Spectrum Conferences & Expos

ISNRE2024

2nd International Summit on

Non-Renewable and Renewable Energy

Dates: August 26-27, 2024

Venue: Valencia, Spain

FOREWORD

Dear Colleagues,

It is our pleasure to invite all scientists, academicians, young researchers, business delegates and students from all over the world to attend the 2nd International Summit on Non-Renewable and Renewable Energy (ISNRE2024) will be held in Valencia, Spain during August 26-27, 2024.

ISNRE2024 shares an insight into the recent research and cutting edge technologies, which gains immense interest with the colossal and exuberant presence of young and brilliant researchers, business, delegates and talented student communities.

ISNRE2024 goal is to bring together, a multi-disciplinary group of scientists and engineers from all over the world to present and exchange break-through ideas relating to the Non-Renewable and Renewable Energy. It promotes top level research and to globalize the quality research in general, thus makes discussions, presentations more internationally competitive and focusing attention on the recent outstanding achievements in the field of Non-Renewable and Renewable Energy.

We're looking forward to an excellent meeting with scientists from different countries around the world and sharing new and exciting results in Non-Renewable and Renewable Energy.

COMMITTEE

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Development of Renewable Liquid Fuels from Woody Biomass - From Lab to Pilot Plants

Hemant Pendse
Forest Bioproducts Research Institute (FBRI), University of Maine, USA

Abstract:

Maine has significant quantities of unmerchantable low-grade woody biomass due in part to many pulp-mill closures and a very limited market for a few remaining biomass power plants to generate electricity. UMaine's Forest Bioproducts Research Institute (FBRI) has developed processes to produce renewable liquid fuels from low-grade woody biomass, along with chemicals and advanced materials. This presentation traces shifting focus on ethanol and butanol to liquid hydrocarbon fuels such as gasoline, diesel and jet fuel. Underlying constant theme is to find new revenue streams for sustainably harvested low grade woody biomass, that doesn't go to sawmills or pulpmills, through judicious use of wood components – cellulose, hemicellulose and lignin.

Our wood to jet fuel project is based on FBRI's patented thermal deoxygenation process, which yields jet fuel that meets key specifications for Sustainable Aviation Fuel (SAF) blends. We operate two pilot plants. The Biomass to Bioproducts Pilot Plant (B2P2) is designed to convert one dry metric ton of biomass into organic acids and biochar. The intermediate process stream containing mixed organic acids is then converted to crude oil in the BioCrude Oil Pilot Plant (BioCOPP) designed for a crude oil production rate of 100 kg/day. The conversion technologies have been tested in several continuous operation campaigns.

This presentation tells the story of discovery, innovation, and the proof-of-concept at commercially relevant scale using various biomass feedstocks including sawdust and old corrugated cardboard (OCC). Plans for demonstrating the technology at a small commercial facility in Maine are underway and discussions with an oil refinery show promising options to blend the wood derived UMaine jet fuel with conventional jet fuel for the commercial aviation market as SAF. The journey from discovery to innovation started with undergraduate and graduate student research. Scale up from laboratory to floor scale reactors and transitioning from batch

to continuous processing helped development of pilot scale operating campaigns. Lessons learned from the pilot plant operations have been invaluable in guiding further foundational research initiative.

Keywords: Biofuels; woody biomass; cellulosic jet fuel; pilot plants.

Biography:

Prof. Pendse, Professor Emeritus of Chemical Engineering and Director Emeritus of FBRI has led research in the conversion of woody biomass to bioproducts including fuels, chemicals and advanced materials since 2006. Dr. Pendse led the establishment of a new Technology Research Center (TRC) for floor-scale processing of biomass at a 40,000 sq. ft. high-bay facility. TRC operates the Biomass to Bioproducts Pilot Plant (B2P2) and the BioCrude Oil Pilot Plant (BioCOPP), for its "Wood to Jet Fuel" program.

As an internationally recognized leader in forest bioproducts, Pendse was named the University of Maine's 2021 Distinguished Maine Professor (DMP). His other University of Maine awards include the Ashley Campbell Award from the College of Engineering and 2012 Presidential Research and Creative Achievement Award. His professional service includes AIChE Transport & Energy Division Chair, Maine Economic Advisory Board Member, and Nelson Industries Corporate Advisory Council Member. Dr. Pendse has over 300 technical presentations/ publications, including three patents.

The Biofine Process: Carbon Negative Bio-Fuels and Chemicals from Lignocellulose

Stephen W. Fitzpatrick
Biofine Technology LLC, USA

Abstract:

The Biofine process allows conversion of lignocellulosic or cellulosic wastes into fuels and commodity chemicals with huge markets. The process is based on the acid hydrolysis of the carbohydrate portions of the feedstock under relatively mild conditions of dilute acid and moderate temperature that dissolve and convert the carbohydrates but allow lignin in the feedstock to pass through the reaction relatively unchanged. Carbohydrates are converted simultaneously to the platform chemicals, levulinic acid, formic acid, and furfural. High yields of these products are obtained by virtue of the stable operating regime established within a continuous back-mixed, steam-stripped, reaction vessel.

The biofuel of primary interest is ethyl levulinate (EL), the ethanol ester of levulinic acid suitable for both heavy (diesel-like) and light (gasoline-like) fuel formulations. EL is a promising oxygenated fuel additive for transportation and heating. The process byproducts are levulinic acid, a versatile platform chemical that can be readily converted into monomers such as diphenolic acid, succinic acid, acrylic acid and 3-HPA, sodium formate, an environmentally benign non-corrosive airport deicer and a high-energy content, non-bio-degradable carbonaceous powder consisting of unconverted lignin and humin-like reaction residues. Independent, peer-reviewed carbon dioxide life cycle analyses (LCA) carried out using the "GREET-2" model (A.N.L.) conclude that for production of EL and biochar the commercial scale process is carbon negative: The displacement of fossil fuels, avoidance of emissions from cellulosic waste and sequestration of carbon in the biochar residue results in the reduction of atmospheric carbon dioxide by up to 20 Kg CO2e per gigajoule of biofuel.

The company in recent years has made major strides towards commercialization of the technology and is planning the start of construction of its first commercial plant in Q4, 2024. The process technology has been operated at large pilot scale for several years at the University

of Maine (Orono) and has been validated as ready for scale-up in a peer review by an international independent engineering consulting firm. The company has entered a multi-year off take contract with a large U.S. national fuel distributor and has verified the applicability of U.S. EPA-managed D-7 RINS (renewable Information numbers) for its biofuel product. It has also received a high degree of commercial interest in the deicer and the biochar residue.

Biofine has identified a site for construction of the first commercial plant at an abandoned pulp and paper mill in Lincoln, ME and is currently working with a large international EPC company carrying out detailed process design. This first plant will process a total of over 40,000 dry metric tons of waste wood and post-consumer fiber per year and produce over 10 million liters of fuel. Follow-on plants will process up to 1000 dry tons per day of feedstock.

The economics of the process make it highly profitable even at small commercial scale. The primary markets being served, biofuel (EL), biochar and environmentally acceptable deicers (sodium formate) are sufficiently large to absorb the output from dozens of large scale plants both domestic and international. The feedstock is extremely plentiful being derived in rural settings from forest slash and thinning and in urban settings from municipal paper waste. For many locations, this represents a classic example, possible through green chemistry, of economic circularity in either rural or urban settings where readily available waste feedstock can be converted into commercial products such as biofuel, biochar and deicer with large market demand in the local region while contributing significantly to reduction of atmospheric carbon. This presentation will discuss the process technology, its scale-up, products, feed stocks and economic projections.

Biography:

Dr. Fitzpatrick is a recognized expert in conversion of cellulosic feed stocks to renewable fuels and chemicals. He is inventor of the Biofine process for refining of lignocellulosic biomass and chief executive of Biofine Technology LLC and Biofine Developments Northeast Inc., companies dedicated to the commercial application of the Biofine technology for sustainable production of fuels and chemicals. For over twenty years, Dr. Fitzpatrick was president of Biometics Inc a Boston, MA-based consulting, engineering and construction management company primarily involved in scale-up, design and construction of first-of-a-kind manufac-

turing facilities for production of novel therapeutic biologics. Biometics Inc. was purchased in 2015 by the DPS Engineering Group, Dublin, Ireland. Dr. Fitzpatrick's earlier industrial experience as a chemical engineer in the UK was with Proctor and Gamble, Sterling Health, Rohm and Haas and Shell Chemicals. In 1981 he moved to the U.S. and worked for Badger Engineers, Cambridge, MA and Carlson Associates, Wayland, MA before co-founding Biometics. Dr. Fitzpatrick was born in Manchester, UK. He holds a Bachelor's, Master's and Doctoral degrees in chemical and biochemical engineering from the University of Manchester, UK and is a chartered engineering member of the Institution of Chemical Engineers (UK). He is also a member of the American Institution of Chemical Engineers and the American Chemical Society. He is the 1999 winner of the Presidential Green Chemistry Challenge Award and recipient of the 1972 Manchester University Dista Prize in Biochemical engineering. He holds several patents and has authored various publications on renewable fuels and chemicals and production of biological therapeutics.

Decentralized Financing of the RES Project – Bridge between Real World and Digital Economy

Milos Mladenovic
Managing Director-SEEPEX, Serbia

Abstract:

Renewable Energy Sources (RES) play a crucial role in the green transition, which refers to the shift toward a more sustainable and environmentally responsible economy. Beside helping to combat climate changes and improve environmental quality, such as corresponding reduction of GHG emissions and achievement of carbon neutrality and net-zero emissions, RES are a vital component in efforts aimed to stimulate economic growth and ensure greener and more sustainable future. It is well-known that financing RES projects can present various challenges, including: high initial costs, legal and regulatory uncertainty, project development and construction risks, grid integration and intermittency, long payback period, environmental and community concerns (mostly linked with the large-scale wind or solar farms), as well as lack of access to financing, already recognized as one of the main obstacle for comprehensive green transition, especially in underdeveloped regions. To address all these challenges, stakeholders in the RES sector often employ strategies such as government incentives, power purchase agreements, risk mitigation measures, and partnerships with experienced developers and financial institutions. Additionally, ongoing R&D activities in renewable energy technologies aim to reduce costs and improve reliability, which can help attract more financing for such projects, but access to available financial assets is still very centralized and rigid especially in those regions who are underserved by traditional banking systems.

