantages and disadvantages of microgrids will be given. Informations about renewable energy sources will be given also. Power electronic converters structure for microgrids are also investigated. Buck, boost, buck boost, bidirectional, back to back converter for microgrids and renewable energy applications are given with some simulation results and supported with some published papers. Control of power converters for microgrids are given for Proportional Integrated Derivative (PID), Sliding Mode Control (SMC), Fuzzy Logic Control (FLC). The energy storage process and new technologies in microgrids investigated. Battery, hydrogen energy, supercapacitor applications are investigated for hybrid storage technologies. An overview on related published papers investigated. Moreover the facilities and collaboration opportunities between the other universities and countries are given in this keynote presentation.

Sabine Rode*, Yakoub Laidani, Omran Abushammala, Jean-François Portha, Rainier Hreiz, Cécile Lemaitre

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Biography: Sabine Rode is a full professor at the Université de Lorraine (UL) in Nancy, France, teaching chemical engineering at the École nationale supérieure des industries chimiques (ENSIC). Rode's research, carried out at the Reactions and Process Engineering Laboratory of Nancy (LRGP), focuses on process intensification in multiphase systems in general, and on carbon capture using hollow-fibre membrane contactors in particular.

Carbon capture from flue gases and biogas at atmospheric pressure, existing technologies and development of an innovative technology based on physical absorption in membrane contactors

The majority of current CO_2 emissions occur at atmospheric pressure. Among the available capture technologies, chemical absorption combined with solvent regeneration in packed columns is the most advanced and the one most frequently considered for industrial deployment. Physical absorption is less energy intensive, but, due to hydrodynamic constraints, it cannot be carried out at atmospheric pressure in gravity-driven contactors. Hollow- Fibre Membrane Contactors (HFMCs) offer a promising alternative to packed columns for gas-liquid mass transfer. In HFMCs, the hollow-fibre membrane forms a physical barrier between the gas and liquid phases, enabling efficient mass transfer without direct contact between the phases. Gas and liquid flow as separate single-phase streams, eliminating reliance on gravity and avoiding operational issues such as foaming and flooding. Thanks to their high surface-area-to-volume ratio, modular design, and operational flexibility, HFMCs enable significant process intensification.

We have developed a new carbon capture process that operates at atmospheric pressure and uses physical solvents. This process utilises cylindrical cross-flow HFMCs for both the absorption and solvent regeneration stages. The specific energy consumption of this process is significantly lower than that required by chemical absorption. For example, with an inlet CO_2 mole fraction of 0.09 and a carbon capture efficiency of 0.9, the specific energy required is about 1 GJ per tonne of carbon captured, which is more than three times lower than the specific energy requirements of optimised chemical absorption plants. For an inlet CO_2 mole fraction of 0.22, the specific energy requirement is even lower, at only around 0.50 GJ per tonne of carbon captured. However, due to the low solubility of CO_2 in physical solvents, the volumetric flow rate of the liquid circulating in the process is high. The large specific surface area of HFMCs results in significant friction and, consequently, a potentially considerable pressure drop. The geometric optimisation of the dimensions and shape of fibre bundles is essential to ensure the viability of this technology. In order to handle gas flow rates relevant to industrial applications, a numbering-up strategy of fibre bundles is required. To meet this challenge, multi-bundle contactors – comprising fibre bundles arranged in parallel, each with an optimal shape – have been designed. 1D calculations, validated by 3D CFD simulations, show that this strategy is effective, confirming the potential of the carbon capture process that has been developed.

Saim Memon

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Biography: Professor Saim Memon is CEO and Industrial Professor of Renewable Energy Engineering, recognised for linking academic research, industrial innovation and global markets. Educated in the UK (PhD Loughborough; MSc Mechatronics; BEng Electrical Engineering), Memon is a Chartered Engineer, Fellow of the Higher Education Academy and holds UK Qualified Teacher Status. This multidisciplinary research in electrical, mechanical and renewable energy engineering places Memon in the top 1% worldwide in Energy (ScholarGPS), with 150+ publications, 2,400+ citations and h-index 28+. Memon has led research groups, degree programmes and schools, taught 40+ modules with >90% satisfaction, and given 100+ invited and keynote talks.

Energy performance of world's first vacuum insulated heatable curtain for realistic energy-loss reduction with mild radiant heating

Meeting urgent climate targets requires rapid, scalable reductions in operational energy use, yet traditional fibrous and polymeric insulation rarely achieves sub-0.20 $W{\cdot}m^{-2}{\cdot}K^{-1}$ U-values without excessive thickness, embodied-carbon penalties, installation complexity, or compromised fire safety. This work presents a harmonised portfolio of ultra-thin vacuum insulation technologies (VITs) advanced to TRL 7–9 and, within it, the world's first Vacuum Insulated Heatable Curtain (VIHC) as the main focus and key novelty. The portfolio includes 10–25 mm Vacuum Insulation Panels (VIPs), façade-integrated Decorative VIP (DVIP), 4 mm Vacuum Insulated Wallpaper (VIW), 7 mm Vacuum Insulated Curtains (VIC) and modular Vacuum Insulated Bag/Box (VIBB) systems, all based on evacuated porous cores (≤10 Pa) to suppress convective and gaseous conductive heat transfer. Fibreglass-core VIPs achieve thermal conductivities as low as 2.5 $mW{\cdot}m^{-1}{\cdot}K^{-1}$ ($U{\approx}0.16$ $W{\cdot}m^{-2}{\cdot}K^{-1}$), while 30 mm DVIP cassettes deliver $\lambda{\approx}7$ $mW{\cdot}m^{-1}{\cdot}K^{-1}$ with EN 13501-1 Class A1 fire rating and long-term stability. VIW retrofits reduce solid-brick wall U-values by up to 71% and lower modelled space-heating demand in London homes by about 30%, whereas VIC with 3 mm removable VIP inserts achieves whole-curtain conductivities of 13 $mW{\cdot}m^{-1}{\cdot}K^{-1}$ and around 23% coolingload savings in single-glazed Riyadh office scenarios. Building on VIC, the VIHC integrates low-wattage electrical heaters, consuming roughly 1 kWh per three-hour cycle, to deliver mild radiant warmth at the window perimeter without driving the main heating system into high duty. This combination of very low thermal transmittance and localised comfort control provides realistic, user-centric energy-loss reduction rather than purely theoretical savings. Life-cycle analysis across buildings and cold-chain logistics indicates that modular, shape-flexible VITs, exemplified by VIHC, can prevent approximately 15–60 kg $CO_2e \cdot m^{-2}$ over 25 years, corresponding to 20–90% abatement of end-use thermal energy waste, and therefore represent an immediately deployable pathway for demand-side decarbonisation.

Stanislaw Dzwigaj

Sorbonne Université, UMR 7197, Laboratoire de Réactivité de Surface, France

Biography: Professor Stanislaw Dzwigaj received a PhD degree in 1982 at the Jerzy Haber Institute of Catalysis and Surface Chemistry, Krakow (Poland). After two years of postdoctoral stay at the Laboratoire de Réactivité de Surface, Université P. et M. Curie (Paris), Dzwigaj obtained in 1990 a position of contracted researcher in the same laboratory, devoted to surface reactivity in relation to catalysis phenomena. In 2008, Dzwigaj obtained a permanent position in CNRS as a researcher. On February 19, 2014, for outstanding scientific achievements, Dzwigaj received the title of professor. The published work includes more than 170 papers in reputable international journals.

Application of vanadium and tantalum single-site zeolite catalysts in heterogeneous catalysis

The metal ions well dispersed at zeolite framework are considered to be active sites of catalytic processes. Therefore, the incorporation of these metals into zeolites as isolated tetrahedral sites appears to be the important task. We have earlier shown that the incorporation of transition metal ions into vacant T-atom sites of framework zeolite is strongly favored when, in the first step, zeolite is dealuminated by treatment with nitric acid solution and then, in the second step, the incorporation of transition metal ions results in the reaction between the cationic metal species of the precursor solution and the SiO-H groups of vacant T-atom sites created by dealumination of zeolite. During my keynote talk the design of single-site zeolite catalysts with transition metal will be described and characterized by different physical techniques both at the macroscopic (XRD, BET, TPR, TEM) and molecular level (FT-IR, NMR, DR UV-Vis, XPS, EPR, XAFS). The application of metal single-site zeolite catalysts in environmental catalysis will be discussed. This two-step postsynthesis method applied in this work allowed obtaining vanadium and tantalum single-site zeolite catalysts active in different catalytic processes such as oxidative dehydrogenation of propane into propene, selective catalytic reduction of NO_x to N_2, production of 1,3-butadiene from renewable sources, including ethanol obtained from biomass. Their catalytic activity strongly depended on the speciation and amount of vanadium or tantalum incorporated into zeolite structure as well as their acidity.

Vladimir G. Chigrinov

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Biography: Professor Vladimir G. Chigrinov has been Professor of Hong Kong University of Science and Technology since 1999, an Expert in Flat Panel Technology in Russia, recognized by the World Technology Evaluation Centre, 1994, and SID Fellow since 2008. Chigrinov is an author of 6 books, 31 reviews and book chapters, about 333 journal papers, more than 718 conference presentations, and 121 patents and patent applications including 50 US patents in the field of liquid crystals since 1974, received the Excellent Research Award of HKUST School of Engineering in 2012, and obtained the Gold Medal and The Best Award in the Invention & Innovation Awards 2014, hosted in Kuala Lumpur, Malaysia, on 20-22 Feb 2014. Chigrinov is a Member of the EU Academy of Sciences (EUAS) since July 2017, received A Slottow Owaki Prize of SID in 2018, worked from 2018 until 2020 as Professor in the School of Physics and Optoelectronics Engineering in Foshan University, Foshan, China, and since 2021 is a distinguished Fellow of the Institute of Data Science and Artificial Intelligence. An IETI Fellow since 2019, Chigrinov is Editor in Chief of the Liquid Crystal section in Crystals journal since 2023, and is Senior Researcher at Moscow University of Education, Professor at Peoples' Friendship University of Russia, and Emeritus Professor at Hong Kong University of Science and Technology.

Photoaligned azodye nanolayers: New trends for liquid crystal devices

Photoalignment and photopatterning has been proposed and studied for a long time. Light is responsible for the delivery of energy as well as phase and polarization information to materials systems. It was shown that photoalignment liquid crystals by azodye nanolayers could provide high quality alignment of molecules in a liquid crystal (LC) cell. Over the past years, a lot of improvements and variations of the photoalignment and photopatterning technology has been made for photonics applications. In particular, the application of this technology to active optical elements in optical signal processing and communications is currently a hot topic in photonics research. Sensors of external electric field, pressure and water and air velocity based on liquid crystal photonics devices can be very helpful for the indicators of the climate change.

We will demonstrate a physical model of photoalignment and photopatterning based on rotational diffusion in solid azodye nanolayers. We will also highlight the new applications of photoalignment and photopatterning in display and photonics such as: (i) fast high resolution

LC display devices, such as field sequential color ferroelectric LCD; (ii) LC sensors; (iii) LC lenses; (iv) LC E-paper devices, including electrically and optically rewritable LC E-paper; (v) photo induced semiconductor quantum rods alignment for new LC display applications; (vi) 100% polarizers based on photoalignment; (vii) LC smart windows based on photopatterned diffraction structures; (vii) LC antenna elements with a voltage controllable frequency.

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ORAL PRESENTATIONS

Adhwaith Das*, Shane McIntosh,
Dirk Erler, Andrew Rose
Southern Cross University, Australia

Enhancing biomethanation from anaerobic digestion using hydrochar

Anaerobic digestion is a well-established technology that recovers energy and nutrients from organic wastes. However, the effectiveness (and hence the economic viability) of biogas production depends strongly on the efficiency of biomethanation.

It is well known that the thermal carbonisation of organic materials can increase their digestibility to anaerobic organisms, and it has been suggested that hydrochar can enhance biomethane production during anaerobic digestion by acting as an electron shuttle to facilitate Direct Interspecies Electron Transfer (DIET) between the microorganisms involved.

In this study, we aim to better understand the fundamental role hydrochar could play in improving anaerobic digestion by exploring the relationship between the properties of hydrochar, microbial composition and biochemical processes that contribute to biomethane production. We hypothesise that the carbonaceous matrix of hydrochar can facilitate direct electron transfer through electrical conductance and provide capacitance through electron storage and release. Additionally, the highly porous surface of hydrochar possesses redox-active oxygen-containing functional groups that could facilitate electron donation and acceptance. Moreover, hydrochar could also provide a surface for microbial growth, thereby enhancing closer associations among them.

We aim to investigate the surface and electrochemical properties of hydrochars engineered with reinforcement materials, which can facilitate direct electron transfer between the microorganisms involved. It is anticipated that the outcomes from this study will aid in optimising biomethane production during anaerobic digestion, thus enabling a more significant recovery of energy from organic waste materials and contributing to a circular economy. This project will also contribute to achieving the Sustainable Development Goals (SDGs) adopted by the United Nations member states.

Biography

Adhwaith Das (AD) is a PhD student from Southern Cross University, Australia. This research focuses on recovering energy and nutrients from biomass residues, thereby achieving a micro-circular economic loop within the agriculture and livestock industry, utilising state-of-the-art techniques such as Hydrothermal Carbonisation (HTC) for hydrochar and hydrochar composite preparation and then applying them in Anaerobic Digestion (AD) to study how they enhance biomethane production. Apart from academics, Das has worked as an assistant quality control officer and a technical assistant at a commercial laboratory and factory, and is also active in recreational sports activities and organising cultural events.

Annarita Travaglino[1]*, Lucio Zaccariello[2]

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Co-gasification of coal, plastic waste, and wood in a fluidized bed reactor: Effect of operative conditions

Over the past decades, the global energy system has largely depended on fossil fuels to meet steadily increasing energy demand. This has had a negative impact on the environment, resulting in increased greenhouse gas emissions and a growing dependence on finite resources. A promising pathway is the development of an energy system based on the use of alternative feedstocks, enabling a reduction or shift away from high-emission fossil fuels and highly efficient and environmentally friendly energy technologies. In this contest, gasification, for producing an alternative gaseous fuel, is gaining increasing attention. Several thermochemical processes—such as hydrothermal carbonization/liquefaction, torrefaction, pyrolysis, gasification, and combustion—have been developed to convert alternative feedstocks into heat and power, energy carriers, and chemicals. Among these, gasification offers significant potential for recovering valuable products from a wide range of feedstocks, from clean fuel gas for energy applications to bulk chemicals. In particular, it enables the use of high-efficiency energy conversion devices, such as gas engines and gas turbines, thereby potentially achieving higher electrical efficiencies. Fluidized bed gasification is among the most promising technologies due to its high operational flexibility. The process can be carried out with different feedstocks, gasifying agents, reactor temperatures, and gas residence times; reagents can be introduced along the reactor freeboard, and operation is possible with or without catalytic bed materials.

In this study, the effects of the gasifying agent and bed material on the performance of the co-gasification of a mixture of coal, plastic waste, and wood were investigated. Experiments were conducted in a lab-scale bubbling fluidized bed reactor using air, oxygen-enriched air, an air/steam mixture, and an oxygen/carbon dioxide mixture as gasifying agents. Silica sand, olivine, and a mixture of olivine and dolomite were employed as bed materials. The results indicate that both the gasifying agent and the bed material strongly influence gas composition and, consequently, process performance. In particular, the use of oxygen-enriched air with silica sand yielded a producer gas with the highest heating value (9.32 MJ/Nm^3), whereas the best performance in terms of gas yield (2.98 Nm^3/kg) and tar reduction (–94.5%) was achieved using the air/steam mixture with olivine. Regarding tar composition, naphthalene compounds and Polycyclic Aromatic Hydrocarbons (PAHs) were identified as the most abundant and recalcitrant species. In contrast, phenols and furans were found to be the most sensitive to the effects of the gasifying agent and bed material.