On the other hand, fast-growing digital economy and decentralized finance (DeFi) offer several advantages, transforming various aspects of finance and economics. Main advantages could be summarized as follows: accessibility of financial services to a broader audience (especially those who are underserved by traditional banking systems, full transparency (all transactions on blockchain-based DeFi platforms are transparent and recorded on a public ledger), no need for traditional intermediaries like banks and financial institutions, enhanced security (funds are stored in smart contracts and users have full control over their assets), global market and inclusivity (DeFi operates on a global scale, enabling access to various financial products and

services without restrictions based on location or nationality and making it accessible to the unbanked or underbanked populations, particularly in developing countries), decentralization of power (DeFi projects are typically open-source and community-driven, reducing the concentration of power in a few centralized institutions), and, finally, large scope of yield opportunities (DeFi platforms offer various ways to earn yields on crypto assets through lending, staking, and liquidity provision, providing new income opportunities for users). It's important to note that successful deployment of a DeFi platform for RES financing would require careful consideration of legal and regulatory requirements, as these projects often involve significant amounts of capital and impact on the energy sector. Additionally, the security and auditability of the platform are of paramount importance to gain trust from investors. Collaboration with experts in both the DeFi and renewable energy sectors, as well as regulatory authorities, would be crucial for the successful implementation of such a platform.

In this light, DeFi platforms have the potential to revolutionize financing for RES projects by offering more accessible, transparent, and efficient ways to raise capital, oracles and risk management. Having all above-mentioned in mind, we have launched the Lucca Protocol project to be developed by the consortium of BLUE DOT Group, industrial think-tank comprised of several front-runners in the Serbian/regional energy landscape and TRAKEN TECH, a team of experienced blockchain developers and designers. Our mission is to establish a transparent DeFi platform (Lucca Protocol) to support deployment of the RES facilities by providing accessible, affordable, and efficient financing options world-wide. Main idea is to connect global crypto liquidity with the eligible green-energy projects by tokenizing corresponding green-energy assets and democratise investments into renewable energy projects. The Lucca Protocol will expand the possibilities of digital finance into financing renewable energy, allowing efficient worldwide investment into stable, reliable projects providing yield on real-world digital assets.

The Lucca Protocol is a blockchain-based private credit investment protocol that has been designed to democratise investment into renewable energy projects. The protocol expands the possibilities of digital finance into financing renewable energy, allowing efficient worldwide investment into stable, reliable projects providing yield on real-world digital assets. At the core of the protocol is the use of advanced token bonding curves. These token bonding curves incentivize investors to hold onto their investments for longer periods, promoting stability and security in renewable energy projects. The protocol ensures compliance with relevant legal

and regulatory frameworks, providing transparency and confidence for investors in the legitimacy of digital assets. Additionally, the use of real-world legally binding agreements backing smart contracts offers further protection for investors in the event of disputes or unforeseen circumstances, bolstering the credibility and reliability of the protocol.

The LUCCA token is a key tool in the Lucca Protocol, serving multiple functions. Firstly, it acts as a tool for shared, risk-mitigated investment into multiple projects. This allows investors to gain exposure to multiple renewable energy projects through a single investment, reducing overall investment risk. Secondly, it is used as insurance for risk-averse RES investors, providing a means for investors to mitigate their risk exposure. Also, the LUCCA token is used in a staking mechanic to incentivize protocol growth. As the protocol grows, the value of the token is expected to increase, providing investors with greater returns on their investments.

The Lucca Protocol project will be developed by the consortium of BLUE DOT Group, industrial think-tank comprised of several front-runners in the Serbian energy landscape and TRAKEN TECH, a team of experienced blockchain developers and designers. The UX and UI designers, in collaboration with the front-end developer, will create wireframes and a user flow for the LUCCA Protocol Client App. The wireframes will ensure that the design meets the needs of the user, while the user flow will provide a clear understanding of how the user interacts with the app.

The platform will be fully legally compliant, ensuring that investors' assets are secure and protected. The smart contracts on blockchain platforms will provide additional layers of security and transparency. The platform's user-friendly design and comprehensive functionality will make it an attractive option for both new and experienced investors, providing a reliable and efficient way to invest in RES projects.

Keywords: Renewable energy sources; decentralized finance; DeFi platforms; lucca protocol.

Biography:

Milos Mladenovic has graduated in Faculty of Electrical Engineering in 1995 at University of Belgrade. He joined EPS in 1998, working in the fields of real-time System Operation. After the establishment of the Serbian TSO (EMS), starting from 2005 he has played important role in the emerging process of the electricity sector unbundling and liberalization of the national electricity market. In 2010 he was appointed as the Executive Manager for System and Market operation in EMS, performing executive management role for all System and Market operation issues. Starting from 2012 he has worked as a Director for International and Regulatory Affairs, at the same time performing the role of the ENTSO-E Board member and the Convenor of the ENTSO-E Regional group for the Southeast Europe. With comprehensive regional and European experience, as the member of the ENTSO-E Board and ENTSO-E Market Committee, as well as the Chairmen of the SEE RG within ENTSO-E MC, he becomes one of the key players in the process of the SEE Electricity Market integration and EU Target Model implementation in the SEE region. Since July 2015 he works as a Managing Director of SEEPEX (Serbian Power Exchange) and starting from December 2022, he is also appointed as a Member of the Management Board of ADEX Group, the first regional Power Exchange in the SEE/CEE regions, established in the form of corporate merging of the SEEPEX and BSP (Slovenian Power exchange).

He is also the member of the Group of Experts on Renewable Energy (GERE) established under the UNECE Sustainable Energy Division and participated as an independent expert in the field of Market and System Operation on several consultancy projects all over the world.

Lithium-Ion Battery Technology: Challenges and Opportunities in Qatar

Kenza Maher
Qatar Environment and Energy Research Institute (QEERI), Hamad Bin Khalifa University (HBKU), Qatar

Abstract:

The rapid advancement of lithium-ion battery technology has revolutionized sectors ranging from consumer electronics to electric vehicles and renewable energy storage systems worldwide. As Qatar endeavors to achieve sustainable energy solutions under Vision 2030, comprehending the distinctive challenges and opportunities associated with lithium-ion batteries within the region assumes critical importance.

This plenary talk will comprehensively explore various facets of lithium-ion battery technology, emphasizing the specific environmental, economic, and technical challenges encountered in Qatar. Key topics of discussion will include the effects of high temperatures on battery performance and longevity, the integration of lithium-ion batteries into Qatar's energy infrastructure, and the imperative of establishing a resilient supply chain and recycling ecosystem.

Furthermore, the presentation will delve into Qatar's potential for advancing lithium-ion battery technology, leveraging local capabilities in research and development, fostering international collaborations, and stimulating innovation through strategic investments. By addressing these challenges and capitalizing on opportunities, Qatar can emerge as a leader in sustainable energy solutions, contributing significantly to global efforts in combating climate change and ensuring energy security.

Biography:

Dr. Kenza Maher serves as a Scientist at the Qatar Environment and Energy Research Institute (QEERI) since January 2015. With over 12 years of dedicated experience in battery energy storage R&D, her expertise lies in crafting secure and dependable materials for both Li-ion and Na-ion batteries. She's also a driving force behind pioneering diagnostic approaches and

protocols crucial for verifying the reliability and performance of battery systems, cells, and materials.

Previously, Dr. Maher held pivotal roles such as Research Fellow and Project Leader at the Joint Future Mobility Research Lab in collaboration with the BMW Group and Nanyang Technological University in Singapore. During this tenure, her primary focus was on ensuring the safety and diagnosing BMW electric car batteries, addressing the critical issue of thermal runaway hazards in vehicles.

Dr. Maher earned her PhD from Cadi Ayyad University in Morocco in January 2011, where her research significantly contributed to the advancement of novel phosphate and oxide materials tailored for high-energy lithium-ion batteries. Complementing her academic journey, she conducted research as a Guest Researcher at the Angström Laboratory, Department of Material Chemistry, Uppsala University in Sweden.

Post-PhD, she expanded her insights at the Energy Research Institute of Nanyang Technological University in Singapore, contributing to the innovation of a groundbreaking method for assessing battery state of charge (SOC) and state of health (SOH) through thermodynamic properties. Subsequently, she embarked on a journey with TUM CREATE Ltd in Singapore, delving into the in-depth analysis of batteries' thermodynamic and kinetic attributes.

Renewable Energies in Africa and the Approach for Europe in the Light of the Findings of the Compact with Africa Summit

Kay J. Pfaffenberger
Centre for Business and Technology in Africa, Flensburg University of Applied Science, Germany

Abstract:

Europe's closest neighbour is the African continent. This part of the world therefore offers a great opportunity for the European Community, particularly for a diversified supply of green energy and green products ("green steel"). Moreover, with its 54 independent nations, there are diversification opportunities not only for the European Union. Individual trouble spots do not affect the fundamental suitability of this natural partnership.

The G20 Compact with Africa (CwA) was initiated under the German G20 presidency to promote private investment in Africa, including in the infrastructure and energy sectors. The main objective of the CwA is to increase the attractiveness of private investment by significantly improving the macroeconomic, economic and financial framework conditions. It brings together reform-minded African countries, international organisations and bilateral partners from the G20 and beyond to coordinate country-specific reform plans, support relevant policy measures and identify investment opportunities for private investors. The initiative is demand-driven and open to all African countries. Since its launch in 2017, the CwA has generated a great deal of interest.

A secure and affordable energy supply is important not only for Africa and the African countries, but also for the European Union. Energy prices are of crucial importance in both the consumer goods and capital goods markets. The availability of energy is also crucial for stable economic development.

The further development of renewable energies, especially with regard to energy generation from the conversion of sunlight and the utilisation of wind power, therefore plays a decisive

role. Available energy from hydropower plays a subordinate role.

It should also be noted that Africa accounts for over 40 % of the world's cobalt, manganese and platinum reserves - important minerals for batteries and hydrogen technologies. As a result, the availability of additional sources of financing is a decisive criterion with regard to Africa's energy future. Countries outside Europe, for example from the Gulf region, have also recognised this (it doesn't always have to be China).

The EU Parliament recently approved the Corporate Sustainability Due Diligence Directive (CSDDD). In a phased implementation, the law will oblige EU companies with 1,000 employees or more and a turnover of at least 450 million euros to identify human rights and certain environmental risks in their value chains, take preventive and remedial measures and report on them.

The link to due diligence or supply chain regulations and laws within the European Union will be crucial in answering the question of whether people need to be at the centre of Africa's new energy economy.

The fact that Africa is geographically very close to Europe allows for many different ways of transporting energy. From submarine power cables from locations in the Mediterranean to pipelines and the transport of hydrogen derivatives by ship, many scenarios are conceivable.

At the CwA summit in November 2023, it was made clear that the value chain in Africa needs to be expanded and not just energy needs to be exported. Economic stability guarantees the profitability of investments.

The social and political consequences of operating large-scale plants to expand the value chain are not covered by the current projects. In principle, they only assume inert economic viability; investors assign everything beyond this to the state sphere or see it as a global task.

Keywords: Renewable energy; Africa; European Union; green deal.

Biography:

Prof. Dr. Kay Pfaffenberger (born 1965) holds a Master in Economic Sciences from Leibniz University Hannover and a PhD in Business and Administration from the University of Leipzig. He started his career as a consultant at the S--Kommunal Beratung in Hannover. As head of department he developed and managed electronic banking services at the Cooperative Bank BremenNord. Furthermore he has been consultant for company communication at CardProcess GmbH, Frankfurt. 2009 he founded the Institute for Communication, Finance and Good Governance. In 2012 Kay Pfaffenberger has been appointed as Professor for Business Administration at Flensburg University of Applied Sciences. Also he is the managing director of the Center for Business and Technology in Africa (CBTA). The main focus of his work is lecturing and applied research on business administration and political economics with special focus on business in Africa and inter--cultural--communication, banking and finance, good governance and renewable energy. In these fields he has supported cooperative banks especially in transaction banking with strong relations to DZ Bank. He has a wide experience with projects in the financial sector and recently with solar industry respective renewable energy companies in West-Africa. The sustainable development and green energy are also in his focus. The CBTA had held an online conference in 2021 about Green Hydrogen cooperation possibilities between Africa and Europe. His actual field of research are the EU Green Energy Transition and the effects for local content as well as the need for skilled personnel for operations and maintenance.

In 2024 he had been selected by Africa. Table Professional Briefing, the largest German-language Africa editorial team, as one of the key minds in the “Science” category. He is one of the 100-Top-of-the-Table minds in Germany for Africa.

Optimization Criteria for Complex Energy Systems

A. Amoresano
University of Naples Federico II, Italy

Abstract:

The energy crisis, the adverse events of recent years, and the need to reduce the production of CO2 generated by fossil fuels have radically changed the way energy production systems are designed and operated. Now the integrated production of power and heat from the same source has become a compulsory choice. Solar energy production istems, such as solar thermodynamic systems and photovoltaic systems, are becoming increasingly popular. The advent then of a new production of energy obtained from renewable sources, such as fuel cells, the presence of anaerobic digestion plants, etc., highlights what complexity of design and management is heading toward. This kaleidoscopic landscape therefore confronts plant designers and operators with complex trade-off choices. This paper presents an approach to optimizing both the design and management of energy systems based on MOGA (Multiobjective Optimization by Genetic Algorithms) and DA (Discriminant Analysis) methods. The objective of the work is to formulate optimization principles for the design and management of complex energy systems.

Biography:

Amedeo Amoresano is Ph.D in Thermomechanical Systems is currently an associate professor at the Federico II University of Naples and an associate researcher at the National Research Council at the STEMS Institute of (Science and Technologies for Sustainable Energy and Mobility). It is currently a member of two Joint Programs CSP (Concentrated Solar Power) and Energy Efficiency in Industrial Processes and partner of the European project INSHIP (Integrating National Research Agendas on Solar Heat for Industrial Processes).

Recent Advances in Nanostructured Catalysts for Ethanol Oxidation in Direct Ethanol Fuel Cells

Jelena Lovic
Department of Electrochemistry, Institute of Chemistry, Technology and Metallurgy, University of Belgrade, Serbia

Abstract:

Direct alcohol fuel cells (DAFCs) demonstrate a type of environmentally friendly energy resources applicable for the development of devices that turn the chemical energy of fuel into electrical energy with the aid of electrochemical oxidation. Among various DAFCs, direct ethanol fuel cells (DEFCs) are characterized as promising candidates for practical application due to the several excellent properties such as non toxicity, safe and easy transportation and storage, and high power density. Under alkaline conditions, the kinetics of both the cathodic oxygen reduction and the anodic ethanol oxidation is facilitated. Taking into consideration that alkaline systems are not restricted to platinum-based electrodes, a variety of catalysts were used as anodes for efficient ethanol oxidation reaction (EOR) including PdNi, PdAg, PdBi, PdSb catalysts. Bimetallic Pd-based electrocatalysts have been synthesized by various methods and among them isthe electrodeposition as a simple synthetic strategy for the well-defined control of the size, shape, and dispersion of metal nanoparticles from a surfactant free electrolytes. Bimetallic Pd-based electrocatalysts generally exhibit higher electrocatalytic activity than monometallic Pd catalyst through optimizing electronic and bifunctional effects, as well as by tuning their surface composition and structure.

The talk will review Pd-based electrocatalystsfrom the point of surface characterization and relevance of oxides in order of understanding the catalyst activity andpoisoning tolerance to the carbonaceous intermediates accumulated on the catalyst surface during the electrooxidation of ethanol. Particular attention is dedicated to discuss the important role played by the Pd-based surface composition and morphology in governing the kinetics and selectivity of the EOR. The key problems in the investigation on catalysts for EOR are summarized and outlooks for their future development are provided.

Keywords: Electrocatalysis; electrooxidation; fuel cell anode catalysts.

Biography:

Dr. Jelena Lović is working as a principal research fellow at the Department of Electrochemistry at ICTM from 1997. In the year 2000 she stayed at University of Turku (Finland), where she broadened her knowledge on surface characterization techniques. She holds a PhD degree in Chemistry and Chemical technology, which she obtained in 2006 at the Faculty of Technology and Metallurgy, University of Belgrade, Serbia. The dissertation entitled "Electrochemical oxidation of methanol and formic acid on model and real catalysts" was done in part in 2005 at Institute of Catalysis and Surface Chemistry, Polish Academy of Science, Krakow, Poland. Research field/areas are as follows: electrochemical oxidation of small organic molecules; electrodeposition; electrochemical behavior of organic compounds and pharmaceuticals; electrochemical evaluation of biochemical properties. So far Dr. Jelena Lović has had 59published papers with outstanding peer reviews, 1 book chapter and 2 patent applications registered at the national patent office, h-index 14 (Scopus). Currently Dr. Jelena Lović participate in the bilateral cooperation project of the Max Planck Institute for Dynamics of Complex Technical Systems (Germany) and Institute of Chemistry, Technology and Metallurgy (Serbia).She was a participant in two international EUREKA projects. As part of the Eureka team, she was awarded the Grand Prix prize at the competition "Association of Inventors and Authors of Technical Improvements Belgrade" at 2018. and 2023. and three gold medals at the international competition of technical innovations in Sevastopol, Trinec and Zagreb in 2018. Dr. Jelena Lović is a member of the Serbian Chemical Society(SHD) and the International Society of Electrochemistry (ISE).

Human Comfort in a Residential Building in Terms of Sustainable Development and Renewable Energy

Alicja Kowalska-Koczwara
Cracow University of Technology, Poland

Abstract:

The article discussed the problem of designing energy efficient buildings. This article discusses the problems of ensuring the necessary comfort for humans in low energy buildings. The comfort in NZEB building should be treated in a multi-criterion manner. The article presents the theory and results of research related to providing the necessary comfort in four areas: thermal, air quality, acoustic and vibrational. An attempt has been made to optimize the seemingly unrelated issues, to check if an energy efficient building not only lowers costs of energy consumption but also is able to provide high quality of comfort.

Introduction of nearly zero energy building standard (NZEB) in the European Union member countries has become a revolution in civil engineering. This type of buildings are characterized by a very strict approach to design, construction and use, especially in the aspect of energy consumption.

The standard of NZEB buildings is determined by a very low level of energy consumption during exploitation and by high thermal protection of the building envelope. To reach such parameters of the NZEB buildings, the process of designing and construction should be entrusted to experienced specialists who are still missing on the Polish market. The process should be carried out in an integrated manner, with the participation of specialists from different fields.

This is not the only problem in obtaining buildings of such high energy efficiency (NZEB). In the design process, you one cannot focus only on achieving minimum energy consumption, you must first take into account the human factor, i.e. the indoor climate in which the user of NCEB will stay.