Biography

Annarita Travaglino is a PhD student in Science and Engineering for the Environment and Sustainability at the University of Campania Luigi Vanvitelli. Travaglino's research focuses on thermochemical conversion processes, with particular interest in the gasification of biomass and waste materials. This doctoral research explores hydrogen production from sewage sludge gasification, with the aim of developing sustainable pathways for energy recovery and waste valorization, investigating the influence of operating conditions on process performance, gas composition, and by-product formation, and contributing to improved efficiency and environmental sustainability.

Arun K. Shandilya*, Anupam Shandilya

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Discovery of rare helium gas, in Proterozoic rocks of Vindhyan Super Group, South Ganga Basin, in Sagar district, M.P, India

The discovery of the rare gas helium in hydrocarbon rich zone has been done in the Garhakota and Rahatgarh tahsil, Meerkheri, Piparia-Bhutoli, Banda, Semra Lodhi, Ghoghra, Mandi Bamora, Kurwai, Kantara, and Bannad in Sagar District and Jabera, Mahalawar, Mariadoh, Hatta, Singrampur in Damoh Distt and Jhumata, Vumour, Hinota in Panna Disstt. in M.P., is a unique finding in the history of Earth Science in India. It is remarkable to note that values of helium contents varies from 0.34 % to 0.732 % along with the 72% to 99 % of methane and ethane, and minor amount of oxygen, nitrogen and CO_2 gases in the hydrocarbon rich zone are recorded during the geochemical and stable isotope analysis. It has been found in the stable isotope $\delta^{13}C$ value the values for the methane is -43.6 per mil w.r.t. to 54.9 per mil w.r.t. PDB and for the Ethane gas is --24.9 to -- 26.4 per mil w.r.t. PDB in the gas samples collected in the saturated sodium chloride solution in the glass bottles at Rahatgarh, Meerkheri, Piparia, Bhutoli villages in Sagar District. The occurrence of rare helium gas in the Hydrocarbon rich zone is reported first time in Jan, 2007 from the tubewells of Sagar Distt, which were geochemically and stable isotopically analyzed at KDMIPE Dehradun & NGRI Hyderabad.

The exploration of the Helium gas in the rocks of the Vindhyan Super Group around Sagar, South Ganga Basin, Bundelkhand region, M.P. is carried out in the detail with joint collaboration of Deptt. of Applied Geology and ONGC Energy Centre, Ahmadabad. As Author has already reported the Discovery of Helium has leakages through more than 50 tube wells/e wells excavated in agriculture fields various Villages in Sagar Distt. The geochemical analysis of the soil, gas and water indicates remarkable amount of Helium gas in these tube wells, containing about 0.45 to 0.735 and methane varying from 72 % to 99%. These investigations were done in the long research work (more then 25 years) dedication carried out in this area and research finding published in the Journal of National and International repute, which has attracted the officers/Scientists of ONGC, Dehradun, CGWB, Faridbad, Atomic Mineral Directorate Hyderabad and Bhabha Atomic Research Centre Mumbai.

The Result of the stable isotopic analysis of Ethane gas in these samples $\delta^{13}C$ value are ranging from -24.9 per mill w.r.t. PDB and -26.9 per mill w.r.t. PDB and the Methane gas are ranging from Isotopic Values -54.0 per mill w.r.t. PDB to -61.5 per mill w.r.t. PDB are indicative that this gas is of thermogenic origin, which must have been formed at very high temperature & pressure condition in the deeper horizon of the great Vindhyan sedimentary basin of late Proterozoic (>500m.y.) period. A reporting of leakages of above mentioned gas from 50 tubewells in the inliers of Vindhyan rocks and even in the Deccan trap rocks ensures that this area must be having a big gas reservoir within Vindhayn rocks around Sagar- Distt. in M.P.

The ONGC energy Centre Ahmadabad has started the detail collaborative geophysical work on the drilling exploration upto the depth of 600 m has been carried out and to be carried out in various location from where the leakages of has been earlier reported earlier. In these 600 m deep drill holes detail geophysical logging including the gamma ray logging and Neutron logging, lithological and structural logging will be carried out to know the probable gas reserve and at what depth the, we can get the gas for the exploration and utilization of these gases for industrial purpose and other uses etc. The detail geophysical studies will be very much helpful in the gas reserve calculation and the depth of the gas pockets in the South Ganga Basin in Bundelkhand region in M.P.

Keywords: Vindhyan Rocks, Petroleum Gas, Helium, Proterozoic, Stable Isotopic, Geochemically, Leakages, Thermogenic.

Biography

Prof. Arun Kumar Shandilya worked as Professor in Dr H.S.G University Sagar, having 44 years of experience in teaching, research and administration. Shandilya did doctoral research on Himalayan Tectonics, has published more than 85 research papers in journals of national and international repute, and supervised 8 students for Ph.D and more than 500 students for M.Tech/M.Sc dissertations on Himalayan Geology, Central India and Rajasthan Geology, Geology of Bundelkhand Tectonics, Satpura Tectonics, Coal Geology and impact of mining on the environment of manganese, coal, iron and marble mines, phosphorite mines etc. Shandilya has published a book, Geological and Environmental Processes, published by Springer Nature, and another book titled Peninsula Geology and Environment.

Ashraf Abdelrahim*

United Arab Emirates University, United Arab Emirates

Sustainable energy generation and materials recovery from urban wastes in the United Arab Emirates

Bioenergy is the largest source of renewable energy nowadays. Multitude of biomass feedstocks can be used to produce electricity, heating houses, biofuels for transportation, and supplying process heat for industrial facilities. Biomass residues and waste are potentially major contributors of resources for energy and material production. A range of such biomass feedstocks, including forest, agricultural, and animal residues, food and wood-based industry residues, and the organic component of municipal waste, can be utilized. Amongst all, this paper presents the local potential of energy production and materials recovery from urban waste, considering the amount of waste from two types of urban waste sources: Municipally Solid Waste (MSW) and sewage sludge. The potential urban waste source quantity was computed according to statistical reports and literature review. In United Arab Emirates (UAE), the per capita waste generation rate (1.9 kg/day) is among the highest worldwide. Thus, the UAE has the potential for utilizing MSW through Waste-To-Energy (WTE) projects. The adoption of waste-to-energy gives the UAE a chance to reduce climate change, diversify its energy mix, entice green investments, and valorize the waste that is always growing. Regarding the materials recovery, phosphorus can be recovered from manure and sewage sludge, while nutrient recovery has often been a key factor in sewage sludge treatment and utilization.

Biography

Ashraf Abdelrahim is an instructor in the Engineering Requirement Unit (ERU) at the College of Engineering, United Arab Emirates University, UAE. Abdelrahim obtained a PhD degree in Energy Science and Engineering from the University of Naples Parthenope, Italy, in 2020, majored in Mechanical Engineering, and received an MSc in Energy Engineering in 2012, both from the University of Khartoum, Sudan. These research interests include cleaner production, the transition to sustainable energy systems, as well as energy-efficient aviation industry practices. Abdelrahim served as a faculty member in the Aeronautical Engineering Department (Power/Airframe section) at Sudan University of Science and Technology, Sudan.

Beiyuan Liang

GeoImage LLC, San Francisco, CA 94118, USA

The first principle of microseismic monitoring

Microseismic monitoring has wide applications in the energy field. Any monitoring must first clarify the objective and its monitoring characteristics. The two important characteristics of microseismic are: tiny, and rupture with mainly shear dislocation mechanism. The monitoring characteristics obtained by the two features are: often the signal-to-noise ratio (S/N) is <1 from a few hundred meters away so that the traditional location fails; one dislocated hypocenter radiates longitudinal and transverse waves into space, and their amplitude and polarity change with different directions. This is the essence or first principle of micro seismic monitoring.

Thus we can find that many people: (1) Adhere to traditional relocation, such as relying on borehole proximity monitoring (BPM), sustain but effectively-limited denoising, or is at a loss, but fail to coexist with the residual noise after effective denoising, and implement data migration and stacking (DMS) to discover the microseismic information implied in the noise. (2) Simply use DMS, but the seismic wave vectors are not (correctly) extracted from the 3-component records, based on the far-field displacements generated by the shear force couple at a hypocenter, especially the shear wave vectors SV and SH with large amplitude, low frequency, and propagating far distance. And (3) ignore that the wave arrival amplitude and polarity at different receiving places are functions of the coming direction of a passive or natural earthquake, the stress-strain constitutive relationship in elastic mechanics, and the Anderson discussion in tectonic geology or rock mechanics, which should be used to guide the DMS and microseismicity interpretation, and which may be generally called as the equivalent microseismic focal mechanism.

These problems are evident in the detections of surface, BPM, mine safety, inversion for velocity models, and seismic precursors before destructive earthquakes. We take the research and development of Vector Stacking (VS) as an example, based on the characteristics of far-field microseismic monitoring, to illustrate how to solve the problems. In order to ensure the reliability of microseismic monitoring with high probability, and the establishment of expert systematic automation, many necessary conditions have to be followed.

VS greatly expands the distance range and improves the quality of microseismic monitoring. It can also unify data processing and interpretation of both S/N>1 and <1 using the spatiotemporal distribution of released energy. These have paved the way for microseismologists to develop microseismology, including microseismometry, study the microseismicity, and apply microseismic monitoring in the energy field and seismic disaster forecasting.

Biography

Beiyuan Liang, PhD, Technical Director of GeoImage LLC, mainly researches the theory and methods of microseismic monitoring. After more than 30 years of research, he has recently reviewed the current status, applicable conditions, testing, and prospects of various monitoring methods, including his self-developed Vector Stacking (VS). He clarified the key to successful microseismic monitoring: (1) recognizing extremely low signal-to-noise ratios and implementing VS extraction of microseismic information; (2) mainly using shear waves; and (3) employing shear rupture mechanisms to guide data processing and interpretation. This is the essence or first principle of microseismic monitoring. Based on this, microseismic monitoring can be broadly and reliably researched and applied in the energy field and destructive earthquake forecasting.

Bijendra Singh
Central University of Gujarat, India

Energy transition and the evolving role of oil and gas in achieving net zero emissions

The urgent global need to address climate change has intensified efforts toward a comprehensive energy transition, shifting from traditional fossil fuels to sustainable, low-carbon energy sources. This review paper critically examines the evolving role of the oil and gas sector in the quest to achieve net-zero greenhouse gas emissions by mid-century. While oil and gas remain foundational to the current global energy system, contributing significantly to energy security and economic growth, their environmental impact necessitates profound transformation. The paper explores key technological advancements, including Carbon Capture and Storage (CCS), Carbon Capture, Utilization, and Storage (CCUS), the development of blue and green hydrogen, and strategies to mitigate methane emissions. These innovations offer pathways to reduce the sector's carbon footprint substantially. Additionally, the review analyzes the influence of regulatory frameworks, carbon pricing mechanisms, and international climate commitments that drive industry and market adaptations. Investment trends toward decarbonization and diversification highlight the sector's shifting priorities. The challenges posed by infrastructure inertia, geopolitical factors, and economic dependencies are also addressed, emphasizing the complexity of the transition. Through detailed case studies and comparative analysis, the paper identifies best practices and potential risks. Ultimately, this review underscores that achieving net-zero goals will require a pragmatic, multidimensional approach that integrates technological innovation, effective policy support, and strategic business realignment. The oil and gas industry can contribute to a sustainable energy future by embracing this transformation while maintaining its critical role in the global energy landscape.

Keywords: Energy Transition, Net-Zero Emissions, Oil and Gas Sector, Decarbonization, Carbon pricing.

Biography

Dr. Bijendra Singh is a researcher known for work in the field of Photogalvanic Cells (PGCs), particularly in the context of solar energy conversion and photoelectrochemical cells. Singh has completed a PhD from Central University of Gujarat, India and M.Phil. from School of Chemical Sciences, Central University of Gujarat, India, and has published more than 30 papers in reputed journals & 22 International and national oral presentation. Singh's research focuses on photogalvanic cells, Synthesis and Biological Activities of Some Novel Spiro Heterocyclic Pyrrolizidine Derivatives, The Synthesis of Low Cost Zeolites From Coal Fly Ash Waste, Recovery of iron nanominerals from sacred incense sticks ash waste collected temple, Physico-chemical parameters apply for analysis of quality improvement of cosmetic product, Stick Powders for their Physical, Chemical and Mineralogical Properties. Biological Smart Materials Approach for Synthesis of Selenium Nanoparticles, In the nanozeolites-based oxygen concentrators and their application in respiratory disorders, Enhancing Plasmon Based Ag and Au Nanosystems with their improved Biomedical impacts. Physicochemical analysis of pt.et. extracted lycopene Study of Structural, chemical, and elemental properties on the ashes derived from the coal due to their combustion. Development of Novel Microcomposite Materials from Coal Fly Ash and Incense Sticks Ash Waste and Their Application for Remediation of Malachite Green Dye from Aqueous Solutions. Studies on improving the efficiency of photogalvanic systems using different dyes, surfactants, and redox mediators. Work explores the use of organic compounds and nanomaterials to enhance solar energy storage in photogalvanic cells. Focus on low-cost, efficient methods of solar energy harvesting for long-term utilization. Singh's research aims to contribute developing clean, renewable, and eco-friendly sources of energy with photoelectrochemical cells to enhancing solar energy conversion and storage capacity, Nano materials application for biomedical impact, water treatment, medicine and recovery of minerals from waste materials with environmental impact.

Chen Jun

Shahe Middle School, Chuzhou City, Anhui, China

Dissipative research and development of dissipative work $W=Q=CF^2t$ and gravitational field energy

What is energy?

In physics, if an object has the ability to do work, it possesses energy. Here, doing work refers to mechanical work=FS. With the current proposal of dissipative work $W=Q=CF^2t$, doing work can now include two different forms of work: mechanical work and dissipative work. a gravitational field is not a concrete object, it can do work on any object within it; therefore, the gravitational field possesses energy. Energy can be developed and utilized. The first of development is the well-known hydroelectric power generation, which utilizes $W=Fs=Gh=1/2mv^2$. The essence of hydroelectric power generation is not utilization of the so-called potential energy of water, but rather the development of gravitational field energy, with water serving merely as a medium. The essence of dissipative work is the effect of force, a natural phenomenon universally present in mechanical systems, where $Q=W=CF^2t$ and $P=CF^2$ is the heating power of the force. heating power is proportional to the square of the force, which provides a completely new approach to the research and development of gravitational field energy. By utilizing F=ps and the liquid pressure=ρgh, powerful pressure can be obtained to increase the heating power, and thermal energy can then be used to generate electricity. Two experimental devices will be introduced. For the equation state T=F(p, v), the experimental device serves as the test apparatus, showing that the new and old theories converge to the same conclusion.

Biography

Chen Jun, born in October 1962, graduated from the Department of Physics at Chuzhou University, taught at Shahe Middle School in Chuzhou City, and retired in October 2022. During the International Year of Physics in 2005, Chen Jun developed an interest in studying physics, and twenty years later, that understanding of dynamics has undergone a fundamental change.

Daria Botsula
University of Udine, Italy

Compact high-density gasifier for waste biomasses

Biomass gasifiers, as used during the Second World War, had many drawbacks, particularly the production of gas rich in tar. In recent decades, sophisticated multi-stage gasifier systems with complex filtration mechanisms have been developed to address these issues. However, these systems are highly complex and require high-quality fuels such as wood, making them unsuitable for processing waste biomass like hay or straw. Based on fundamental physics principles, we have developed a new and remarkably simple gasifier with a very high-power density. It can operate at lower temperatures, enabling the gasification of materials like straw and hay at 400–500°C without causing ash liquefaction or sintering. This innovation effectively produces what was once known as town gas from fast-growing biomass that would otherwise be discarded and decompose into CO_2, heat, and water. Since all types of biomasses contain approximately 40% (molecular) hydrogen, they serve as the most efficient and cost-effective hydrogen storage available. Our gasifier is designed to fully utilize this hydrogen storage, making biomass a practical and sustainable energy source.

In parallel, a Computational Fluid Dynamics (CFD) model of the gasifier was developed as a preliminary tool to support the experimental analysis. The model focuses on the description of flow behavior and overall biomass trends.

Biography

Daria Botsula is a PhD candidate at the University of Udine, Department of Physics, working in the field of Renewable Energy with a focus on biomass gasification. This research involves the experimental investigation and advanced CFD simulations of a compact high-density gasifier for waste biomass, combining reactor-scale studies with modeling. Botsula holds a Master's degree in Chemical Technology and Engineering from Lviv Polytechnic National

University, Ukraine, and during the master's studies was involved in the university-scale production of hydrogel alginate bandage for burn treatment. In the thesis research, Botsula performed a comprehensive process analysis and optimization of the drying stage, achieving a reduction in processing time from 48 hours to 1.5 hours.

Emile Braunthal Weisman
Groupe Heurtey, France

Current global warming can be understood when we know physics

Current global warming is not caused by any kind of greenhouse effect. Let's leave that myth to the governments and industrials that want to steer consumption toward other, more lucrative markets, and examine the issue from a purely scientific perspective. To that end, we need to understand how atoms work and how they interact with electromagnetic radiation.

1. The core of the earth as a source of heat: The Earth is a sphere, more than 99.5% of whose volume consists of magma with a temperature exceeding 1500 K. It is the movement of a portion of hotter magma beneath one ocean floor that is causing the current warming.

2. The greenhouse effect: All the components of the atmosphere have an equal greenhouse effect. The concentration of carbon dioxide in the atmosphere is governed by Dalton's law of partial pressures and is independent of the amounts produced.

3. The ozone layer: Atmospheric ozone is produced by the action of solar UV radiation on upper layers of oxygen. It is an everyday activity; ozone appears at day light and disappeared at night. The ozone hole is caused by its proximity to the point where the Earth's magnetic field meets the Sun's magnetic field.

Biography

E. Braunthal Weisman, born in November 1932, began working at the age of 16 as an electrician. Braunthal Weisman took evening classes and joined the Heurtey Group (Engineering and Industrial Furnaces) in 1960. For over 40 years, Braunthal Weisman worked as an Engineer on the design and construction of refining facilities for the petroleum and petrochemical industries. Upon retiring, Braunthal Weisman developed an interest in modern physics, and it was with an Engineer's meticulousness that these theories and challenges were studied. Braunthal Weisman is glad not to have been influenced by the prevailing views of today's physicists. His publications include Structure et Mécanique de l'atome, published by Editions Bénévent in 2009; Atomes et Matière, published by Iliade édition in 2010; Atoms and Matter, published by Iliade edition in 2010; Mécanique céleste et cosmologie, published by Iliade édition in 2010; Mechanics of Atoms, published in Science Journal of Physics in 2016; Speed of Propagation of Waves, published in Journal of Chemical and Physics in 2020. Dependance of Celestial Bodies Growth with Space Density, published by Medwin Publishers in 2022; Pseudocoulombic Force or Molecular Binding, published in Science Set Journal of Physics in 2023; Structure and Functioning of Atoms, published in Science Set Journal of Physics in 2023; Astres et Gravitation, published by Iliade édition in 2024; Stars and Gravitation, published by Iliade edition in 2025; Anti-Quantique, published by Iliade édition in 2025; and Anti-Quantum, published by Iliade edition in 2025.

Fatima El Hiri[1*], Zouhir Mansouri[1,2], Hajar Lamouadene[1], Abedellah El Kenz[1], Abdelilah Benyoussef[1,3], and Omar Mounkachi[1,2]

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[2]College of Computing, Mohammed VI Polytechnic University, 43150 Ben Guerir, Morocco 3Hassan II Academy of Science and Technology, Rabat, Morocco

Prediction of the energy barriers of Na diffusion in blue phosphorene: A DFT and machine learning approach

The development of high-performance anode materials for Sodium-Ion Batteries (SIBs) is crucial for advancing cost-effective and sustainable large-scale energy storage technologies. Among emerging two-dimensional materials, Blue Phosphorene (BluP) has attracted considerable attention due to its favorable lattice structure, large surface area, and high theoretical storage capacity. In this work, Density Functional Theory (DFT) calculations were employed to investigate the structural stability, sodium adsorption, electrochemical properties, and diffusion behavior of BluP. The results confirm the stability of the BluP structure and reveal that sodium preferentially adsorbs at the valley site, with a binding energy of −1.65 eV. An average open-circuit voltage of approximately 0.47 V versus Na^+/Na was obtained, supporting its potential application as an anode material for SIBs.

Since Na-ion mobility is strongly governed by migration energy barriers, this study further combines DFT calculations with Machine Learning (ML) to enable their efficient prediction. A dataset comprising 89 distinct sodium migration configurations and their corresponding energy barriers was generated using the Nudged Elastic Band (NEB) method. Several ML regression models were evaluated, with Leave-One-Out Cross-Validation (LOOCV) employed to assess model robustness. Among the investigated approaches, the Gradient Boosting Regressor (GB) exhibited the best predictive performance. Under LOOCV, the model achieved an R^2 of 0.884, RMSE of 0.068 eV, and MAE of 0.045 eV. For the independent test set, it maintained strong predictive accuracy, reaching an R^2 of 0.928, RMSE of 0.053 eV, and MAE of 0.045 eV. Overall, the proposed DFT–ML framework provides an efficient strategy for predicting ionmigration barriers while reducing the computational effort associated with extensive firstprinciples calculations, thereby facilitating the computational screening of promising electrode materials for next-generation SIBs.

Biography

Fatima El Hiri is a PhD researcher at the Faculty of Sciences, Mohammed V University in Rabat, Morocco. Her research focuses on computational modeling of advanced electrode materials for rechargeable lithium-ion and sodium-ion batteries. Her work combines Density Functional Theory (DFT), Kinetic Monte Carlo (KMC) simulations, and Machine Learning (ML) techniques to investigate ion adsorption, diffusion mechanisms, and transport properties in two-dimensional materials. Her current research particularly explores lithium diffusion on graphene and sodium diffusion on blue phosphorene, with the aim of understanding ion transport at the atomic scale and supporting the development of efficient electrode materials for next-generation rechargeable batteries.

Fazel Ziraksaz
Shahid Beheshti University, Tehran, Iran

The role of low-voltage, low-power architectures in enabling a sustainable energy future

The rapid pro life ration of portable electronic devices—from smartphones and tablets to laptops, IoT sensors, and wearable technologies—has made energy efficiency one of the most critical challenges of the 21st century. While global attention often focuses on power generation and large-scale energy infrastructure, a significant and growing portion of worldwide electricity consumption is actually driven by the billions of Integrated Circuits (ICs) operating in everyday devices. Each of these ICs consumes power, and collectively, they represent a substantial—and often overlooked—contributor to global energy demand and environmental pollution. With over 7.3 billion smartphone subscriptions projected by 2026, just one category of electronic devices, the potential for energy savings through optimized circuit design is immense.

This presentation explores the fundamental importance of low-voltage and low-power design techniques in electronic circuits and communication systems. Drawing on the author's recent book, Fundamentals of Low Voltage and Low Power Integrated Circuit Design, the talk will examine how reducing power consumption at the circuit level can have a multiplicative effect across the global electronics ecosystem. The presentation will briefly review key technological approaches to achieving low-power operation, including advancements in fabrication technologies, innovative circuit architectures, and dynamic voltage scaling strategies.

Beyond the technical aspects, this talk will address the broader implications of low-power design: extended battery life in portable devices, improved system reliability through reduced heat dissipation, lower cooling costs, and a meaningful reduction in the carbon footprint of the electronics industry. By bridging the gap between microelectronic circuit design and global energy sustainability, this presentation aims to demonstrate that energy-efficient electronics are not merely a technical convenience but a strategic necessity for a sustainable energy future.

The findings underscore that optimizing power consumption at the IC level is one of the most effective, yet underappreciated, pathways toward achieving global energy efficiency goals—aligning directly with the conference's themes of reliability, affordability, and sustainability.

Keywords: Low-Power Integrated Circuits, Energy Efficiency, Voltage Scaling, Sustainable Electronics, Power Consumption, Electronic Devices.

Biography

Fazel Ziraksaz is a Lecturer at Shahid Beheshti University, Tehran, Iran, specializing in low-voltage and low-power integrated circuit design, and energy-efficient electronics. Ziraksaz's research interests also include RF circuits, CMOS integrated circuits, power amplifiers, and modulators. Ziraksaz is the author of the book Fundamentals of Low Voltage and Low Power Integrated Circuit Design, has served as a keynote speaker, committee member, and reviewer for several international conferences, including the 3rd International Meet on Electronics and Electrical Engineering and CSAE 2025, and has been a member of the Iranian Microelectronics Association since 2019.

Harishchandra Singh

Amity Institute of Applied Sciences, Amity University, Noida, India

University of Oulu, Finland

Operando and in-situ characterisation of energy materials: Understanding dynamic processes in catalysis and hydrogen technologies

Energy materials rarely behave in steady-state — catalysts restructure under reaction conditions, electrode surfaces evolve during charge-discharge, and hydrogen storage materials undergo phase transitions invisible to post-mortem analysis. Understanding these dynamic processes is the prerequisite for designing systems that remain reliable and efficient across operational lifetimes, and operando and in situ characterisation methods have transformed this landscape by making it possible to observe structure-property relationships as they unfold. This talk presents an integrated framework built around synchrotron XAS/XANES/EXAFS, AP-XPS, and HE-XRD, applied across electrocatalysis, alkaline water electrolysis, and hydrogen carrier systems, enabled by purpose-designed in situ electrochemical cells that replicate realistic operating conditions of temperature, pressure, electrolyte composition, and applied potential.

Across several material systems, the talk demonstrates how these methods resolve questions static techniques cannot: oxidation state trajectories in Ni-Fe OER catalysts under applied overpotential; coordination environment changes in Mo-based HER electrocatalysts during hydrogen evolution; and reversible structural transitions in LOHC dehydrogenation catalysts across hydrogenation-dehydrogenation cycles. Practical aspects of cell design — window material selection, beam path geometry, electrolyte compatibility, and minimising X-ray-induced artefacts — are discussed as transferable guidelines accumulated across multiple beamtime campaigns at the Canadian Light Source, NSLS-II, APS, SSRL, MAX-IV, and INDUS-2. The talk closes with a forward look at multi-modal pipelines combining operando XAS with in situ Raman, impedance spectroscopy, and X-ray fluorescence to resolve increasingly complex degradation phenomena in next-generation electrochemical energy systems.

Biography

Dr. Harishchandra Singh is an ANRF Ramanujan Faculty Fellow at Amity University, Noida, India and Adjunct Professor (Docent) at University of Oulu, Finland. Singh's research focuses on the whole hydrogen value chain, including hydrogen production, storage, and utilization materials, as well as investigating underlying mechanisms using advanced multi-scale and multimodal synchrotron-based characterizations. Singh actively engages in fostering research collaborations between India and Finland, particularly around hydrogen technologies and green transition, and earned a Ph.D. in Physical Sciences from RRCAT/HBNI, India, followed by postdoctoral research at IIT Bombay (India), Stony Brook University (USA), and the University of Oulu (Finland).

Harishchandra Singh

Amity Institute of Applied Sciences, Amity University, Noida, India

University of Oulu, Finland

Breaking the energy-power trade-off for next-generation energy storage

Conventional energy storage architectures force a fundamental compromise: Batteries deliver high energy density but are limited in power output and cycle life, while supercapacitors offer rapid charge-discharge and exceptional durability but fall short on energy density. For next-generation applications — from grid buffering and EV fast-charging to wearable electronics and remote sensing — neither endpoint of this trade-off is adequate on its own. Bridging the gap demands a rethinking of device architecture, electrode materials, and electrolyte design simultaneously.

This talk presents a materials and device-level strategy for overcoming the energy-power trade-off through aqueous asymmetric hybrid supercapacitor technology. At the core of this approach is a fabric-based device architecture in which a faradaic positive electrode and a double-layer negative electrode are paired in an aqueous electrolyte system, enabling simultaneous exploitation of pseudocapacitive charge storage and high-rate electrostatic mechanisms. The electrode materials — including transition metal oxide composites and functionalised carbon frameworks — are engineered to maximise accessible surface area, ionic diffusion pathways, and redox-active site density.

The talk situates this work within the broader challenge of energy system integration — specifically, the need for a storage layer that can absorb intermittent renewable inputs and deliver them at demand-matched rates without degradation. The fabric-based form factor opens deployment pathways in building-integrated energy systems and distributed microgrids that are inaccessible to rigid cell formats. Collaborative development with industrial partners and the current device status at TRL 4 are outlined, along with the roadmap toward prototype validation and scale-up under ongoing deep-tech startup activities.

Biography

Dr. Harishchandra Singh is an ANRF Ramanujan Faculty Fellow at Amity University, Noida, India and Adjunct Professor (Docent) at University of Oulu, Finland. Singh's research focuses on the whole hydrogen value chain, including hydrogen production, storage, and utilization materials, as well as investigating underlying mechanisms using advanced multi-scale and multimodal synchrotron-based characterizations. Singh actively engages in fostering research collaborations between India and Finland, particularly around hydrogen technologies and green transition, and earned a Ph.D. in Physical Sciences from RRCAT/HBNI, India, followed by postdoctoral research at IIT Bombay (India), Stony Brook University (USA), and the University of Oulu (Finland).

Imanuel Wustinger[1,2*], Robin Lamparter[1,3], Philipp Graefe[1], Hermann Hofbauer[2], Gerald Weber[1], Matthias Kuba[1,4]

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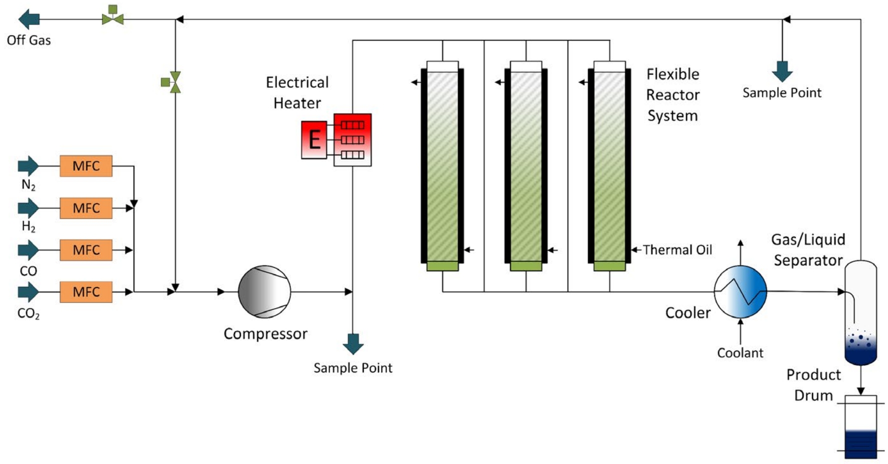
Commissioning of a lab-scale alcohol synthesis plant and first operation results using a Cu/ZnO/Al_2O_3 methanol synthesis catalyst

Broadening the research infrastructure of BEST – Bioenergy and Sustainable Technologies GmbH, a lab scale alcohol synthesis plant is being constructed at the Syngas Platform Vienna as of March 2026. The primary aim of the plant is to enable the investigation of the conversion of CO_2 to alcohols. Thereby, different catalysts can be used to yield either mainly methanol or mixed alcohols. To accommodate the harsh conditions of mixed alcohols synthesis, the plant has been designed for a maximum operating pressure of 200 barg and a maximum operating temperature of 300°C. As the plant includes a system to provide syngas mixtures of any desired ratio of H_2, CO, CO_2 as well as N_2 from gas bottles, a multitude of different experiments becomes feasible. Alternatively, it is even possible to feed syngas from actual gasifiers such as BEST's 1 MW dual fluidized bed gasifier into the alcohol synthesis plant. In order to further broaden the array of possible experiments, the plant is fit with a recycle and a flexible reactor system consisting of three individual fixed bed reactors that can be run in parallel or in series and provide intermediate sampling and measuring points while being tempered by thermal oil.