The main part of the article is devoted to the analysis of the results of "in situ" test carried out in the building of Malopolskie Laboratory of Energy Efficient Building.
"In situ" research are the basis for demonstrating in the experimental demonstration of relationships and parameters influencing the human perception of comfort in the NZEB buildings. Because the topic is a broad, in this article, the Authors focused on research of thermal and vibration comfort.

Especially vibrational part of the indoor comfort is often neglected. Meanwhile, our cities are developing, more and more infrastructure is being built there, and therefore people are exposed to the harmful effects of vibrations, for example transport vibrations. At the same time, awareness of health risks resulting from long-term exposure to vibrations is still low in society and among designers.

Keywords: In-situ measurements; thermal comfort; vibrational comfort; indoor climate.

Biography:

Alicja Kowalska-Koczwara, Professor of Cracow University of Technology, Faculty of Civil Engineering. Employee of the Cracow University of Technology, Faculty of Civil Engineering as professor. In 2015 – Civil Engineer, 2016 –Master of Science and 2020 – PhD, at Cracow University of Technology, From 2005 working at the Cracow University of Technology and participating in scientific and industrial projects like Horizon2020 MEZeroE, research and development on human perception of vibration in buildings, structural dynamics, vibroacoustics. Author of 79 publications considering noise and vibrational comfort. The scientific interest is more holistic approach to human comfort in buildings considering noise and vibration simultaneous occurrence. She has skills and expertise in human perception of vibrations in buildings, non-structural elements influence on dynamic characteristic of the building and in sustainable development. She is also an author of many expertise for railways or Warsaw Metro.

Optimizing Efficiency and Reliability Power Distribution Lines: A Study on Conductors and Loss Reduction Strategies

Sude Kozalioglu, Necati Keskin
R&D Department, ADM Electricity Dis. Inc., Turkey

Abstract:

The section covering support points, poles, their foundations, overhead conductors, conductor hardware, insulators, insulator connecting elements, and grounding collectively constitute the overhead lines, which facilitate high-voltage power transmission. For high-voltage overhead lines, the selection of conductors for both energy transmission and mechanical suitability is crucial. Conductors are spirally stranded to provide necessary flexibility and prevent breakage due to vibrations at suspension and tension points. In spiral-stranded conductors, current flows within the spiral due to dirt and oxide layers on the surface of each strand, leading to higher resistance, inductance, and thus, inductive reactance compared to non-spiral conductors of the same cross-section and type. To reduce inductance increase, layers are made concentrically in opposite directions. When selecting conductors, both electrical effects and mechanical structure affecting electricity transmission must be considered. Mechanical structure impacts insulators and poles and should be considered alongside electrical values. The selection of conductors should consider factors like energy loss, optimal cost, voltage drop, heating conditions, and corona loss. Faults due to conductor breakage occur in various forms, potentially causing significant damage and interruptions in the grid. Therefore, immediately addressing broken conductors by adding extensions to rectify faults and restore energy is crucial. Various methods, including twisting conductors together or using a joint sleeve, are employed for conductor extension. While manually extending conductors without additional tools provides a quick solution, it can lead to increased interruptions and technical losses due to surface roughness, conductor entanglement, and sharp ends. While shorter conductor lengths result in relatively lower energy losses, this doesn't apply to distribution networks covering kilometers of medium and low-voltage lines, including transformer stations and end-users. Acceptable total transmission line loss is typically 50 kW/km, primarily stemming from ohmic losses, with corona losses ranging from 0-20 kW/km, particularly increasing with voltage fluctuations.

These losses result in approximately 2-3% of the electricity transmitted through the distribution network being consumed annually. Distribution line losses range from 26.1-86.4 kW/km for overhead lines and 42.8-75.7 kW/km for underground lines at 0.4 KV. Through this study, a practical solution will be developed to reduce losses by creating a cast-type product group that allows for the convenient assembly of pointed, rough, faulty joint locations under energized or de-energized conditions.

Keywords: Conductors; lossless joint; loss reduction; electrical efficiency.

Biography:

Sude Kozalıoğlu was born in Denizli, Turkey in 1995. During her university education, she participated in projects supported by TUBITAK and was selected as one of the top 20 entrepreneurs by the 'Turkey Covid19 Common Mind Platform' due to her work during the pandemic period. In 2021, she graduated from Eskişehir Osmangazi University with a thesis titled 'Portable AC Power Supply with Solar Energy'. She previously held various positions in companies working on the installation and infrastructure of renewable energy sources, and currently works as an R&D engineer at ADM Electricity Distribution Company. She conducts research on machine learning, artificial intelligence, deep learning, and computer vision. Throughout her career, she has published academic studies on national/international platforms. In these studies, she focuses on developing innovative and sustainable solutions to contribute to sustainable growth, and increasing energy efficiency in the use, transmission, and distribution of energy sources by leveraging current trends.

Using Completed of the Economic Life Lithium-Ion Batteries in Energy Storage Systems

Baris Cetinkaya, Andac Kilic, Yahya Atilgan
R&D Center Directorate, ADM Electricity Distribution Company, Turkey

Abstract:

In contemporary times, energy storage systems play a pivotal role in enhancing the efficiency of electricity distribution networks and ensuring energy continuity. In this context, the recycling of disused lithium batteries for utilization in energy storage systems holds significant promise both environmentally and economically.

This article presents a pilot study aimed at improving the service quality of electricity distribution companies and reducing costs by recycling disused lithium batteries for use in energy storage systems. The scope of the pilot study involved examining similar practices abroad, designing a new battery pack, and preparing a prototype. Following the prototype's preparation, the performance of the batteries was optimized, and real-time reporting of performance metrics on the electricity distribution grid was facilitated.

Technically, the operation of system components is detailed extensively. Particularly, emphasis is placed on managing the charging and discharging processes of the batteries and the development of a Battery Management System (BMS) circuit board used in the system.

In conclusion, findings from the pilot study demonstrate the feasibility and efficacy of recycling disused lithium batteries in energy storage systems. This approach could serve as a significant step towards enhancing the efficiency of electricity distribution networks while realizing economic and environmental benefits by reintegrating disused batteries into the economy.

Keywords: Energy storage systems; recycling lithium ion batteries; sustainability.

Biography:

Baris Cetinkaya is currently working as a Technology Development Engineer at ADM Electricity Distribution Company.

Fault Identification Methods in Electrical Systems: Examination and Applications of Bridge and Pulse Reflection Measurement-Based Approaches

Necati Keskin, Sude Kozalioglu
R&D Department, ADM Electricity Dis. Inc., Turkey

Abstract:

Initially used for power distribution, overhead distribution lines have evolved due to increasing energy demands and environmental concerns, leading to widespread adoption of underground cables. While offering advantages, underground cables pose challenges such as structural damage or weakness resulting in faults. Efforts to detect faults in underground cables started early, employing methods like the Murray Loop Bridge method, which relies on balanced resistors in a resistance bridge to identify fault points. The emergence of radar technology in the 1930s revolutionized fault detection in underground cables. Time Domain Reflectometry (TDR), akin to air radars, reflects signals sent into the cable to determine fault distances. Subsequent studies focused on improving TDR's effectiveness. TDR can be applied to faults with resistance values up to ten times the cable's characteristic impedance. In the 1970s, passive methods based on examining traveling waves from arcing at fault points were developed. One such method is the impulse current method by Dr. P. F. Gale, involving examining arc reflections through an inductive coupling element. Later, studies involved detecting reflected current pulses using a differential amplifier, enabling fault determination without operator interpretation. This method measures applied and reflected currents via high-frequency transformers, calculating distances using a differential amplifier-controlled counter. Efforts have aimed at software-based fault detection to reduce reliance on operator experience. The Real-Time Expert System by K. K. Kuan and Prof. K. Warwick analyzes measured pulses based on reflection measurements, reducing the need for operator expertise. A similar study is the adaptive filtering system by Hathaway Systems, distinguishing connection points from fault points within pulse reflection data. An obstacle in the impulse current method is the variation in damping rates of components due to high-frequency reflected current pulses and different cable resistances, distorting the current pulse. The method by Sun and Wei uses wavelet analysis to filter noise from the current signal, achieving approximately 2% accuracy in measurements. The challenges faced

in the impulse current method led to the emergence of a more robust method known as the secondary impulse method. This method, also known as the arc reflection method, involves detecting the short circuit created at the fault point with a low-voltage pulse reflection signal sent to the cable when an arc occurs at the fault point. This method is effective as it is not affected by transient conditions at the fault point. Currently, faults are commonly detected using this method. This study examined various fault detection methods to investigate the most efficient fault detection method.

Keywords: Fault detection; bridge measurement; pulse reflection measurement; types of faults.

Biography:

Necati Keskin was born in Denizli, Turkey in 1995. He graduated from the Mechatronics Engineering department at Pamukkale University in 2017. During his university education, he worked on automation systems, computer technologies, and computer-aided designs, and participated in projects in the field. He began his professional career after graduation. In 2020, he started Master's degree in Mechatronics Engineering at Pamukkale University to further support his professional and academic development. Currently, he works as an R&D Engineer on projects at ADM Electric Distribution Company. These projects involve innovative solutions to increase efficiency in electrical distribution systems. He specializes in technology and software development and leads projects in these areas. Throughout his career, he has published academic studies on national and international platforms and delivered presentations at numerous conferences and seminars, accumulating extensive experience in the field. He continues to work towards providing innovative solutions in electrical distribution and control systems and contributing to the industry.