In the scope of the presented work, a commercial Cu/ZnO/Al_2O_3 methanol synthesis catalyst shall be used to commission the plant. Parameter variation experiments are intended, encompassing process parameters such as pressure, temperature, gas hourly space velocity and composition as well as recycle rate. Through this, baseline data for the plant shall be generated. The analysis of this data shall be presented together with lessons learned in course of commissioning.



Process Flow Diagram of the Alcohol Synthesis Plant

Biography

After finishing a master's degree in Chemical and Process Engineering at the Technical University of Vienna in 2021, Imanuel Wustinger worked on a multitude of different projects in the EPC field, including R&D projects. In the course of this, a passion for research intensified and led Wustinger to return to the Technical University of Vienna in 2024, now pursuing a PhD in cooperation with BEST – Bioenergy and Sustainable Technology. Wustinger's work there focuses on the utilization of CO_2 as a valuable resource in Fischer-Tropsch and mixed alcohol synthesis for the production of sustainable aviation fuels.

Jing Fu*, Amirhoushang Mahmoudi, Artur Pozarlik

University of Twente, Department of Thermal and Fluid Engineering, P.O. Box 217, 7500AE Enschede, the Netherlands

Non-woody biomass combustion in grate furnaces: Model optimization and parametric analysis

Grate combustion is widely used in biomass utilization due to its strong fuel adaptability. However, accurately modeling the conversion process is challenging due to the complex interactions between drying, pyrolysis, gasification, and char combustion. This study presents a one-dimensional numerical model that describes the conversion of non-woody biomass on a grate. Based on time and space discretization, the model comprehensively considers the conservation of mass, momentum, and energy, as well as the multistage conversion process of biomass in a moving grate-fired bed. This process includes moisture evaporation, volatile matter release, char gasification and combustion, and heat transfer mechanisms. The model also incorporates reaction kinetics and free-board radiation coupling effects to more accurately describe bed temperature distribution and the reaction process. The research focuses on the thermochemical conversion of non-woody biomass fuels in grate furnaces, emphasizing model optimization and sensitivity analysis.

Base on our previous models, this study introduces several improvements. In particular, the radiation model has been improved to account for radiation penetration within the fuel bed rather than being applied only at the top layer. This allows for a more realistic simulation of heat distribution between different layers. This improvement overcomes the limitations of the previous assumption that radiation occurs only in the top layer of the fuel bed, enhancing the accuracy of predicting the internal temperature distribution.

Additionally, a parametric study was conducted to investigate the impact of operating and fuel parameters on conversion behavior. Parameters such as fuel particle size, residence time, and radiation conditions were systematically varied to evaluate their influence on temperature changes, reaction rates, and overall combustion efficiency.

The results provide insight into radiative heat transfer and its impact on the distribution of temperature, moisture content, and char mass fraction along the grate. Additionally, the results of parametric study shows the impact of operating and fuel parameters on conversion behavior. The improved model enhances the accuracy of predicting biomass conversion behavior and can be used as a reference for optimizing operating conditions in future grate furnace applications.

Biography

Jing Fu is a Ph.D. candidate at the University of Twente in the Netherlands. This research focuses on the thermochemical conversion of biomass and the modelling and simulation of grate furnace systems, developing numerical models to investigate the complex interactions between heat transfer and chemical reactions during biomass combustion. Before pursuing the Ph.D., Jing Fu worked as a research assistant in Geneva, Switzerland, involved in the design of thermal systems, particularly radiators. Jing Fu holds a background in thermal engineering and is interested in improving the efficiency and sustainability of biomass combustion technologies.

Kaveh Moghanirahimi[1*], Richard Kempton[2], Valeriya Shulakova[2], Lionel Esteban[2], Stefan Iglauer[1], Alireza Keshavarz[1]

[1]School of Engineering, Edith Cowan University, Perth, Australia

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Experimental investigation of water-magnetite interactions: Implications for natural hydrogen generation and storage

Magnetite-bearing geological formations may serve as natural, low-carbon hydrogen (H_2) sources through water–rock reactions under anoxic conditions. However, H_2 generation is expected to alter mineral surfaces and mechanical properties, potentially affecting reservoir integrity. This study investigated how long-term hydrothermal brine exposure changes the surface morphology and mechanical behaviour of magnetite. Polished natural magnetite slabs were exposed to anoxic brine at 100°C and 100 bar for 60 days, and pre- and post-treatment samples were analyzed using nanoindentation to assess mechanical property changes. Results revealed significant mechanical stiffening following hydrothermal alteration. Mean Young's modulus increased threefold from 76.4 GPa (pre-treatment) to 218.5 GPa (post-treatment), with maximum values rising from 320.9 GPa to 483.3 GPa. Although these values differ from pure phase literature values, the systematic increase provides mechanical evidence for extensive magnetite-to-hematite transformation. These findings suggest that progressive mineral alteration during H_2 generation could substantially modify reservoir geomechanical properties, with implications for fracture development, permeability evolution, and long-term reservoir integrity in magnetite-hosted hydrogen systems.

Keywords: Magnetite, Nanoindentation, Hydrothermal Alteration, Geomechanical Properties, Natural Hydrogen.

Biography

Kaveh Moghanirahimi is a PhD candidate at Edith Cowan University in Perth, Western Australia, funded by CSIRO. Moghanirahimi's research explores natural hydrogen generation and storage in iron-rich minerals and rocks, combining hydrothermal experiments with advanced characterisation (XRD, SEM, BET and wettability testing). With several years of experience in reservoir geology, mining and petroleum laboratories in Iran, Moghanirahimi focuses on geochemical processes that support cleaner energy and carbon management, including CO_2 sequestration and mineral/fluid interactions.

Klaudia Łyzińska
Warsaw University of Technology, Płock Branch, Poland

Biofuels: From simple raw materials to advanced technologies

Biomass is a renewable source of energy that includes biodegradable matter of plant and animal origin, in which solar energy is stored through the process of photosynthesis. The process of producing biofuels from biomass involves a range of diverse conversion methods, which depend both on the type of feedstock used and the desired final product. There are three main groups of biofuels: solid, liquid and gaseous. Depending on the applied technology and the origin of raw materials, biofuels are classified into three main generations: first, second, and third. First-generation biofuels, also referred to as conventional biofuels, are produced from edible feedstocks such as sugar beet, corn, sugarcane, and starch-rich crops like potatoes, as well as from vegetable oils. These materials are primarily used to produce bioethanol and biodiesel. Second-generation biofuels are derived from non-edible feedstocks, including lignocellulosic biomass and various types of plant waste. Their key advantage is the lack of competition with food production, which makes them a more sustainable alternative. Third-generation biofuels include fuels obtained from microorganisms such as algae, which are characterized by high productivity and significant development potential. The production of biofuels from biomass plays an important role both environmentally and economically. It contributes to the reduction of greenhouse gas emissions, enables efficient waste management, and reduces dependence on fossil fuels. At the same time, it requires rational resource management in order to avoid negative environmental impacts and conflicts with food production. The aim of this work is to review new technologies used in the biofuel production process.

Biography

Klaudia Łyzińska is an assistant at the Institute of Chemistry, Faculty of Civil Engineering, Mechanics and Petrochemistry, Warsaw University of Technology, scientific discipline: chemical engineering. Łyzińska is co-author of a chapter in a monograph and has participated in the implementation of 3 research and development works, specializing in synthetic fuels and modification of road asphalts.

Lili Sun
Guangzhou Inspection, Testing, and Certification Group Co., Ltd.(GTTC), China

Rapid screening methods of harmful chemicals in textiles

The detection rate of harmful chemicals in textiles is usually less than 1%. However, the testing process consumes a large number of reagent and consumables, which produces a large amount of waste to pollute the environment. Moreover, the test period is long and the cost is high. This project focuses on the toxic and harmful chemicals in the national mandatory standard GB 18401-2010 National Basic Safety Technical Specifications for Textile Products, GB 31701-2015 Safety Technical Specifications for Infant and Children's Textile Products and GB/T 14272-2021 Down Clothing. We have developed a series of rapid screening methods and colored products for harmful substances such as formaldehyde, azo, lead, cadmium, APEO, and so on. The coloring product of formaldehyde is blue-green, which is easier to be distinguished than the yellow color presented in the existing standard. The coloring time is shortened from 1 h to 5 min. The detection limit is 20 mg/kg, which can meet the limited value requirements (75 mg/kg) specified in GB 18401-2010 National Basic Safety Technical Specifications for Textile Products. The coloring product of azo is yellow, which was added to the solution of aromatic amines after reduction of azo dyes. If the color of the sample solution changed, it may contain azo dyes. This rapid screening method of azo shortens the testing time from 1 day to 1.5 hours. The detection limit is 5 mg/kg, which meets the limited value requirements (20 mg/kg) specified in GB 18401-2010 National Basic Safety Technical Specifications for Textile Products. X-ray testing of Pb and Cd in textile coatings has been developed, which is non-destructive testing without digestion. The testing time was shortened from 1 day to 5 minutes. This method meets the limit value specified in GB 31701-2015 Safety and Technical Specifications for Infant and Children's Textile Products (the limit value of Pb is 90 mg/kg, and the limit value of Cd is 40 mg/kg). Besides the above methods, we also developed the chromogenic agent for the rapid detection of APEO and its detection limit could reach 20 mg/kg without using expensive equipment such as LC-MS/

MS. Moreover, we developed rapid detection chromogenic reagent for the rapid identification of down/polyester and silk/cotton. These rapid screening products can be used for internal quality control of large textile manufacturers, and form a supplementary verification scheme for existing standards to ensure the accuracy of the results. This presentation will elaborate on the developing process of these rapid screening methods. Moreover, it will provide the usage of the screening products and the advantage compared with the existing methods. In sum, our products are unique, which has not been reported all around the world.

Biography

Lili Sun was proficient in computer simulation research before joining a company in China. During doctoral studies, Sun studied chemical reaction mechanisms, thermochemistry, and optical properties using quantum chemistry. During postdoctoral studies, Sun studied the interaction of biomolecules using molecular dynamics simulation and umbrella sampling technique. After joining the company in China in 2020, Sun has been engaged in developing new methods for detecting harmful chemicals in textiles. Sun's research interests are molecular simulation and chemical analysis.

Lina Montuori*

Institute for Energy Engineering, Universitat Politècnica de València, Camino de Vera s/n, 46022 Valencia, Spain

From sewage to sustainability: Machine learning based predictive modelling of biogas production in energy-positive wastewater treatment plants

As demand for cleaner energy grows, wastewater-derived biogas provides cities with a scalable and affordable solution for sustainable energy. By turning waste into a useful resource, biogas serves as an environmentally friendly substitute for fossil fuels in multiple applications, such as electricity production or vehicle fuel, while supporting the circular economy.

Wastewater Treatment (WWT) plants require significant amounts of energy and are characterized by complex, nonlinear, and time-varying behaviour of biological and physicochemical processes. At a global scale, WWT energy consumption faces challenges in accurate quantification. Moreover, conventional Proportional–Integral–Derivative (PID) control systems, while historically reliable, struggle to cope with fluctuating influent characteristics, seasonal variability, operational disturbances, and multivariable process interactions. These limitations directly affect treatment performance, energy efficiency, and regulatory compliance.

Concurrently, the ongoing digitalization of WWT infrastructure, along with the integration of advanced technologies such as IoT devices, AI, and digital twins, is reshaping the water sector by improving monitoring, management, and decision-making transparency.

In this context, the present research article, developed within the PAID-06-25 project funded by the Vice-Rectorate for Research of the Universitat Politècnica de València (Spain), delves into the design and implementation of a machine learning–based tool to predict and model biogas production in energy-positive wastewater treatment plants. In line with this, WWTP energy demand has been characterized by evaluating emerging energy valorization techniques from waste and exploring the role of demand flexibility for the deployment of energy-positive wastewater treatment plants. Limitations and opportunities of the existing data-driven energy models for WWT have been identified, and their suitability for capturing nonlinear relationships, identifying hidden patterns, and learning system dynamics from historical and real-time data has been assessed.

A comprehensive modeling framework to disaggregate the energy demand of WWTPs by processes and end uses has been implemented using hybrid modeling approaches that combine mechanistic process knowledge with data-driven learning. This enhances model interpretability and robustness while promoting the transition of WWTPs toward energy-positive infrastructures aligned with circular economy principles.

Finally, the ML-predictive model has been validated using real operational data from wastewater treatment facilities located in Spain, evaluating different operational scenarios, including energy recovery from waste and strategies for exploiting electricity demand flexibility.

Results show the effectiveness of ML applications for forecasting influent loads, predicting effluent quality, optimizing aeration, reducing energy consumption, and enabling predictive maintenance. By adopting innovative strategies and utilizing emerging technologies, wastewater utilities can effectively exploit biogas production and reframe wastewater sludge as a valuable resource while improving energy efficiency, enhancing operational reliability, and supporting decision-making in WWTPs.
limit

Biography

Lina Montuori obtained a Ph.D. cum laude in Industrial Engineering and an MBA both from the Polytechnic University of Valencia (Spain). Previously, Montuori received a B.Sc. and M.Sc. cum laude in Industrial Engineering from the University of Naples Federico II (Italy), and then an Executive Master in Digital Marketing and Analytics from the Catholic University of Avila (Spain). Montuori worked at the Power Center for Utility Explorations of the State University at Buffalo (USA) and has more than 15 years as R&D Manager at international companies (Enel, Solaer Group, Toshiba Mitsubishi-Electric Industrial Corporation). At present, Montuori holds the position of Associate Professor at the Department of Applied Thermodynamics at the Polytechnic University of Valencia, and is a senior researcher at the Institute for Energy Engineering (IIE), Author and Editor with multiple and relevant publications in high-impact journals.

Lucio Zaccariello[1]*, Annarita Travaglino[2]

[1]University of Campania Luigi Vanvitelli, Department of Environmental, Biological and Pharmaceutical Sciences and Technologies, Italy

[2]University of Campania Luigi Vanvitelli, Department of Engineering, Italy

Biomass gasification in a 1.5 MWth fluidized bed reactor: A sustainable route for biofuel production

The production of syngas through biomass gasification has attracted considerable attention due to its potential to promote circularity, enhance sustainability, and address emerging needs, including those driven by socio-political events, to improve energy self-sufficiency.

Nonetheless, concerns arise when biomass is used as fuel to produce syngas, and they are mainly focused on the heterogeneous composition of these materials, which may negatively affect both the gasifier performance and the generation of undesired compounds, such as tar, condensable organic compounds produced along with syngas that are commonly not accepted in the devices for end-use application of the syngas. Proper selection of gasifier design and operating conditions, use of a catalyst during gasification, and cleaning of the syngas (e.g., by thermo-catalytic tar cracking or filtering) are means to address this issue. In this context, fluidised bed (FB) reactors are widely recognised as appropriate gasifiers, due to the very good mass and heat transfer coefficients provided by FB fluid dynamics, and to the possibility of controlling emissions through proper gasifier design and operating conditions.

This study investigated biomass gasification in a 1.5 MW_{th} bubbling fluidised bed demonstration plant, employing air or an air/steam mixture as the gasifying agent and olivine as the bed material. Gasification tests were conducted under autothermal conditions with a constant equivalence ratio of 0.30. The gasification products—including producer gas, elutriated particles, tar, and contaminant gases—were comprehensively characterised. The performance of the entire gasification plant and its individual process units was quantitatively assessed through material and energy flow analyses. Results demonstrated that steam addition enhanced producer gas quality by promoting the conversion of tar and char into permanent gases, thereby increasing the specific yield of producer gas, although the lower heating value and cold gas efficiency of the producer gas decreased slightly. Material flow analysis revealed that carbon conversion efficiency was primarily affected by carbon loss associated with solid particles collected by the cyclone. Energy flow analysis indicated that cold gas efficiency was significantly influenced by the energy required to convert the initial biomass into producer gas. The efficiency of biomass conversion into electrical energy was approximately 24%.

Biography

For the past two decades, Dr. Lucio Zaccariello has focused research on the development and optimization of thermochemical processes for converting biomass and waste into biofuels and biochemicals. This work has mainly addressed the technical aspects of fluidized-bed gasifiers using various feedstocks, in particular studying issues related to the design of both the reactor and the producer gas cleaning section, as well as aspects concerning energy production from the gasification of biomass and waste. Zaccariello's current work centres on the production of hydrogen from sewage sludge gasification and the development of selective carbonization reactors to obtain high-value-added carbonaceous materials.

Manuel Alcazar-Ortega*, Lina Montuori

Institute for Energy Engineering, Universitat Politècnica de València, Camino de Vera s/n, 46022 Valencia, Spain

District heating operators as demand aggregators in integrated energy systems

The increasing penetration of renewable energy sources is accelerating the transition towards highly integrated energy systems, where electricity, natural gas, district heating, water, and other energy vectors are increasingly interconnected. In this context, the operation of future energy systems will require a much more active participation of demand-side resources, which are expected to play a central role as providers of flexibility services to support system reliability, efficiency, and decarbonization. Harnessing demand-side flexibility is particularly relevant for facilitating the integration of variable renewable energy resources and addressing the operational challenges associated with their intermittency.

This paper investigates the role of district heating operators as natural demand aggregators within integrated energy systems. Due to their centralized management of thermal energy supply to a large number of end-users, district heating operators are uniquely positioned to aggregate, coordinate, and exploit distributed thermal flexibility. District heating networks supplied by centralized generation facilities using natural gas, biofuels, or other energy carriers can leverage the flexibility available at the consumer level to optimize fuel consumption while maintaining service quality and end-user comfort.

Furthermore, recent developments in information and communication technologies enable district heating operators to access real-time metering, monitoring, and remote management capabilities for connected consumers, thereby facilitating the implementation of advanced demand response strategies. The aggregated flexibility of district heating customers can provide valuable services not only to the gas system, by mitigating operational constraints and improving balancing capabilities, but also to interconnected infrastructures, particularly electricity systems. Therefore, district heating operators may become key flexibility providers and strategic actors in the operation and decarbonization of future integrated energy systems.

Biography

Dr. Alcázar-Ortega holds a PhD in Industrial Engineering (Polytechnic University of Valencia, UPV, Spain) and a PhD in Electrical Engineering (University of South Florida, USA). At present, Alcázar-Ortega is an Associate Professor and Deputy Director of the Department of Electrical Engineering at UPV, and was previously also a professor at the State University of New York at Buffalo (USA). Within the Institute for Energy Engineering at UPV, Alcázar-Ortega works on various lines of research related to the study of smart grids and microgrids, the characterization of energy consumer demand patterns, and the active participation of demand in energy markets.

Maren Pauly*
SGS Beta, United States

Carbon-14 analysis: An accurate verification method for verifying the biogenic carbon content of biomass-derived fuels

This presentation will explore the methodology and applications of biogenic carbon content measurement of biofuels via ASTM D6866 carbon-14 analysis. Analysis is performed using an Accelerator Mass Spectrometer (AMS) instrument. Bio-ethanol and biodiesel are processed using photosynthetic plants that contain the radioactive isotope carbon-14. The detection limit of carbon-14 analysis is approximately 43,500 years, making this method highly accurate and reliable for detecting and measuring carbon-14. Biofuels from fossil-derived sources will not contain any carbon-14 due to radioactive decay. The results of biogenic content testing reveal the fraction of biomass-derived versus fossil-fuel derived carbon in biofuels. Mixtures formulated with a fraction of biomass can be measured and verified accurately.

Biogenic content testing is recognized by biomass industry manufacturers, suppliers, and distributors as a reliable third-party verification tool for validating the biogenic carbon content of biofuel blends.

Refineries can also benefit from the precision of carbon-14 analysis to determine the ratio of their biofuel blends that originate from bio-oil as opposed to petroleum feedstocks.

Additionally, several industry regulations require ASTM D6866 biogenic carbon testing. For example, the Roundtable on Sustainable Biomaterials (RSB), Renewable Energy Directive (RED), and the Dutch Emissions Authority's Hydrotreated Vegetable Oil (HVO) Regulation recognize ASTM D6866 biogenic content testing results. In North America, the US EPA Renewable Fuel Standard (RFS), Canada's Clean Fuel Regulation (CFR), and the California Air

Resources Board Low Carbon Fuel Standard (LCFS) also accept carbon-14 analysis to validate the accuracy of biogenic content.

Biography

Maren Pauly is a natural scientist specialising in isotope geochemistry who undertook a PhD in Natural Sciences at the Freie Universität Berlin and previously completed a Master of Science and Bachelor of Science at the University of Waterloo in Canada. Pauly is currently working as a scientific associate at SGS Beta.

María Paz Sánchez Amono
CEVE (Experimental Center for Affordable Housing) AVE-CONICET, Córdoba, Argentina

Thermal performance of tiles roof based on recycled waste. Introduction to the National Housing Labeling Program (PRONEV) in Argentina

Currently, the amount of waste generated has a negative impact on the environment. The increased use of sustainable materials in the construction industry is due to a strong social awareness of environmental protection. This implies the development of methodologies that allow for alternative final disposal of waste. This research presents the construction component (roof tile) developed by the Experimental Center for Affordable Housing (CEVE) in collaboration with the CINTEMAC Institute (Center for Research, Development, and Transfer in Materials and Quality), part of the National Technological University, Regional Faculty of Córdoba. This component is applied to pitched roofs on a wooden structure. It is manufactured entirely from recycled materials derived from two types of industrial waste: plastics and end-of-life tires (ELTs). This roof tile is more resistant to bending, frost, and hail than traditional roof tiles, such as ceramic or concrete tiles, and is also lighter. Energy efficiency consists of achieving lower energy consumption for the same performance. Optical and thermal characteristics determine the thermal performance of materials. This paper presents the thermal conductivity and transmittance parameters, as well as some aspects of the optothermal properties (surface temperature, solar reflectance index, albedo, and thermal emissivity) of roofing tiles.

Biography

María Paz Sánchez Amono is a Researcher in the New Materials Area at the Experimental Center for Affordable Housing (AVE and CONICET), an architect (UCC) who holds a PhD in Materials Engineering (UTN-FRC) and is a Certified Energy Certifier (PRONEV) with a diploma in circular economy and sustainability strategies. Sánchez Amono is the author of book chapters and journal articles, has given scientific presentations in Argentina, Peru, Chile, Brazil, and Mexico, teaches undergraduate and graduate courses, supervises undergraduate and master's theses, and leads research projects. Sánchez Amono holds the patent for the Roof Tiles Based on Recycled Materials project, which won the Recircle Awards.

Michael Anjello Jothi Rajan

Aadhavan Educational and Research Trust,
Chennai-600040, Tamil Nadu, India

Ethics of energy equity and human security

Any new technology brings with it inherent benefits as well as more overt ethical concerns when it becomes operative in the society in the short or long run. The emergence of AI and Data Science require the maximum power consumed compared to the older technologies. Hence energy generation is an inevitable additional burden on the already existing grids under energy crisis. Energy generation supports economic growth and a higher standard of living. At the same time it also has financial and environmental costs. Energy equity focuses on fair distribution, ensuring low-income communities benefit from modern, renewable energy without disproportionate costs. Unlike traditional state-centric energy security, this approach ensures individuals have access to energy for health and livelihoods. Energy equity and human security are inextricably linked to the global shift toward sustainable, decentralized, and equitable energy systems that support, rather than exploit, local communities.

- How do we reconcile the disproportionate consumption of energy by developed countries with increasing demand for energy in developing countries?
- Is it fair for rich countries to encourage developing countries to limit their energy consumption and shun luxury lifestyles?
- What are the ways for developing countries to access the technology and expertise that permits more efficient energy generation in the developed world?
- At the social level, should governments provide concessions to make energy more affordable and accessible for lower-income people as a fair justice?
- Will subsidies for energy run the risk of subsidizing inefficient use of energy?

This presentation will explore the ethical aspects of the questions mentioned.

Biography

Michael Anjello Jothi Rajan, Ph.D., Doctorate in Physics, retired from active service on 31.05.2017 having worked as an Associate professor of Physics; Director, Bio-Nano Research Laboratory and Dean of Research and Project, and headed the Department of Foundation Courses for a period of 13 years in Arul Anandar College (Autonomous), Karumathur-625514, Tamil Nadu, India. Jothi Rajan put in a service of 8 years in Tamil Nadu Government PG School Education and 27 years in Higher Education in Tamil Nadu, and guided 8 Ph.D. Scholars in Physics. Jothi Rajan is on the editorial board and reviewer board for many national and international journals and serves as TAC member for multidisciplinary International Conferences related to cancer theranostics, served as the Project Consultant of the prestigious Tamil Nadu State Council for Science and Technology, Chennai, Tamil Nadu, India from December 2017 to December 2020, and served as Associate-Director for Anantharaman Applied Research Centre for Science & Technology Innovations for Villagers Livelihood Empowerment in Don Bosco College (Co-Ed.), Athanavur, Yelagiri Hill -635853, Tamil Nadu, India from December 2022 to July 2025. Jothi Rajan assisted Don Bosco College, Yelagiri Hills and Loyola College of Arts and Science, Mettala, Rasipuram Taluk, Tamil Nadu - 637407 for the first Assessment and Accreditation process for NAAC Bangalore to score A and B grades respectively, has received many awards for academic works as well as work for poverty alleviation, and has visited many countries to motivate youth in the field of Physics, Science Communication, Bioethics, Medical Ethics and Human rights. In that capacity till December 2020, Jothi Rajan generated funds worth of 16.00 Crores Indian Rupees (Approx. 17,93,600 US$) towards own projects and projects for Tamil Nadu State Council for Science and Technology, Chennai – 600025. At present Jothi Rajan serves as General Secretary for Aadhavan Educational and Research Trust, whose Trust has adopted one Women's College in an Island in Tamil Nadu and supports them academically.

Olam Mikail[1*], Karaca Hüseyin[1], Koyunoğlu Cemil[2], Soyhan H.Serhad[3], Coşkun Gökhan[3], Bulut Betül[4], Yaşar Fevzi[5]

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Monod-based kinetic evaluation of biogas production from food-waste-derived substrates

Biogas formation from organic wastes depends strongly on microbial growth, substrate availability and hydraulic retention time. This study evaluates the fermenter reaction kinetics of a food-waste-based biogas production system using a Monod-type kinetic approach. The kinetic model used a hydraulic retention time of 160 days, a maximum specific growth rate of 0.45 h-1, a half-saturation constant of 0.08 g/L, a gas yield of 0.35 mol biogas per gram biomass, a microbial cell concentration of 1.2 g/L and a substrate concentration of 0.5 g/L. Based on these inputs, the microbial growth rate was calculated as 0.38793 h-1 and the gas production rate as 0.16293 mol/h. These values indicate that the microbial activity is sufficient to support biogas formation, while further optimization of temperature, pH, nutrient balance and substrate loading may improve gas productivity. The resulting kinetic indicators provide a quantitative basis for designing the first stage of an integrated biogas-to-Bio-DME process. The Monod-based evaluation provides an initial quantitative framework for the fermenter stage of the Bio-DME process. The calculated kinetic values can be used to guide experimental operation and to connect biogas generation data with downstream syngas and DME production models.

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Biography

Mikail Olam received a PhD degree in mechanical engineering from Firat University in 2021. He has carried out a number of studies on the design and manufacture of pilot-scale systems for biofuel production, materials science, and fuels. He is an educator in the Ministry of National Education and a researcher in chemical engineering at Inonu University.

Olam Mikail[1*], Karaca Hüseyin[1], Koyunoğlu Cemil[2], Soyhan H.Serhad[3], Coşkun Gökhan[3], Bulut Betül[4], Yaşar Fevzi[5]

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Integrated process flowsheet and preliminary design for Bio-DME production from organic wastes

Organic wastes can be converted into renewable gaseous intermediates and high-value fuels through integrated biochemical and catalytic processing. This study presents a preliminary process flowsheet for converting food-waste-derived biogas into bio-dimethyl ether (Bio-DME). The proposed line includes anaerobic fermentation, gas cleaning, an R1 packed-bed reforming reactor, cooling and water removal, CO2 separation with recycle, a syngas storage tank, an R2 DME synthesis reactor, gas-liquid separation, distillation, and final DME storage. The biogas stream was represented as approximately 70% CH4 and 30% CO_2. The R1 design window involved CH4/CO_2 ratios of 1/1-3/1, CH4/H_2O ratios of 1/1-1/4, 500-900 degC, 10-50 bar, and 100-300 mL/min. The R2 reactor was evaluated at H_2/CO = 0.5-2, 200-350 degC, and 5-25 bar using bifunctional catalysts. The integrated configuration allows water and CO_2 management before DME synthesis and enables product purification by distillation. The proposed scheme provides a practical basis for laboratory and pilot-scale Bio-DME development.The integrated process scheme provides a complete engineering framework from waste conversion to purified Bio-DME. The inclusion of CO_2 separation and recycle, GC monitoring at reactor outlets, and distillation-based purification makes the system suitable for laboratory validation and pilot-scale development.

Acknowledgements: The authors would like to thank to Scientific and Technological Research Council of Turkey for financially supporting this project under grant number of TUBITAK-5240036, AYGAZ A.Ş. and Inonu University Scientific Research Projects Coordination Unit under project number FDP-2025-3854.

Biography

Mikail Olam received a PhD degree in mechanical engineering from Firat University in 2021. He has carried out a number of studies on the design and manufacture of pilot-scale systems for biofuel production, materials science, and fuels. He is an educator in the Ministry of National Education and a researcher in chemical engineering at Inonu University.