State of the Art of Biogas Enrichment with Hydrogen Aiming at the Introduction of the Technology in Brazil

Ederaldo Godoy Junior, Raquel Marques Carrico Ferreira Martins
1. University of Taubate, Brazil
2. Federal University of Sergipe, Brazil

Abstract:

The present work aimed to survey the state of the art of biogas enrichment with hydrogen (H2) for possible introduction in Brazilian enterprises through favorable legislation for the biogas/biomethane production chain. Traditional systems for purifying biogas into biomethane use purification systems where the filter elements, after saturation, become clogged and are neither reusable nor recyclable, so that they become an environmental liability for waste biomass biomethanization projects, both agricultural as well as industrial and sanitation. Therefore, it is essential that this process becomes more eco-efficient and sustainable. In this way, the enrichment of biogas with hydrogen has stood out as an aspect of promoting the production of more biomethane, in this case synthetic, via the catalytic reaction between the CO2 present in the biogas with the injected sustainable hydrogen, thus forming more biomethane molecules. . The consolidation of eco-efficient biomethane production technologies that meet ANP resolutions in a sustainable way, from biogas enriched with sustainable hydrogen, for injection of green biomethane molecules and/or sustainable hydrogen to comply with the new Gas Law, the Law No. 14,134, of April 8, 2021 and the Hydrogen Law Projects, PL No. 2,308, PL No. 3,452 and PL No. 4,907, of 2023, which establish the legal framework for low-carbon hydrogen, as well such as the production of renewable energy with socio-environmental responsibility, meeting the sustainable development objectives (SDGs), without waste, and also, producing biofertilizers with by-products for the production of plant-based foods, whether in partnership with family farming in agroforestry systems in recovered degraded areas , or in other agricultural modalities, is very timely and associates the energy transition with global decarbonization, as well as empowerment in agriculture at all levels. It can be concluded that the injection of sustainable hydrogen into biogas is a technology for energy enrichment of biogas, global decarbonization, as part of the hydrogen can react biochemically with CO2, producing more CH4, thus sequestering CO2, and also , this is an eco-efficient variant of H2 storage in the form of

a green biomethane molecule for the production of electrical energy, injection into natural gas networks or use as vehicle biomethane, thus generating new revenues in the product market and with the by-products with socio-environmental responsibility.

Keywords: Biogas; hydrogen; biogas enrichment; biomethane synthesis.

Biography:

Ederaldo Godoy Junior, Professor at University of Taubate UNITAU, has Mechanical Engineer, Master in Environmental Sciences and Doctor in Energy, Researcher DTA CNPq and EPE, develops eco-efficient systems for environmental protection, sustainable energy, food and use of biofertilizer in agroforestry systems. He received more than 22 international awards.

LCOE for Different Incentive Scenarios for Renewable Energies in Colombia

Fernando Villada Duque
Universidad de Antioquia, Colombia

Abstract:

Renewable energy (RE) installations have experienced rapid growth in recent years. According to the International Renewable Energy Agency (IRENA), RE grew by a record of 295 GW in 2022 and account for more than 80 percent of all added capacity during this year, sharing about one third of total electricity generation.

These new installations have not been equally distributed across the world, because of the higher cost of the electricity generated compared with conventional plants. Countries with a larger proportion of renewable energy capacity, have implemented programs with public subsidies and other incentives to promote new projects.

The potential for renewable energy deployment in Colombia is estimated to be large for wind resources, solar PV, biomass, and water resources suitable for small runs of river hydropower plants. Nevertheless, the share of renewable energy in the electricity basket is still tiny due to the delay of the government for establishing incentives.

Fortunately, the Colombian parliament approved the renewable energy regulation, which encourages the construction of new clean energy projects. This regulation, approved in the Act 1715 of 2014 provides a series of incentives covering income tax reduction during the first five years of operation, accelerated depreciation, and exemption of tariffs on some imported equipment; in order to make these technologies competitive with conventional power plants.

A proposed tax adjusted Levelized Cost of Electricity (LCOE) to analyze the effects of the new regulation for renewable energy in Colombia is presented in. The results show some restrictions for small or new business from applying for investment tax reductions during the first five years of operation. The paper proposes two complementary mechanisms to allow small business ventures.

The development plan of the Colombian government for the period 2018-2022, approved in the Act 1955 of 2019, considered the restrictions for small or new business found in reference. Specifically, it increased from 5 to 15 years the possibility of investment tax reductions.

Reference proposes a methodology to determine the areas with the best characteristics to developed wind and photovoltaic solar farms in Colombia, using Geographic Information Systems that depict the distribution of the physical, biotic, economic, cultural, and political characteristics restricting or conditioning the implementation of these projects. As a result, La Guajira region shows the highest potential for RE projects with LCOE around 60 US$/MWh.

The effects of the regulation to promote the development of renewable energies in Colombia, and the modifications approved in the development plan of the government for the period 2018-2022 are analyzed in this paper. The LCOE method is used to determine the change in the cost of generating electricity from wind, solar PV, biomass, and small hydro projects for different scenarios. As a result, the LCOE can be reduced up to 49.03 US$/MWh for wind energy and 49.53 US$/MWh for forest biomass which are cheaper than those achieved in previous studies and are sufficient to attain the grid parity.

Keywords: Renewable energies; levelized cost of electricity; public subsidies.

Biography:

Fernando Villada has a degree in Electrical Engineering and an MBA from Universidad Tecnologica de Pereira (Colombia) in 1987 and 1995 respectively. He completed his PhD in 2001 from Universidad Politecnica de Catalonia (Spain). He is currently Research Professor at Universidad de Antioquia (Colombia) in the areas of Renewable Energies and Energy Markets. He has published more tan 100 papers in international journals.

Regression Relationship between the Cold Flow Properties and Distillation Profiles of Sustainable Aviation Fuels at Hydroprocessed Ester and Fatty Acid

Hwayeon Jeon
Korea Petroleum Quality & Distribution Authority, South Korea

Abstract:

In order to meet global greenhouse gas emissions targets, set by various regulatory and government authorities, the International Civil Aviation Organization (ICAO) adopted a long-term global aspirational goal (LTAG) for international aviation of net zero carbon emissions by 2050, in support of the Paris Agreements temperature goal of 1.5 °C/year. To reduce carbon emissions in the aviation industry, aircraft structural technology, new route development, GHG trading systems, and alternative fuels are being promoted. For this reason, there is increasing interest in researching and developing biomass, such as animal fat, palm fatty acid, and tallow based sustainable aviation fuel (SAF), to meet the rising demand of the aviation industry and address environmental issues. The prediction of post-blend quality standards for approved bio- and petroleum-based jet fuels through statistical techniques such as correlation analysis represents a significant challenge, especially given the need for drop-in. Our aim was to predict the cold flow properties using the distillation profile results obtained from Simulated Distillation (SIMDIS) according to the carbon number and chemical compositions of bio-jet fuel using hydroprocessed ester and fatty acid (HEFA) bio-jet fuel, which is the most commonly used SAF produced from palm oil as a raw material in Korea using hydrotreatment and upgrading, and hydrocarbon reagents that include C8, C10, and C12 carbons and five main chemical groups (n-paraffin, iso-paraffin, naphthene, olefin, and aromatic) for blended jet fuel. In this study, 45 samples of bio-jet fuel were prepared by blending 10%, 20%, and 30% chemical compound with C8, C10, and C12, respectively. The freezing point depends on the chemical composition, such as the content of n-paraffin and naphthene. However, it was found that the C8 and C10 contents were close to the jet-fuel A-l quality requirement (at -47 °C), except for C8 iso-paraffin. Even for C12, the aromatic and olefin contents met the ASTM quality requirements. The kinematic viscosity at -20 °C indicates that for the C12 samples, the kinematic viscosity at -20 °C increased in the following order: naphthene > n-paraffin > olefin

> aromatic (except for iso-paraffin). The correlation analysis between the compositions and distillation profiles revealed that the freezing point had a strong positive positive correlation with a 40 to 70% recovery temperature and a weak negative correlation with final boiling point. The correlation between the freezing point and 40% to 80% recovery temperature was strongly positive for the naphthene content. In addition, the analysis of the carbon numbers showed a significantly positive strong correlation between the initial boiling point and the 10% to 30% recovery temperature for the iso-paraffin content. Subsequently, by classifying the sample components in terms of chemical components, content and carbon number, each equation for the low temperature properties was calculated using single liner regression based on the obtained SIMDIS data.

Keywords: Sustainable aviation fuel; kinematic viscosity; freezing point; regression analysis.

Biography:

Hwayeon Jeon works senior researcher at the R&D Department, Research Institute of Future Technology, Korea Petroleum Quality and Distribution Authority (K-Petro), Cheongju, Republic of Korea. He received a B.E. degree in Environmental Engineering from Korea University, Republic of Korea in 2012. Currently, he is Ph.D. Candidate in Environmental Engineering at Korea University in 2023. His research interests include standards and specifications for renewable biomass-derived energy and pyrolysis oil and his main work is R&D and quality testing for petroleum and alternative fuels. In 2020, at the 2020 academic conference of the Korean Society of New and Renewable Energy, it was awarded the excellent thesis presentation award through the study on the fuel quality characteristics of bio-heavy oil for domestic power generation.

Scaling Renewables Energy and Storage through Digital AI Technology

Maher Chebbo
Managing Director for Europe at Univers, France

Abstract:

The transition away from traditional energy sources to renewables is one of the biggest challenges the energy sector must face at this time. The success of this transition is crucial to the reduction of greenhouse gas emissions and the worst effects of climate change.

In 2050, EU carbon-neutral and especially renewable energy alternatives to fossil fuels are to be implemented for all energy needs. The use of crude oil for all domestic, commercial, industrial, buildings, cities and mobility's needs is marginal thanks to the substitution of crude-oil with Renewables (wind, solar, hydro, hydrogen, geo-storage, biomass, biofuels), Storage and other energy sources, such as CO2-free electricity for cars, trains, urban buses and delivery trucks.