Mohsen Banaei*, Eghbal Hosseini, Ahlam Jameel, Konstantin Filonenko, Shahrzad M Pour, Razgar Ebrahimy

Technical University of Denmark, Department of Applied Mathematics and Computer Science, Copenhagen, Denmark

A multi-stage linear state estimation method for three-phase unbalanced distribution grids

This paper addresses the challenge of state estimation in distribution grids with limited observability and complex three-phase network behavior. Unlike transmission systems, distribution grids are characterized by sparse measurement infrastructure, unbalanced operation, and nonlinear three-phase power flow equations, which make accurate and computationally efficient state estimation difficult. To address these challenges, this paper proposes a novel iterative linear method for three-phase state estimation in distribution networks. The proposed approach performs state estimation using real-time measurements from a limited number of meters, installed at less than 10% of the network nodes, together with historical aggregated energy consumption data available at each node.

To enhance observability, a forecasting framework is first employed to estimate nodal active and reactive power consumption. The historical measurements are preprocessed through timestamp alignment, duplicate aggregation, and missing-data treatment using interpolation and forward/backward filling techniques. A multi-level ensemble learning model based on a voting regressor framework is then applied to generate 24-hour-ahead forecasts using weighted combinations of decision trees, random forests, and gradient-boosted models (XGBoost). The final forecasted time step is subsequently used for phase disaggregation and state estimation.

The proposed state estimation framework captures the complexity of the distribution grid through the development of sensitivity matrices that linearize the relationship between nodal power injections and voltage profiles. These matrices are incorporated into a linear optimization problem to estimate the system states efficiently. Since the sensitivity matrices

depend on the network operating point, a multi-stage iterative framework is introduced to update the matrices at each iteration and progressively improve the estimation accuracy.

The proposed method is validated on a real distribution test system using real-time measurements collected from a limited set of nodes. The framework estimates voltage magnitudes at unmeasured nodes, and its performance is evaluated using actual smart meter data. The results demonstrate that the proposed approach achieves high estimation accuracy despite the limited measurement availability and the nonlinear characteristics of three-phase distribution systems. In particular, the proposed estimator achieves a mean absolute voltage estimation error of less than 0.75 V across the evaluated scenarios.

The findings indicate that the proposed iterative linear state estimation framework provides an effective and computationally efficient solution for monitoring modern distribution grids with sparse measurements. The proposed approach offers a practical alternative to conventional nonlinear state estimation techniques while maintaining high accuracy, making it suitable for real-time applications in active distribution networks with high penetration of distributed energy resources.

Biography

Mohsen Banaei is a Tenure Track Researcher at the Technical University of Denmark (DTU), holding a Ph.D in power electrical engineering. Banaei's research interests are optimization, energy management, demand-side flexibility, and electricity markets.

Mustafa Ergin Şahin[1*], Soner Tokçalar[1], Yasin Karan[1], Berkan Emre İnce[2,3]

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PID control of the tension system for the helical wound superconducting cable production system

Energy efficiency, whose importance is increasing day by day for zero carbon emission, is prompting scientists to seek different solutions in this field. One of the most significant problems in this field is the losses in energy transmission, and superconducting cables are proposed to minimize these losses at high currents. Conductor on round core design for coated conductive tapes for low-temperature (-273°C) superconducting cable design is the most studied superconducting cable design today. One of the most important issues here is the adjustment of tension force and angle in these helical-wound cables and the proper winding of the cable.

This study aims to achieve accurate tension and angle control for helical cables using an automatic control method. A servo motor system employing a tensioning system and a laser measurement system for this aim. The literature was reviewed, and measurements were taken using the necessary experimental setups to obtain the best solution parameters. The system's transfer function was derived using the system parameters, and suitable Proportional Integrated Derivative (PID) parameters were obtained using the Routh-Hurwitz method for stability analysis. For this parameters the system stability checked with Bode and Nyquist plots. The system was simulated in MATLAB/Simulink to investigate its stable operation for different PID parameters and to determine by trying the best parameters for this system.

Biography

Mustafa Ergin Şahin was born in 1978 in Trabzon, Turkey. Şahin received a B.Sc. degree in Electrical & Electronics Engineering from Karadeniz Technical University (KTU), an M.Sc. degree from Gazi University in Ankara and a Ph.D. degree from KTU, Trabzon, Turkey, in 2002, 2006 and

2014, respectively, and was a Guest Researcher with the TUBITAK 2219 postdoctoral research program at the Department of Energy Technology, Aalborg University, from September 2018 to September 2019. Şahin is currently an associate professor in the Electrical and Electronics Engineering Department at RTE University, has worked on different projects on low voltage power systems and relay manufacture for power systems, is an active reviewer for scientific journals in the field, and is also a member of the Chamber of Electrical Engineers in Turkey. Main research interests are power electronics and utilization of renewable energy, and Şahin is the author of two books in circuit analysis and measurement, electronics laboratory.

Preeti Mehta Kakkar[1*], Dilip Singh[2], AS Mathur[2], Ravi K Gupta[2], DK Tuli2

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Two-stage fermentation for converting waste CO_2 into omega-3 fatty acids and biodiesel

This work introduces a novel two-stage continuous fermentation process for converting industrial waste CO_2 into omega-3 fatty acids and biodiesel. In the first anaerobic stage, bacteria convert CO_2 into acetic acid (~3%), which acts as an intermediate carbon source. In the second aerobic stage, a marine oleaginous microalga developed in our laboratory utilizes this acetate to produce biomass and lipids. The system achieved high productivity 80 g/L/day of biomass, 25 g/L/day of DHA and 40% lipid content in cell dry weight. Continuous biomass separation and liquid recycling enabled zero liquid discharge, enhancing process sustainability. By using CO_2-derived acetate instead of costly sugars, this integrated process offers a low-cost, eco-friendly and scalable route for producing high-value biofuels and nutraceuticals, contributing to carbon mitigation and circular bioeconomy development.

Keywords: Lipids, CO_2 Sequestration, Omega 3 Fatty Acids, Biomass.

Biography

Dr. Preeti Mehta Kakkar is an Assistant Professor at the Centre for Bioprocess and Biochemical Research, Amity University, Noida, India, currently working on an industry-funded project focused on lignin valorization to biogas, advancing sustainable bioconversion technologies for renewable energy production. Mehta Kakkar worked as research leader for more than 12 years at DBT-IOC, Indian Oil Corporation Limited, Faridabad, India, where the lab integrated gas fermentation with aerobic process and developed novel two-stage integrated pilot-scale bioprocess approaches for the production of green, sustainable biobased fuels and nutraceuticals, i.e. omega 3 fatty acids, carotenoids, antioxidants etc., using renewable bioresources such as waste raw materials, waste flue gas, algae, yeast, bacteria and protists, within the Circular Bioeconomy concept. The lab works closely with industries worldwide, and its R&D work is now ready for scale-up for demonstration. With this experience and background, Mehta Kakkar was privileged to work at international labs under the award of the prestigious Endeavour Post Doctoral by the Australian Government in 2018. Mehta Kakkar has 30+ publications in peer-reviewed journals with 6 granted international patents, and several awards/fellowships to credit.

Prince Kumar Barnwal*, Ravi Chandra Gurrala, Nageswara Rao Peela

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Engineering octahedral redox sites in $NiMn_xCo_{2-x}O_4$ spinel oxides for selective base-free aqueous phase 5-hydroxymethylfurfural oxidation to FDCA

Biomass-derived 5-hydroxymethylfurfural (HMF) is a key platform molecule for the sustainable production of 2,5-furandicarboxylic acid (FDCA), a promising renewable alternative to petroleum-derived terephthalic acid. However, efficient FDCA production commonly relies on noble-metal catalysts and alkaline additives, limiting industrial sustainability. In this study, a series of crystal-engineered spinel oxides, $NiMn_xCo_{2-x}O_4$ (x=0–2.0), were synthesized through controlled octahedral-site substitution to elucidate the structural and electronic descriptors governing HMF oxidation activity. Comprehensive characterization using XRD, Raman spectroscopy, FTIR, BET, FESEM, TEM, ICP-MS, and XPS revealed that Mn substitution significantly alters the redox properties and oxygen activation capability of the spinel lattice. Among the investigated catalysts, $NiMn_{1.0}Co_{1.0}O_4$ exhibited the optimum catalytic performance, achieving 96.4% HMF conversion and 72.1% FDCA yield under base-free aqueous conditions using molecular oxygen as the sole oxidant. The enhanced activity was attributed to a balanced Mn^{3+}/Mn^{4+} ratio (~0.91), which promotes efficient lattice oxygen participation and oxygen vacancy replenishment through synergistic Mn–Co redox cycling. Kinetic studies revealed that HMF oxidation proceeds predominantly through the HMF → DFF → FFCA → FDCA pathway, with FFCA oxidation representing the rate-determining step. Furthermore, ESI-MS analysis identified HMFCA-derived oligomers as major humin precursors responsible for carbon loss under prolonged reaction conditions. The catalyst demonstrated excellent structural stability and reusability over six consecutive cycles. This work establishes octahedral-site engineering as an effective strategy for designing earth-abundant spinel catalysts for sustainable biomass valorization and green production of FDCA.

Biography

Prince Kumar Barnwal is a Ph.D. candidate in the Department of Chemical Engineering at the Indian Institute of Technology Guwahati, India. This research focuses on biomass valorization, sustainable catalysis, biorefinery development, and process intensification to produce renewable chemicals, including the synthesis of 5-hydroxymethylfurfural (HMF), catalytic oxidation of HMF to 2,5-furandicarboxylic acid (FDCA), reaction engineering, and heterogeneous catalyst development. Barnwal has published research articles in reputed international journals and actively participates in national and international conferences related to sustainable chemical and energy technologies.

Rakesh Biswas
Iysert Energy Research Pvt Ltd, Rajasthan, India

Design and feasibility of a solar-wind hybrid self-sustaining underground capsule living accommodation for military applications

Modern defense logistics and tactical engineering require high-security, resilient, and independent habitats capable of enduring extreme geopolitical and environmental stress. Traditional surface-level military out posts are increasingly vulner able to advanced surveillance, ballistic threats, and extreme meteorological conditions. These abstract outlines the research conceptualized under the guidance of Rakesh Biswas at IYSERT Energy Research Pvt. Ltd. (Rajasthan, India), focusing on a Solar-Wind Hybrid Self-Sustaining Underground Capsule Living Accommodation designed specifically for high-risk and remote military applications.

The proposed accommodation utilizes a modular, prefabricated underground capsule architecture optimized for rapid deployment and structural resilience. Built using high-tensile composite polymers, reinforced concrete linings, and shock-absorbent geopolymer matrices, the capsule mitigates seismic shocks and kinetic impacts. The modular layout features concentric zones including core habitats (ergonomically designed living quarters, command-and-control decks, and medical bays), life support systems (ECLSS) featuring advanced atmospheric scrubbing, closed-loop greywater recycling, and solid-waste bio-digestion modules, as well as buffer zones providing acoustic insulation, thermal management layers, and Electro Magnetic Pulse (EMP) shielding to protect sensitive communication systems.

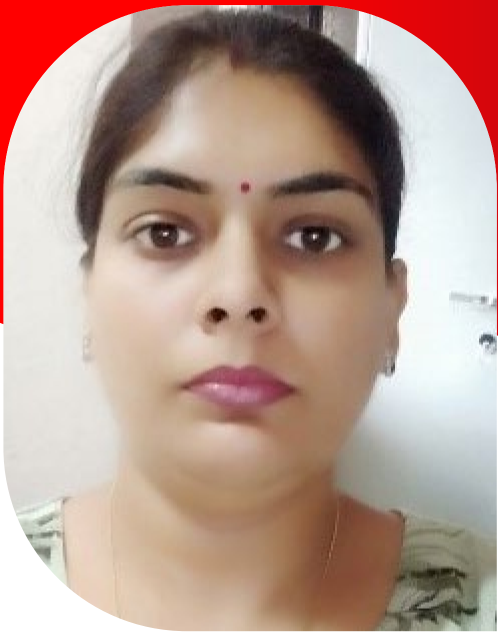
A primary engineering challenge of subsurface habitation is achieving complete energy independence without relying on vulnerable external fuel supply chains. This projectintegrates a dual-source Solar-Wind Hybrid Power Generation Grid. Surface-to-subsurface solar generation deploys photovoltaic arrays on surface masts to harness solar irradiance during operational windows, utilizing high-efficiency monocrystalline panels integrated with automated tracking and dust-clearing mechanisms suitable for arid or desert environments. Subterranean micro-wind harnessing utilizes compact, Vertical-Axis Wind Turbines (VAWTs) positioned on surface-penetrating ventilation shafts to capture localized kinetic airfow. Power harvested from these intermittent sources is managed by an intelligent microgrid architecture stored within high-capacity, deep-cycle lithium-iron-phosphate (LiFePO4) battery bank sand hydrogen fuel cellreserves, ensuring continuou sun interrupted base-load power for extended deployment cycles.

Thermal comfort and stealth capability are maintained through geothermal heat exchangers that utilize deep-earth stable temperatures to naturally precondition internal air. Thermodynamic modeling indicates that sub-surface placement drastically reduces active HVAC energy demands compared to surface structures. Operational feasibility assessments confirm that the closed-loop layout minimizes logistical resupply requirements by up to 85%, allowing military personnel to sustain multi-month operations autonomously. Furthermore, thermal and acoustic signature dampening ensures low observability againstenemy infrared and seismic detection systems.

Ultimately, the solar-wind hybrid self-sustaining underground capsule livingaccommodation presents a paradigm shift in military engineering and tactical defense infrastructure, offering a foolproof template for modern defense resilience in hostile terrains.

Biography

Rakesh Biswas is the Chairman of Iysert Energy Research Pvt Ltd located in Rajasthan, India, where he leads pioneering research and development in advanced renewable energy integration, sustainable architecture, and defense-oriented technological applications. Under his visionary leadership, the organization focuses on engineering robust off-grid power solutions and resilient modular habitats designed to operate autonomously in extreme environments. He is an innovator and advocate for bridging the gap between cutting-edge green technologies and critical tactical logistics to secure a self-sustaining future.



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Sustainable conversion of waste printed circuit boards into phenol-rich pyrolysis oil through catalytic upgrading and bromine removal

Waste printed circuit boards (WPCBs) represent a significant secondary resource of carbonaceous materials; however, their recycling is challenged by the presence of brominated flame retardants and toxic organic compounds. This study explores the catalytic valorization of metal-free WPCBs through pyrolysis using zeolitic and alkaline catalysts for the generation of high-value chemical products and cleaner pyrolysis oil. Fixed-bed catalytic pyrolysis experiments were performed using ZSM-5, $Ca(OH)_2$, and a combined catalytic system. The influence of catalysts on product distribution, oil composition, bromine removal, and reduction of undesirable oxygenated compounds was investigated using GC–MS, LC–MS, XRF, and physicochemical fuel characterization techniques. The incorporation of ZSM-5 enhanced selective aromatization and cracking reactions, increasing the phenolic fraction of pyrolysis oil from 54.44% to 72.08% while reducing undesirable heavy hydrocarbons and oxygen-containing compounds. $Ca(OH)_2$ exhibited effective bromine capture capability, achieving up to 69.79% bromine reduction, while the combined catalytic system further improved detoxification with 71.39% bromine removal along with reduced furan formation. The upgraded pyrolysis oils demonstrated improved fuel characteristics, including favorable viscosity and cetane number, indicating their potential for further refining into fuels and value-added chemicals. This work provides an integrated approach for sustainable WPCB management by combining waste minimization, hazardous component removal, and recovery of phenol-rich chemical resources within a circular economy framework.

Keywords: Catalytic Pyrolysis, Waste Valorization, Circular Economy, ZSM-5 Zeolite, $Ca(OH)_2$, Bromine Removal, Phenolic Compounds

Biography

Dr. Shina Gautam is an Associate Professor with expertise in environmental engineering, waste valorization, sustainable materials, and resource recovery. Her research focuses on the development of innovative technologies for waste management, including e-waste recycling, catalytic pyrolysis, metal recovery, biomass utilization, biodegradable polymers, and circular economy approaches. She has contributed to research on the recovery of valuable materials from waste electrical and electronic equipment (WEEE), lithium-ion batteries, and agricultural residues, with emphasis on sustainable process development and environmental protection. Dr. Gautam has published research articles in peer-reviewed international journals and has presented her work at national and international conferences. Her current research interests include catalytic conversion of waste into value-added products, recovery of critical and strategic metals, advanced recycling technologies, greenmanufacturing, and sustainable packaging materials. She is actively involved in interdisciplinary research collaborations and is committed to developing environmentally friendly technologies that support resource efficiency and a circular economy.

Silmara Furtado da Silva[1*], Maria Letícia Murta Valle[2]

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Navigating the sustainable aviation fuel landscape in Brazil: Resources, barriers, and policy pathways

Brazil's abundant biomass resources position the country as a potential cornerstone in the global effort to decarbonize aviation through Sustainable Aviation Fuel (SAF). This study provides a techno-economic and policy-focused assessment of Brazil's capacity to develop a large-scale SAF industry, crucial for meeting international climate obligations and domestic energy security goals. Our analysis confirms the availability of approximately 61 million metric tons per year of sugarcane straw and bagasse, alongside 21 million metric tons per year of wood processing residues. Utilizing the well-established Alcohol-to-Jet (ATJ) biochemical pathway, these feedstocks hold a theoretical production potential of up to 6.48 billion liters and 1.9 billion liters of SAF per year, respectively. When combined, this output could address a substantial portion of Brazil's current annual jet fuel consumption, estimated at approximately 9 billion liters, demonstrating a viable pathway toward near-complete domestic supply substitution.

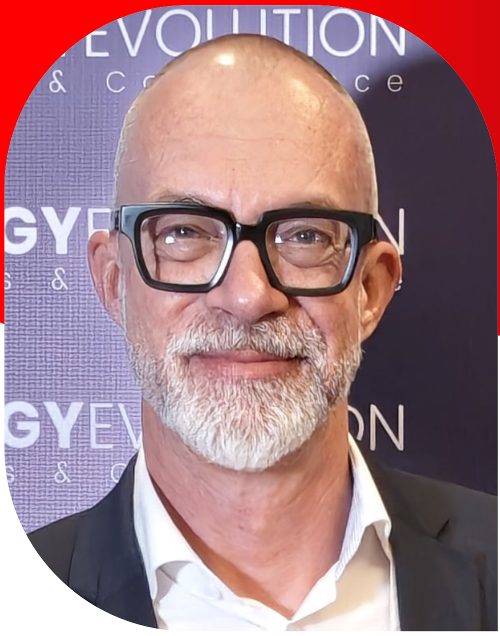
However, this significant potential remains unrealized. Currently, SAF represents less than 0.6% of global aviation fuel volumes, with its development in Brazil impeded by economic challenges. Current production costs for biomass-derived SAF via ATJ and related pathways are estimated at two to six times that of conventional fossil kerosene, influenced by feedstock logistics, capital-intensive biorefining, and certification expenses. This research employs a comprehensive policy analysis framework to examine the domestic regulatory environment, including the fuel certification specifications of ANP Resolution 856/2021 and the carbon credit mechanism under the RenovaBio program. We identify three systemic barriers: the lack of a specific, volumetric SAF blending mandate, which creates market uncertainty; a complex and multi-layered environmental licensing process that varies across states, delaying project deployment; and the high cost and time required for the ASTM D7566 certification of new production pathways, which stifles innovation.

Our findings indicate that overcoming these barriers requires an integrated policy strategy that moves beyond isolated incentives. We propose a coordinated governance model centered on the immediate implementation of a progressive national SAF blending mandate, starting at one percent by volume by 2028 and scaling to ten percent by 2035. This regulatory signal must be coupled with targeted fiscal instruments, such as production tax credits, low-interest financing via BNDES, and integration into the CBIOs market under RenovaBio with specific multipliers for aviation. Additionally, streamlining the environmental licensing into a unified federal process and establishing a national fund to subsidize ASTM certification for pioneering plants are identified as essential enabling steps.

The urgency for this policy framework is underscored by two converging timelines: the impending mandatory phase of the International Civil Aviation Organization's CORSIA scheme in 2027, which will impose carbon offsetting costs on Brazilian airlines, and Brazil's enhanced Nationally Determined Contribution commitment to reduce GHG emissions by 53.1% by 2030. Developing a domestic SAF industry is not merely an energy transition opportunity but a strategic imperative to maintain competitiveness in global aviation, attract green investment, and translate Brazil's bioenergy prowess into tangible climate action. This study concludes that without such a coherent and forceful policy package, Brazil risks forgoing a leadership role in the emerging global clean aviation economy.

Biography

Silmara Furtado da Silva is a PhD student in Chemical Engineering at the Pontifical Catholic University of Rio de Janeiro, where the research focuses on the catalytic conversion of bioethanol into olefins using process simulation and sustainability assessment. With experience in Petrobras R&D projects on fuel optimization and catalytic pathway design, Furtado da Silva is passionate about bridging academia and industry. Actively involved in STEM education, Furtado da Silva has coordinated Green Chemistry mentorship programs and contributes to diversity initiatives through LatinX in AI, and is also a recipient of multiple American Chemical Society awards for contributions to Green Chemistry and outreach.



Sven Van Elst
ASTER cv, Belgium

The energy transition will be social and inclusive, or it will not be

SAGE is an integrated, people-centred energy and housing model designed to accelerate Europe's sustainable transition by combining solar panels, home batteries, and heat pumps into one coherent, affordable system. As the document notes, most European homes are old, inefficient, and expensive to heat—yet the technologies to address this already exist. SAGE bridges this gap by bundling proven technologies with cooperative governance and long-term financing, making deep renovation accessible to households, social housing providers, and local communities.

Developed in Flanders by ASTER and already deployed in social housing, SAGE demonstrates that large-scale electrification and renovation can be delivered without overwhelming residents. The model reduces energy bills, improves comfort, and cuts emissions while addressing energy poverty and strengthening neighbourhood cohesion. Its modular, technology-agnostic design allows adaptation across diverse building types, climates, and regulatory environments, making it a practical blueprint for replication throughout Europe.

SAGE aligns closely with the European Green Deal, Fit for 55, the Renovation Wave, and the revised Energy Performance of Buildings Directive. Rather than introducing new policy, it operationalises existing EU ambitions at street level by integrating energy efficiency, electrification, and renewable generation into a single delivery model. Through system optimisation—coordinating PV generation, battery storage, and heat pump demand—SAGE supports grid stability and higher renewable penetration.

The model's social impact is central to its value. By lowering and stabilising energy costs, improving indoor comfort, and removing upfront investment barriers, SAGE provides a fair and inclusive pathway into the energy transition. Its cooperative structure enables shared ownership and collective decision-making, ensuring that economic benefits remain within communities. Local job creation, skills development, and support for SMEs further reinforce regional economic resilience.

Scalability is a defining feature of SAGE. Standardised technical packages, portfolio-based deployment, and streamlined procurement reduce transaction costs and enable rapid replication. Social and affordable housing portfolios serve as ideal launchpads, supported by EU and national funding instruments such as the Social Climate Fund, Cohesion Policy, and Recovery and Resilience Plans. Cities and regions can embed SAGE into one-stop shops, public-cooperative partnerships, and regional delivery vehicles, while EU-level technical assistance and green finance aggregation can accelerate continent-wide adoption.

By integrating technology, governance, and financing into a single, replicable system, SAGE offers a concrete pathway to decarbonise millions of European homes. It moves Europe beyond fragmented pilot projects toward a coordinated, just, and scalable transformation—home by home, neighbourhood by neighbourhood—powered by clean energy and shared benefits.

Biography

Sven Van Elst has been active in the Flemish social housing sector since 2011, first as a staff member and from 2017 until 2022 as general secretary. In 2022, after a short period as operational director, Van Elst became general manager of ASTER, the energy cooperative of all Flemish social housing companies.

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Advancing waste-to-fuel technologies: Integrated research on DFB gasification, Fischer–Tropsch synthesis and process monitoring

The production of advanced biofuels and green chemicals via advanced dual fluidized bed (aDFB) gasification combined with Fischer–Tropsch (FT) synthesis represents a promising pathway to defossilize hard-to-abate sectors such as aviation or heavy transport. These technologies enable the conversion of low-quality waste material into high-value products. At the Syngas Platform Vienna a plethora of feedstocks (e.g. wood chips, sewage sludge, plastic waste fractions) are converted to sustainable fuels and chemicals in a fully integrated demonstration-scale process chain. It consists of a 1 MW aDFB gasifier, coarse and fine gas cleaning units and a 250 kW FT pilot plant capable of producing 1-barrel synthetic crude per day. An industrial Cobalt-based catalyst is used for the production of higher-molecular-weight hydrocarbons such as diesel and wax fractions in a Slurry Bubble Column Reactor (SBCR).

Recent research at the Syngas Platform Vienna aims to optimise Fischer–Tropsch (FT) synthesis processes based on non-fossil feedstocks. This work focuses on three key aspects to enhance the performance and robustness of this waste-to-fuel conversion pathway:

1) Heat transfer in the reactor

2) Influence of feedstocks and impurities

3) KPI estimation for advanced process control

The first point involves investigating the hydrodynamic behaviour within SBCR reactors, as this has a strong impact on mass and heat transfer within the reactor. To this end, a cold flow reactor model was developed and the impact of different gas distributors was assessed to identify suitable ones.

Regarding the second point, fuel-derived impurities can significantly affect the utilisation of synthesis gas in downstream conversion processes. In particular, sulphur-containing compounds are known to poison the catalysts used in FT synthesis, leading to reduced activity and stability. Consequently, the presence of such contaminants requires careful monitoring and efficient gas cleaning strategies. In addition to catalyst deactivation, experimental observations have shown that impurities in the synthesis gas can also influence the product distribution, resulting in noticeable changes in the composition of the produced hydrocarbons.

Thirdly, for industrial applications of this technology, possibilities to assess the performance of the plant in real time are necessary and were developed. Online process monitoring of the FT synthesis is essential to control the desired product composition since the typical FT syncrude consists of long-chain hydrocarbons (waxes) as well as middle distillate used as a drop-in fuel and naphtha. However, offline analysis of liquid products via conventional Gas Chromatography is slow and requires staff effort. Evaluation of the gas compositions at the inlet and outlet of the FT reactor as well as the liquid levels in the downstream condensers are most promising to estimate the product composition and were evaluated in experimental campaigns.

Biography

Theresa Köffler is a Junior Researcher at the K1 Competence Center BEST – Bioenergy and Sustainable Technologies, working in the area Syngas Platform Technologies in Vienna. Köffler's research focuses on non-fossil-based Fischer Tropsch Synthesis and the optimization of slurry bubble column reactors for industrial applications. At BEST, Köffler manages the 250 kW pilot-scale FT plant, wax cleaning unit and cold flow models, completed two Bachelor's degrees in Process Engineering and Environmental System Studies at the University of Technology Graz, and completed a Master's degree in Process Engineering at the Technical University Vienna, where Köffler now pursues a PhD.

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Aqueous/EtOH: p-TsOH deep eutectic solvent assisted low-temperature deconstruction of *Miscanthus × giganteus* biomass for production of bioethanol

Technological innovations, global climate concerns, and the overuse of fossil-based feedstocks for energy and chemicals have driven the demand for viable, sustainable alternatives for value-added chemicals and fuels production. Recently developed industrially relevant bioenergy crops such as *miscanthus* (Mxg) have been reported to produce higher carbohydrates in the plant cell and have the potential to produce renewable fuels, chemicals, and materials altering the entire fossil-based economy. However, the complete valorization of Mxg is highly limited due to its natural recalcitrance. Almost $6 billion has been spent on trying to develop and start viable lignocellulosic biorefineries for ethanol production. However, many plants shut down due to the enormous costs of the pretreatment, significant chemical and energy inputs, and negative environmental impacts caused by the use of harsh chemicals.

Therefore, developing efficient deconstruction methods with economic and environmental benefits is highly encouraged for deploying sustainable biorefinery. Deep Eutectic Solvents (DES) are a type of eutectic solvent made from a Hydrogen Bond Donor (HBD) and a Hydrogen Bond Acceptor (HBA) and are considered greener alternatives to fossil-based solvents. DES enables the selective extraction of plant cell components, solubilizes lignin and hemicellulose, and exposes the cellulose surface area for enzymatic activity. DES falls under the category of green chemistry because of its low toxicity, recyclable nature, and natural origin, meets green solvent criteria, and is more cost-efficient than its traditional counterparts. Thus, herein, we aimed to develop a promising biorefinery technology to valorize bioenergy crops using an aqueous/ethanol-DES-based solvent system. The p-Toluenesulfonic acid (p-TsOH) was chosen as HBD in association with ChCl (HBA), serves as a cost-effective brønsted acid, and has unique solvatochromic properties to cleavage β-O-4 linkage benzyl ether, and benzyl ester bonds in linkage polymeric lignin units, and prevent lignin condensation under mild reaction conditions. The ChCl was chosen to control the H+ concentration of the p–TsOH/ChCl solvent system. Further, the pretreatment efficacy of ChCl-p-TsOH DES was investigated by varying the addition of ethanol and water at a moderate temperature (e.g., 60 to 90 °C. Pretreatment effects were correlated with enzymatic sugar yield, regenerated lignin, and structural characteristics have been comprehensively investigated by scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FT-IR), X-ray diffractometry (XRD), 2D NMR, ^{31}P NMR to fulfill the effective separation and depolymerization of plant components. Interestingly, ChCl:p-TsOH pretreatment at 80 °C, using 30% water, resulted in maximum glucan content of 61.7% with high xylan and lignin solubilization. The lowest weight percentage of glucan collected was found for 10% aqueous ChCl:p-TsOH solution while pretreating the biomass at 100 °C. The results showed DES pretreatment using 20% (w/w) and 30% (w/w) ethanol-ChCl:p-TsOH at 80 °C condition resulted in high (96%) glucose yield within 24 h of enzymatic hydrolysis. The findings further concluded that ethanol addition during DES pretreatment could reduce the recondensation of lignin molecules while solubilizing a higher amount of lignin in the liquor stream, thus increasing the ease of cellulose hydrolysis of pretreated pulp during enzymatic hydrolysis.

The yeast fermentation of sugar-rich hydrolysate enabled the achievement of 40 to 42 g/L of ethanol after 48 hours. Scanning electron imaging estimation revealed a very smooth, loose, and porous structure after ethanol-ChCl-p-TsOH DES pretreatment, leading to a 95% enzymatic hydrolysis yield. XRD analysis of pretreated biomass demonstrated an increased CrI value from 18.6% (raw) to 23.8%, 27.2%, and 38.2%, respectively, for aqu.-DES pretreated biomass, varying pretreatment temperatures of 60, 80, and 100 °C. This was due to the disruption of inter/intramolecular linkages in the carbohydrate-lignin cell wall matrix, leading to higher cellulose content in the pretreated pulp. In short, this work demonstrated an efficient, tailored DES system to process bioenergy crops and may offer an advanced strategy for the production of high sugar syrup and pure lignin for downstream biorefinery units for co-production of value-added chemicals and biofuels.