Digital & AI Technology focusing on CleanTech, like EnOS platform, support these massive & immediate investments towards the journey to Net Zero and accelerate the transition to a more sustainable world by combining energy and economics data meeting an optimal LCOE.

It enables the convergence of technology, infrastructure, energy, carbon and finance business models for continuous decision-support in the Net Zero journey.

Keywords: Artificial intelligence; smart renewables; smart storage; carbon management.

Biography:

Maher acted in Global and EMEA Senior Executive roles within large Corporates (GE Digital, SAP, Cap Gemini) as well as successful Startups (accenta.ai), Digital, AI and Data Science, Energy, Telecommunications, Manufacturing, Mobility & Cleantech (Renewables, Batteries

& BESS, Green Hydrogen, Green Ammonia, Smart Cities, Smart Building, Geo-Storage, EV Charging, Carbon Management). He is currently Managing Director for Europe at Univers.

Maher is a non-Executive Board member of Elisa, Telecom operator of Finland.

Maher have been President of ESMIG (European Smart Metering Industry Group), is member of the Council of Engineers for Energy Transition of UN (CEET) and is chairing the digital batteries task force at Batteries Europe.

Maher areas of expertise are AI, ML, AIOT, Blockchain, SmartGrids, Cleantech, Smart Renewables, Smart Cities, SaaS, PaaS, Cloud, AI, AIOT, ML, Cyber Security, and Data Science.

Comparative Study on Green Hydrogen Renewable Energy and Lithium-Ion Batteries Towards Circular Economy - Challenges and Opportunities

Nevenka R. Elezovic
University of Belgrade – Institute for Multidisciplinary Research, Center of Excellence for Green Technologies, Serbia

Abstract:

Energy transition is going on all over the world – from fossil fuels to renewables: wind, solar, hydrogen and lithium-ion batteries based mainly. Almost 70% of today energy consumption is still based on fossil fuels. It has already caused undesirable effects: environment pollution, greenhouse effect, raising average Earth temperature, the climate changes, biodiversity disorder and natural disasters. The alternative power sources have been developed, but still not enough. United Nations recognized problem during seventies years of twenty century and global actions have taken. European Council established main targets in the frame of Climate and Energy Package. Zero-carbon solutions are increased, especially in transport sector, new business solutions and new markets, as well.

Green hydrogen is considered as environmental friendly, zero emission energy fuel to be used in fuel cells power sources, with many prospective practical applications in stationary and transport devices. So, green hydrogen fuel cells as zero-emission technologies are needed, to achieve sustainable economic development and circular economy. The advantages of these environmental friendly power sources are: zero pollution–only water steam, silent working conditions, less friction losses. Moreover, producing green hydrogen by water splitting starts from water and at the end of cycle only product is water, as well. On the contrary, lithium-ion batteries mass commercialization induced definitely many problems for environment, as well as other undesirable consequences. Thus, these two different renewable energy types were compared - advantages and disadvantages of both were discussed from different aspects: technological, economic and influence on environment.

Keywords: Renewable energy; green hydrogen fuel cells; lithium-ion batteries; zero-emission.

Biography:

Dr. Nevenka R. Elezovic completed her PhD in 2005, from University of Belgrade. She is currently Research Professor at the Institute for Multidisciplinary Research, University of Belgrade. Her research interests include: Nanostructured materials and alloys for low temperature fuel cells and water electrolysis application - green energy production. Since 2013 she has been serving as representative of Serbia and member of the European board in European Academy of Surface Technology:

She has published more than 50 papers in reputed peer reviewed journals of eminent Publishers such as Elsevier, Royal Society of Chemistry, The Electrochemical Society and more than 70 conference papers. She has been serving as a reviewer for: Energy and Environmental Science, Applied Materials and Interfaces, Journal of Materials Chemistry A, Electrochimica Acta, Applied Catalysis B: Environmental, RSC Advances, PCCP, Chemical Communications, Journal of the Electrochemical Society, International Journal of Hydrogen Energy, as well as adjudicative reviewer for Energy and Environmental Science, Journal of Materials Chemistry A. She has given numerous invited lectures at the International conferences, recently at International Summit on Conventional and Sustainable Energies, 2018 Orlando, Florida, USA, Global Experts Meeting on Frontiers in Green Energy and Expo, 2019 Rome, Italy and Materials, the Building Block for the Future 3rd AAAFM-UCLA conference, 2021, International summit on non-renewable and renewable energy, 2023 London, UK. The main current research area is based on synthesis and characterization of advanced functional materials for hydrogen production and proton exchange membrane fuel cells - to diminish classical fossil fuels usage and CO2 emission.

Validation and Optimization of Vertical Axis Wind Turbine

Haitham Aboshosha
Toronto Metropolitan University (TMU), Canada

Abstract:

This research explores the behaviour of Vertical Axis Wind Turbines (VAWT) using Large Eddy Simulation (LES) through Computational Fluid Dynamics (CFD) with moving mesh. By simulating the turbine at various Tip Speed Ratios (TSR) and comparing the generated torque and power coefficients with published wind tunnel data, the study demonstrates that LES-based CFD simulations are practical and effective for evaluating wind turbine performance. A validation study confirmed the accuracy of these simulations, showing their potential for optimizing wind turbine design. Furthermore, the research introduces innovative modifications to the VAWTs to enhance performance in low wind speed and turbulent urban areas. These modifications include a system to prevent wind interference with the turbine's returning blades and accelerate airflow. Furthermore, gaps within this system are introduced and optimized to enhance efficiency, a new blade shape is utilized within the rotor that harvests lift and drag aerodynamic forces simultaneously, as well as the effect of a large shaft within the rotor for generator installation is investigated. These enhancements led to a significant increase in efficiency by a factor of 2.3.

Keywords: Vertical axis wind turbine; large eddy simulations; computational fluid dynamics (CFD); moving mesh.

Biography:

Dr. Aboshosha has recently joined Ryerson University, where his research focuses on evaluating the response of structurers to wind actions employing experimental wind tunnel testing, Computational Fluid Dynamic (CFD) simulations, Finite Element and mathematical modeling. In addition to developing and validating computer models for indoor air quality, stack effect for air infiltration in tall buildings, pedestrian level winds.

Before joining Ryerson, Dr. Aboshosha worked at the Boundary Layer Wind Tunnel at the Western University (Formerly University of Western Ontario), where he conducted wind tunnel, Computational Fluid Dynamic (CFD) simulations and site measurements for iconic tall buildings and long span bridges around the world. Notable project he contributed to include (i) Dubai Creek Tower (Would be the tallest tower in the world by 2020), Dubai, UAE, (ii) New Champlain Cable Stayed Bridge in Montreal, QC, Canada, (iii) Ship Channel Cable Stayed Bridge in Houston, Tx, USA, (iv) Z5L Transmission line, Hydro One, Ontario, Canada (v) Noor solar farm (one of the largest solar farm worldwide), Ouarzazate, Morocco, and many other projects related to structural performance, air quality and natural ventilation.

Currently, Dr. Aboshosha and his research team are collaborating with the other faculty members at Ryerson and other Universities to utilize Wind Tunnels hand by hand with CFD simulations to further study challenging wind-structural and building engineering problems.

Human-Machine Interface of Today: How to Integrate Expert Knowledge with Equipment Data and Set-up Asset Predictive Maintenance

Valentina Litovchenko
Co-Founder and CEO of Applied Smart Industry, Spain

Abstract:

The advent of the digital era has fundamentally transformed the landscape of industrial operations, particularly in the realm of predictive maintenance. As machines become more intelligent and interconnected, the human-machine interface (HMI) plays a pivotal role in optimizing performance, ensuring reliability, and minimizing downtime. This paper explores the human aspects of predictive maintenance within the framework of modern HMIs, emphasizing the critical interplay between human operators and advanced technological systems.

The integration of predictive maintenance strategies with sophisticated HMIs has enabled unprecedented levels of efficiency in monitoring, diagnosing, and addressing potential equipment failures. However, while technological advancements have driven significant progress, the human factor remains indispensable in the successful implementation and operation of these systems. This paper argues that the effectiveness of predictive maintenance is not solely dependent on the accuracy of predictive algorithms or the capabilities of the hardware but equally on the design, usability, and user engagement with the HMI.

The focus of this paper is on the human-centric challenges and opportunities presented by predictive maintenance in industrial settings. It investigates how the user interface design, cognitive load, and decision-making processes influence the efficacy of predictive maintenance systems. By examining case studies and real-world applications, the paper identifies best practices for designing HMIs that enhance operator understanding, reduce errors, and foster a proactive maintenance culture.

Key human aspects discussed include the need for intuitive and adaptive interfaces that can accommodate operators with varying levels of expertise. The paper also highlights the im-

portance of training and continuous education to ensure that human operators are not only comfortable with the technology but can also leverage it to its full potential. Additionally, the paper addresses the psychological and ergonomic factors that impact operator performance, such as the stress associated with interpreting complex data and the potential for over-reliance on automated systems.

In the context of the rapidly evolving digital landscape, the paper argues that the future of predictive maintenance hinges on the seamless integration of human intuition and machine intelligence. It advocates for a collaborative approach where human operators are viewed as partners in the maintenance process rather than mere overseers of automated systems. This partnership is essential for the continuous improvement of predictive maintenance strategies and the prevention of system failures that could have catastrophic consequences.

Moreover, the paper explores emerging trends in HMI technologies, such as augmented reality (AR) and artificial intelligence (AI), which have the potential to further enhance the human role in predictive maintenance. It considers how these technologies can be leveraged to provide real-time support, improve decision-making accuracy, and reduce the cognitive burden on operators.

In conclusion, this paper underscores the importance of a human-centered approach to the design and implementation of HMIs in predictive maintenance systems. By prioritizing the human element, industries can unlock the full potential of digital technologies, leading to more effective, efficient, and reliable maintenance practices. This approach not only enhances operational efficiency but also contributes to a safer and more resilient industrial environment in the digital era.

Keywords: Predictive maintenance; digital strategy; human-machine interface.

Biography:

Ms. Valentina is a seasoned professional with over 25 years of experience spanning various roles in the Oil & Gas and Chemical sectors across different countries. Over the past decade, Valentina has delved deeply into the realm of Digital Asset Management, fascinated by the

intricate interplay between humans and machines. Her passion for this field has led her to explore and experiment with solutions for predictive maintenance, leveraging cutting-edge technologies to optimize operational efficiency. Driven by her commitment to sustainability, Valentina has made significant contributions to the renewable energy sector. She played a pivotal role in the development of wind energy by founding a start-up that specializes in anti-icing coating for turbine blades, thereby enhancing the performance and longevity of wind turbines. Beyond her technical prowess, Valentina is also deeply passionate about yoga philosophy. Drawing upon the principles of yoga, she adeptly incorporates mindfulness and holistic approaches to improve the performance of teams and individuals alike. With her diverse skill set, unwavering dedication, and innovative mindset, Valentina continues to make a positive impact in both professional and personal spheres, embodying a steadfast commitment to excellence and sustainability.

Diagnostic Analysis of Aging Temperature and Thermal Stability in Lithium-Ion Batteries

Kenza Maher
Qatar Environment and Energy Research Institute (QEERI), Hamad Bin Khalifa University (HBKU), Qatar

Abstract:

The degradation of electrochemical performance in lithium-ion batteries due to repeated cycling is a well-documented phenomenon. However, the impact of aging on the thermal properties of these batteries remains less understood and is crucial for ensuring their safe and reliable operation. Thermal transport degradation within the battery cell can lead to increased temperatures, potentially accelerating aging and even triggering thermal runaway events.

This presentation focuses on a comprehensive diagnostic analysis of the thermal stability, heat generation, and thermodynamic properties of electrodes in lithium-ion battery cells subjected to various aging temperatures. The study aims to elucidate how aging affects these critical thermal parameters and their interplay within the battery system.

Our findings reveal significant insights into the "aging memory effect", where thermal properties are altered and stabilized over time as a result of aging processes.

Understanding the complex relationship between aging temperature and thermal stability is essential for developing strategies to enhance the safety, reliability, and performance of lithium-ion batteries. This diagnostic analysis contributes valuable knowledge toward advancing battery design and management practices, ultimately facilitating the development of safer and more efficient energy storage solutions.

Biography:

Dr. Kenza Maher serves as a Scientist at the Qatar Environment and Energy Research Institute (QEERI) since January 2015. With over 12 years of dedicated experience in battery energy

storage R&D, her expertise lies in crafting secure and dependable materials for both Li-ion and Na-ion batteries. She's also a driving force behind pioneering diagnostic approaches and protocols crucial for verifying the reliability and performance of battery systems, cells, and materials.

Previously, Dr. Maher held pivotal roles such as Research Fellow and Project Leader at the Joint Future Mobility Research Lab in collaboration with the BMW Group and Nanyang Technological University in Singapore. During this tenure, her primary focus was on ensuring the safety and diagnosing BMW electric car batteries, addressing the critical issue of thermal runaway hazards in vehicles.

Dr. Maher earned her PhD from Cadi Ayyad University in Morocco in January 2011, where her research significantly contributed to the advancement of novel phosphate and oxide materials tailored for high-energy lithium-ion batteries. Complementing her academic journey, she conducted research as a Guest Researcher at the Angstrom Laboratory, Department of Material Chemistry, Uppsala University in Sweden.

Post-PhD, she expanded her insights at the Energy Research Institute of Nanyang Technological University in Singapore, contributing to the innovation of a groundbreaking method for assessing battery state of charge (SOC) and state of health (SOH) through thermodynamic properties. Subsequently, she embarked on a journey with TUM CREATE Ltd in Singapore, delving into the in-depth analysis of batteries' thermodynamic and kinetic attributes.

Recycling Spent Lithium Iron Phosphate Battery for Lithium Recovery

Fu-Shen Zhang
Chinese Academy of Sciences, China

Abstract:

Lithium iron phosphate (LiFePO4, LFP) battery has attracted great attention in recent years for its advantages in cost, cycling performance and safety performance. The recycling of spent LFP battery has posed severe challenge along with the increasing market share of LFP battery. The current study provides a green, economical and effective approach for selective recovery of lithium from spent LFP battery by inducing electron transfer through mechanochemical activation, and the residue was simultaneously transferred into functional material LiFe5O8. In the mechanochemical process,, only ferric chloride was used as a grinding agent. Under optimal conditions (FeCl3:LiFePO4 mass ratio of 1.2:1, rotary speed of 600 rpm, and reaction time of 30 min), more than 97 wt% of lithium in LFP cathode materials was selectively recovered. The recovered lithium was in the form of carbonate with a purity of 99.9%. In the process of mechanochemical activation, LFP cathode materials was activated by mechanical forces such as friction, extrusion, shearing and impact. Then the electrons in the LFP were transferred to ferric chloride, and the LFP was oxidized to iron phosphate, which still maintained the olivine structure. Therefore, lithium could extract from the olivine structure of iron phosphate. Through economic analysis, the income from recycling a ton of spent LFP batteries is $4,959. In addition, the lithium ferrite (LiFe5O8) could also directly prepare by the leaching solution after mechanochemical activation had good magnetic properties, in which the saturation magnetization (Ms) was 49.2 emu/g. Therefore, this study developed a green and economic process for the resource utilization of spent LFP battery.

Keywords: Waste battery; lithium recycling; mechanochemical activation; electron transfer.

Biography:

Fu-Shen ZHANG, PhD, professor, is the head of Solid Waste Treatment and Recycling Group at Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences. He is also the distinguished professor of University of Chinese Academy of Sciences. He obtained his PhD in the field of environmental engineering from Tohoku University (Japan), and carried out post-doctoral research at the University of Michigan (USA). He was also JSPS research fellow at Nagoya University in Japan. Professor Zhang's research addresses effective recycling of solid wastes, including functional materials development from solid waste, valuable matters recovery from solid waste and pollution control of solid waste, typically highlights e-waste, polymer waste and industrial waste. Professor Zhang has published more than 100 peer review articles and obtained more than 20 patents.

Conceptual Design of the Architecture to Implement Energy Transactions in Local Energy Markets: Integration of Renewables and Distributed Energy Resource

Manuel Alcazar-Ortega
Polytechnic University of Valencia, Spain

Abstract:

Optimization of Distributed Energy Resources (DER) management is moving to explore new technical and commercial relationships that may be established between them (including distributed generation, local energy storage and demand) and their trading in Local Energy Markets (LEM). Therefore, the implementation of LEM requires a set of agents interacting in diverse ways, which entails the complexity of integrating renewable energy sources (RES) and DER. The nature of renewables, which are intrinsically variable and unpredictable, makes necessary the design of mechanisms to guarantee the power quality and security of the grid. Moreover, a transparent process to implement energy and capacity transactions needs to be defined to guarantee the confidentiality and security related to such a basic and sensitive good as electricity.

This research is focused on the conceptual design of the architecture necessary to implement energy transactions in LEM, identifying the different agents that would be necessary to play the different roles in this kind of market and the relationships between them. In this context, one of the main actors is the prosumer, located at the end of the chain as energy consumer, but also as RES supplier and energy services provider. Therefore, one of the main tasks nowadays is to determine the technical and economic conditions to enable this kind of agent by means of appropriate information, training, knowledge and technology to allow it participating proactively in this class of market.

A significant role to be played by the consumer is that of service provider for the operation of the system, which would consist of the ability to fully or partially manage the amount of energy demanded from the grid. This ability can be very significant in the case of consumers

who have energy storage or electric vehicle charging devices. Using these devices, as well as other consumption that could be managed, the consumer could dynamically offer other agents variations in their usual consumption pattern, which could be very useful for the operation of the electrical system.

The implementation of functionalities of LEM also entails the active participation of other agents, such as network operators, energy traders, virtual power plants or load aggregators, which will need also systems, protocols and tools to act co-ordinately.

Keywords: Distributed energy resources; local energy markets; renewable energy sources; smart grids.

Biography:

Dr. Alcázar-Ortega is an Associate Professor and Deputy Director at the Department of Electrical Engineering of the Polytechnic University of Valencia (UPV), Spain. Previously, he was an Assistant Professor at the State University of New York at Buffalo, USA, where he was also Director of Smart Energy Systems and Demand Response at the Power Center for Utility Explorations. Moreover, he worked as electrical engineer at the company RWE Deutschland AG in Germany. At UPV, he has been linked to the Research University Institute for Energy Engineering from 2004 to the present. There, he has carried out research activities through many different international projects in collaboration with transmission system operators, large and medium energy consumers, distributors, energy traders and regulators in Europe, the United States of America and different South American countries. Currently, he works on different lines of research, including the study of smart grids and micro-grids, the characterization of energy consumers and the active participation of demand in energy markets.

Decarbonization of Ports and Maritime Sector: Challenges, Opportunities and Effects of Disruptive Technologies to its Sustainable Development

Lina Montuori
Polytechnic University of Valencia, Spain

Abstract:

Ports and Maritime sectors are experiencing challenging times ahead mainly due to the zero net targets imposed by the International Maritime Organization (IMO) by 2050. Globally 11 billion tons of goods are transported by ship each year and the United Nations Conference on Trade and Development (UNCTAD) found that almost 40% of all cargo ships are powered by oil, coal, and gas. Renewable energies are considered the answer to meet the new industry goals of cutting greenhouse gases together with the employment of new fuels (methanol, hydrogen or liquefied natural gas) and the use of technological innovations (onshore power supply and electrification). In this framework, disruptive technologies as Artificial Intelligence, Machine Learning, Automation, IoT and edge computing among others are emerging as solutions able to replace manual tasks allowing improvements of the operation process in terms of efficiency, control and safety contributing to get sustainable development goals. Previous studies highlighted the maritime ecosystem is close to maturity but there are still several challenges to be addressed and opportunities to be explored.