Keywords: Deep Eutectic Solvents, *Miscanthus* Bioenergy Energy Crop, Ethanol, Sugar, Lignin.

Biography

Dr. Tirath Raj received a PhD in Chemistry from the Indian University of Petroleum and Energy Studies, and has more than 15 years of expertise in the field of green chemistry synthesis and its application for environmentally friendly biomass processing for the generation of fuels and chemicals at the laboratory and pilot scale, while working at leading laboratories in India, South Korea, and the United States. Raj is currently working as Senior Research Scientist at a start-up organization at Champaign for commercial development of the biorefinery industry for renewable fuels, chemicals and materials production, and worked as a post-doctoral research associate at the University of Illinois in Urbana-Champaign, Illinois, USA, mainly involved in the development of efficient bioprocess for the conversion of bioenergy crops for chemicals, biofuels, and other bioproducts at CABBI, the fourth Bioenergy Research Center supported by the US Department of Energy. Scientifically, Raj has contributed >50 publications in peer-reviewed international review journals, co-invented 3 international patents, co-authored 3 books, and served as an editorial board member of three reputed journals.

Alexander N. Valyaev

Nuclear Safety Insitute of RAS, Moscow, Russia

Nuclear risks and damages in Europe

Today, the growing danger of nuclear weapons in Europe is evident, linked to the uncontrolled military operations on its territory, including the Russian nuclear defence in Ukraine. Major nuclear industry facilities are located there, including several nuclear power plants (NPP) and a number of supporting enterprises, including uranium processing.

The significant risk of accidents and disasters, including significant irreversible pollution is NPP river basins, but radiation emissions intoatmosphere, which can spread to vast densely populated areas. The greatest danger is the Zaporizhzhia NPP (ZaNPP) with combined capacity 6,000 MW. Any disruption to the operation of even one reactor at the NPP poses risk of polluting Dnieper River basin and Black Sea. Special monitoring of its condition is necessary to ensure the normal functioning of its water supply systems. Here have already been attempts to disrupt their operation through targeted terrorist attacks under the negative and undesirable with some EU political structures. Unfortunately worsen overall social dynamics and diminishrole of the human factor. in preventing both natural and man-made disasters. The existence of not only local but also widespread dynamic chaos is undeniable. It is the complex taskto develop special methods for reducing its harsh turbulence and softening it to a laminar nature.

Somemeasuresto improve security not only for ZaNPP but other large industrial facilities are discussed. They include various measures, including combating terrorist attacks, increasing total safety culture with clean awareness of consequences of terrorist attacks, timely operational information support, improving security NPP, includingaccelerated advanced training of NPP operators.

Biography

Alexander Valyaev, Leading Researcher, professor, doctor in Physics and Mathematics Sciences, Division of Ecological Safety and Radiation Risk, Nuclear Power Plant Safety Analysis Department, Nuclear Safety Institute of Russian Academy of Sciences. Born on May 15, 1949. In 1994 Valyaev was technical expert in USA and Canada according to international government contract, participated at many international conferences and symposiums, and from 2001-2011 participated in 12 events of the NATO Program Scientific Committee. Valyaev has more than 300 publications in Russian and foreign issues, is owner of 8 patents, and from 2017 was in successful collaboration on nanomedicine with world scientists and organizations.

Viacheslav Konoval
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Monetary assessment of attractiveness production sharing agreement

Current, the significance and role of production sharing agreements is assessed in terms of the area of land granted for subsoil use to the investor(s), the amount of funds spent on the extraction of mineral raw materials, the volume of extracted materials, the investor(s)' share in the raw materials, the amount of funds spent by investors on social obligations, etc.

Despite established views on the valuation of production sharing agreements, the monetary expression of such agreements is not carried out, since there are no regulatory or design bases for such an assessment.

The foundation of the monetary valuation of production sharing agreements is the conditional two whales:

1) operational whale;
2) financial whale.

The operational whale is inherent in the formula for the monetary expression of production sharing agreements, which was proposed in 2010 by contract researcher Mazeel (2010) in the work Fiscal Systems and Oil Contracts (gross income, net income, taxable income, deductions).

The economic activities of the financial whale under a production sharing agreement are:

1) currency purchase and sale transactions;
2) the rental rate.

The only drawback of this formula, in my opinion, is:

1) that it is not applied in hydrocarbon transactions (selective);
2) the amount of refunded value added tax is not taken into account;
3) the lack of market infrastructure for the resale of the natural asset for investors under a production sharing agreement.

However, the organizational basis of a concession contract is significantly different from production sharing agreements, and therefore production sharing agreements must have their own monetary valuation formula.

In view of the above, the optimal model for monetary valuation of production sharing agreements, which is closer to PSA, regardless of the mineral category, is the valuation should be according to the following components:

Year of production sharing agreement	Production value	Gross income after deduction of taxes and fees	Total amount of all bonuses	Group of intangible assets and their value	Capital expenditure	Asset price per year	Total tax and rent expenses	Amount of tax refunds returned

Biography

Viacheslav Konoval is a Public Sector Advisory (PSA) and natural resources policy analyst specializing in energy, mining, and investment governance. Konoval's work focuses on translating evidence-based research into practical policy recommendations for governments, international organizations, and industry stakeholders, and has developed policy briefs and analytical notes addressing resource efficiency, regulatory frameworks, and energy transition in emerging markets. At the conference, Konoval presents a policy-oriented perspective on sustainable resource governance and investment attractiveness, emphasizing actionable solutions, cross-sector cooperation, and improved decision-making in transitional and post-conflict economies.

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Vacuum insulation panel/polyurethane foam hybrid insulation for offshore oil pipe-in-pipe systems: Structural and thermal simulation studies

Offshore oil production and export pipelines depend on high-performance thermal insulation for flow assurance, maintaining the produced fluid above wax-appearance and hydrate-formation thresholds during steady-state operation and shutdown transients. Conventional Pipe-in-Pipe (PIP) systems fill the annular space between the inner production pipe and the outer casing with Polyurethane (PU) foam. However, the relatively high thermal conductivity of PU foam (typically 0.021–0.028 W/(m·K) at offshore service conditions) requires a thick insulation layer and hence a large outer-pipe diameter, which increases steel consumption, structural weight, installation cost, and embodied carbon. Aerogel blankets reduce the required thickness but at a material cost that is difficult to justify for long-distance export lines.

This work proposes and numerically evaluates a hybrid insulation architecture for offshore oil PIP pipelines: pre-formed curved Vacuum Insulation Panel (VIP) segments are first fitted into the annular gap between the inner and outer pipes, after which the residual annular space is injected with polyurethane foam, yielding an integrated VIP–PU composite insulation. In this architecture the VIPs, with a center-of-panel thermal conductivity typically below 0.005 W/(m·K), act as the primary thermal barrier, while the PU foam locks the panels in position, protects the VIP cores and barrier films from point loads and hydrostatic pressure, suppresses panel-joint thermal bridging, and provides secondary insulation and structural damping.

Coupled thermal–structural finite-element simulations of the composite pipeline were performed. The thermal analyses quantified the effective conductivity of the hybrid annulus as a function of VIP coverage ratio, panel thickness, joint density, and foam properties, and compared steady-state heat loss and cool-down behaviour against pure PU-foam and aerogel-blanket reference designs under identical service conditions. The structural analyses verified the mechanical integrity of the VIP–PU annulus under external hydrostatic pressure, installation loads, and thermal-expansion mismatch between the two pipes.

The simulations demonstrate that, at equivalent thermal performance, the VIP–PU hybrid insulation reduces the required outer-pipe diameter by approximately 20% relative to a pure PU-foam insulation layer and by approximately 10% relative to an aerogel-blanket insulation. For a typical offshore export line this translates into substantial savings in casing steel tonnage, lower pipeline submerged weight, reduced installation vessel time, and a significant reduction in embodied CO_2 emissions over the project life cycle. The concept and the simulation methodology are directly transferable to subsea CO_2 (CCUS) and liquid-hydrogen pipeline insulation, supporting the decarbonization of offshore energy infrastructure in line with the conference themes of reliability, affordability, and sustainability.

Biography

Prof. Zhaofeng Chen is Professor and Doctoral Supervisor at the College of Materials Science and Technology, Nanjing University of Aeronautics and Astronautics (NUAA), China. With nearly three decades of research experience in thermal insulation and advanced composites, his interests cover Vacuum Insulation Panels (VIP) and their industry standards, aerogel-based insulation for nuclear power and aerospace applications, glass-fibre acoustic/thermal systems for aircraft cabins, and CVI-fabricated continuous fibre-reinforced SiC ceramic matrix composites. He serves as chief editor of the VIP industry standards in China, has received provincial science and technology awards, and actively collaborates with international partners on energy-efficiency materials.

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POSTER PRESENTATIONS

Jose Antonio Romero Paguay

Amazon State University, Ecuador

Evaluation of climate resilience and degradation of photovoltaic systems in the Ecuadorian Amazon-2025-2026

The performance, degradation, and climate resilience of photovoltaic (PV) systems were assessed in three Ecuadorian Amazon cantons—Pastaza, Tena, and Macas in the provinces of Pastaza, Napo, and Morona Santiago, respectively—through empirical monitoring over 6–12 months using IEC 617224 standards. IoT sensors, I-V curves, IR thermography, and visual inspections were combined to analyze climatic variables—temperature (16–27°C), RH (64–95%), precipitation (up to 430 mm/month), and irradiance (3.8–4.8 kWh/m^2/day)—and PV metrics: PR (73–78%) and yield (1350–1450 kWh/kWp). Stable irradiance with a coefficient of variation of approximately 5–6% and a reliability of 89–90% was evident. Macas had superior performance (4.4–4.5 kWh/m^2/days, PR 78%). The high RH>80% accelerates soiling (1.8–2.4 months), reducing efficiency by 10–20%. Intense rainfall generates natural washing, recovering 10–15% of the performance, while cloud cover causes losses of 15–25%. The annual PLR (0.8–1.8%/year) is higher than the global average (approximately 0.5%/year) and was modeled with SLT (R^2=0.95). Hotspots were identified, primarily associated with bypass diodes (45%), microcracks (30%), and chronic failures (EVA, corrosion). The LCOE (0.09–0.15 USD/kWh) with an ROI of 5–7 years covers 45–100% of local demand and avoids~0.17 t CO_2/kWh. The Amazon region's climate is suitable for PV systems with mitigation measures, bifacial modules, hydrophobic coatings, 20% oversizing, fortnightly or monthly cleaning, elevated flood-proof structures, and strategies to limit PLR to 0.4–0.6%/year, extending the useful life to 23–25 years. Public and private institutions should develop operational guidelines to promote energy sustainability in the Ecuadorian Amazon.

Biography

Jose Antonio Romero Paguay is a full-time University Professor at the Amazonian State University, Ecuador, teaching there since 2010. Romero Paguay is a mechanical engineer from the Polytechnic School of Chimborazo (ESPOCH), Ecuador, and holds a master's degree in renewable energies and a doctorate in Technical Sciences, obtained at the José Antonio Echeverría Higher Polytechnic Institute (CUJAE), Cuba. Romero Paguay has more than three decades of academic experience in several Ecuadorian universities, teaching subjects in Physics, Fluid Mechanics, Thermodynamics, Industrial Supervision, renewable energy, and others related to engineering. This line of research focuses on renewable energies, photovoltaic systems, energy technologies resilient to climate change and sustainable engineering solutions applied to tropical environments. Romero Paguay is the author of 14 scientific publications, has been actively involved in research related to the integration of renewable energy systems and adaptation to climate change, and directed the project Implementation and evaluation of photovoltaic systems in non-electrified communities of the Ecuadorian Amazon.

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Streamlining energy savings calculations in the EU member states + (streamSAVE+)

The recast Energy Efficiency Directive (EED) has raised the ambition of Member States' energy savings obligations under Article 8, yet many national authorities still lack harmonised, ready-to-use bottom-up methodologies for calculating and verifying savings from technical actions in fast-evolving sectors. streamSAVE+ (Streamlining Energy Savings Calculations in the EU Member States +), an EU LIFE-funded project running from 2024 to 2027 and led by a consortium of 10 partner organisations from 9 countries, addresses this gap by building on the completed H2020 streamSAVE project's 10 original priority actions and developing harmonised bottom-up calculation methodologies for 5 new priority actions. Deep renovation covers the comprehensive, structural upgrading of residential and non-residential buildings, going beyond cosmetic measures to substantially reduce primary energy consumption, with a calculation framework that compares building energy performance before and after renovation. Heat recovery in ventilation units addresses the replacement, upgrade or adaptation of ventilation systems to incorporate heat recovery technology, estimating the resulting reduction in space heating final energy consumption; the methodology follows the Ecodesign Directive's (EU 1253/2014) definition of ventilation units and applies indicative values differentiated by building type and by three European climate zones. Data centres, one of the fastest-growing sources of electricity demand in the EU, are covered by two closely related new priority actions. IT efficiency estimates savings from measures such as virtualisation, server consolidation, hardware modernisation, workload optimisation and energy-aware system management, comparing electricity use before and after implementation across servers, storage and network systems, with combined effects of multiple measures calculated multiplicatively. DC cooling uses Power Usage Effectiveness (PUE) as its core metric, comparing PUE before and after measures such as replacing legacy CRAC units, optimising airflow, or adopting free or liquid cooling, to isolate savings in the non-IT energy overhead of cooling, power distribution and lighting. Public traffic management provides a methodology for four categories of measures: active traffic management of recurrent and non-recurrent congestion, active demand management to redistribute travel to alternative modes, routes or off-peak periods, active parking management, and traffic-calming measures to reduce vehicle speeds and volumes, with boundary conditions defined individually according to the design of each implemented measure. Together, these five new methodologies extend the streamSAVE+ knowledge hub and online platform, giving public authorities across all Member States practical, comparable and auditable tools for reporting energy savings in sectors where robust calculation approaches have so far been limited, supporting the achievement of the EU's binding 2030 energy efficiency targets.

Biography

Mindaugas Mizutavicius - an Energy Efficiency Data Analyst at the Lithuanian Energy Agency, coordinating the implementation of the LIFE streamSAVE+ project in Lithuania. Also involved in data analysis and other international projects related to energy savings measurement and verification, working directly with energy efficiency policy measures, forecasting and calculating energy savings, and administering the progress of energy efficiency policy measures.

Moukam Tchawe Tchawe[1]*, Maxwell Tientcheu Nsiewe[1], Thomas Djiako[2], Denis Tcheukam-Toko[3]

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A different approach to hydropower: An eco-friendly approach (Clean Hydro Production)

Hydroelectric power is considered a form of green energy. However, the system used to generate it has a significant impact on nature. Not only does it generally require substantial financial resources, but it also irreversibly alters the environment in which it is built (whether on land, through the occupation of agricultural land, for example, or at sea, through the disruption of aquatic life). In this paper, we present a new methodology based on an approach we have named CHP, which stands for Clean Hydro Production. This approach represents a new philosophy we are developing, which involves either generating electricity from hydropower without altering the morphology of watercourses (by using more environmentally friendly solutions such as tidal turbines and floating wheels), or to generate more energy from existing structures at a lower cost by utilizing discharge flowrate, for example. This new philosophy is a sustainable solution and aligns with environmentally friendly methods.

Biography

Dr Tchawe Tchawe Moukam is a Researcher and Senior Lecturer at ENSAI, University of Ngaoundere, a member of several research laboratories and head of the 'Wind and Hydraulic Energy' research team at the University of Ngaoundere.

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