This research study aims to provide an overview about the knock-on effect, disruptive technologies, are having on ports and terminals and how shifting from traditionally fuelled engines to electricity provision at berths can benefit ports and the neighbouring urban areas. Moreover, the role of Port Authorities as landlords/ grantors of port areas, as well as to privately owned terminals will be discussed as they are now called to action not only to maximize throughput volumes but also promoting sustainable patterns.

Finally, the backdrop of a patchwork of different regulatory frameworks that are varying from state to state across geographies in the globe will be pointed out together with a brief analysis of the main initiatives adopted by ports and terminals to push towards the end of fossil fuel-powered shipping.

Keywords: Maritime industry; sustainability; disruptive technologies; automation.

Biography:

Lina Montuori obtained her Ph.D. in Industrial Engineering and the MBA from the Polytechnic University of Valencia (Spain). Previously, she had received her B.Sc. and M.Sc. in Industrial Engineering from the University of Naples "Federico II" (Italy). In the energy sector, she worked at the Power Center for Utility Explorations of the University at Buffalo (USA) and she hold the position of Project Development Manager at the company Enel Rete Gas in Milan (Italy) and at Solar Group in Valencia (Spain). At present, she combines her work in Toshiba Mitsubishi-Electric Industrial Corporation with the position of Assistant Professor at the Department of Applied Thermodynamics of the Polytechnic University of Valencia. Furthermore, she is senior researcher at the Institute for Energy Engineering (IIE) with multiple and relevant publications in prestigious Q1 journals.

Design of a Biomass-Fueled Internal Combustion Engine

Gonzalo Suanes Foncea
Polytechnic University of Madrid, Spain

Abstract:

Currently our society is dependent on fossil fuels. Basic activities such as agriculture or transportation depend on oil. But the world's oil reserves will be depleted in a few decades. A suitable (and sustainable) alternative must be urgently developed. Biomass from crops and forest by-products is a renewable energy source that can replace the fuel needed for food production and (probably) heavy road transport. Unlike other proposed alternative fuels such as hydrogen, biomass is readily available and can be easily and safely stored and managed. But biomass burns in solid state, diesel or gas engines cannot be powered by it. For now, alternative fuels have been used, but a different solution is proposed: to develop an engine for the fuel that is currently available, biomass pellets.

The engine is being developed from old hot bulb engines that can burn a wide range of fuels, even very poor quality ones. The thermodynamic cycle has been studied and published (1) and different combustion chambers have been tested. A working prototype has been made from a single-cylinder diesel engine. A video of the prototype running and an abstract of the research, can be watched on X (2). A patent has been applied for on the combustion chamber design. A second article is in progress to publish how to apply the results of the research to a real engine.

(1). Energies | Free Full-Text | Definition of the Thermodynamic Cycle of a Biomass-Fueled Internal Combustion Engine (mdpi.com). https://www.mdpi.com/1996-1073/16/2/896.
(2). Gonzalo Suanes on X: https://twitter.com/SuanesGonzalo/status/1681603153135915009.

Keywords: Biomass; oil depletion; alternative fuels; combustion engine.

Biography:

Gonzalo Suanes is mechanical engineer from the Universidad de La Rioja. He is currently a PhD student of the Universidad Politecnica de Madrid (UPM). He joined the Spanish Army Corps of Engineers. He was head engineer in the deployment of the Spanish Field Hospital. Now, he is posted at Instituto Nacional de Tecnica Aeroespacial (INTA), being the head of Ballistic Test Laboratory.

Standard Study of the Technology and Safety Performance Evaluation on Emergency Core Cooling System Strainer

ZHU Jingmei, GONG Zhao, ZHU Minghua
China Nuclear Power Engineering Co., LTD, China

Abstract:

Emergency Core Cooling System (ECCS) strainer is the important equipment to ensure the effective and safe operation of ECCS, Containment Spray System (CSS) etc. after Pressurized Water Reactor (PWR) Nuclear Power Plants (NPP) accidents. Strainer design technology, test technology and relevant core cooling safety evaluation technology are important R&D work of nuclear power projects, and also one of the important contents of nuclear safety review. In the past decade's years, many countries carried out a lot of research work in this field, and made great efforts to solve related nuclear safety issues. However, there is still lack of a complete set of international standards to guide research, design and safety performance evaluation work associated to ECCS strainer. Therefore, it is necessary to establish a set of standards covering the performance evaluation of ECCS strainer in accordance with the requirements of nuclear safety regulation, combined with the research results and engineering practices of NPPs owners. The standards can be the basis and reference for the nuclear regulatory authorities and the NPP owners to have unified standards to carry out nuclear safety work, greatly improving work efficiency and reducing unnecessary contradictions in nuclear safety review work.

Based on the research results of the ECCS strainer and its nuclear safety performance evaluation and the nuclear engineering practice research conducted by the author, this paper proposes to establish a set of standards on ECCS strainer which covering debris source walkdown, upstream analysis, debris pressure drop test, chemical effect test, downstream effect (in-vessel) test and downstream effect (ex-vessel) analysis, and finally give out preliminary research results.

Keywords: Emergency core cooling system strainer; debris source; upstream analysis; debris head loss test.

Biography:

Ms. Jingmei Zhu is a highly experienced professional in nuclear engineering, boasting over three decades of expertise in the field. With a Bachelor's degree in Mechanical Design and Manufacture from Beijing Union University and a Master's in Nuclear Engineering and Technology from Tsinghua University, she has a solid academic background. Throughout her career, Ms. Zhu has held key positions in prominent organizations, including the Beijing Nuclear Industry Research & Design Institute and China Nuclear Power Engineering Co., Ltd. Her roles have involved designing nuclear power plants, overseeing operations, and addressing safety concerns. Ms. Zhu's extensive knowledge and contributions have earned her recognition as a Professorship Senior Engineer, underscoring her esteemed status in the industry.

Forecasting of Solar Irradiance and Wind Speed in India using Time Series and Machine Learning Models

Sarita
Birla Institute of Technology and Sciences Pilani, India

Abstract:

India is continuously increasing the production of renewable energy to meet the country's rising needs for energy. The present study concentrates on the forecasting of solar irradiance and wind speed at four selected locations in India, one from each state of Rajasthan, Gujarat, Karnataka, and Telangana. For this, we first analyse wind speed and GHI (global horizontal irradiance) data through time series plots, descriptive measures, time series decomposition, stationarity test, and fitting of probability distributions. The preprocessing steps reveal that the datasets are stationary with yearly seasonal patterns. Thus, we implement various statistical time series methods such as AR, MA, ARMA, ARIMA, and SARIMA. We adopt the grid search method to find the optimum values of the parameters for these models. Since the above models fail to fully capture the high amount of fluctuation (mostly, seasonal fluctuation) in the hourly, daily, and weekly observations, we additionally implement the WS-ARIMA (Window-Sliding ARIMA) model and note its improved modeling efficacy. The WS-ARIMA technique with a fixed window length is popular in the areas of finance, energy, and traffic management, where the dataset of necessity exhibits a seasonal pattern. Then, we implement a few highly recommended machine learning models, namely ANN, SVR, LSTM and CNN. These models are well-known in capturing nonlinear associations and they enable learning from data. After this, we develop ARIMA based hybrid models in two steps. In the first step, we use the ARIMA model to analyze the linear part of the problem. Then, in the second step, we develop a neural network model for the residuals from the ARIMA model. Since the ARIMA model cannot capture the nonlinear structure of the data, the residuals of the linear model contain information about the nonlinearity. We compare and discuss the results based on 15 years (2000-2014) of hourly, daily, weekly and monthly experimental data from four Indian study sites. Finally, we perform residual analysis as a post processing step of the implemented models. Therefore, the present study provides a comprehensive analysis of time series and machine learning models for wind speed and solar irradiance forecasting based on desired time scale.

Keywords: Renewable Energy; forecasting; time series; machine learning.

Biography:

Ms. Sarita graduated with B.Sc. (H) degree in Mathematics from the Department of Mathematics, Maharshi Dayanand University, Haryana in 2013, and post-graduated with M.Sc. degree in Mathematics from the Department of Mathematics, Indian Institute of Technology Delhi in 2016. Currently, she is working towards a Ph.D. degree from Birla Institute of Technology and Science, Pilani (Pilani Campus). Her research interests lie in modeling of renewable energy resources such as wind speed and solar irradiance using statistics and machine learning.

A Systematic Review of Clean Cooking and to Whom Does the Clean Cooking Agenda Belong? Empirical Evidence from Disruptions in Cultural Household Cooking Behaviour in East Africa

Yusuph John Kulindwa
Moshi Co-operative University, Tanzania

Abstract:

Currently, around three billion people, including Tanzania, still use primary solid fuels for their daily cooking. It has been reported that the consumption of solid fuels, including wood fuels from natural forests, causes health problems and forest degradation. The use of traditional fuel and wood fuels stoves contributes to a range of adverse health impacts especially for women and children in their homes because women are traditionally responsible for the time-consuming task of fuelwood collection. Mortality burden from household air pollution is high, with an estimated 33 000 premature deaths per year in Tanzania. Adoption to clean cooking is a priority to address the significant health issues posed by air-polluting fuels and the use of clean fuels. However, the understanding of clean cooking practices and energies, including clean energies published in the articles, is not well known in East Africa. Changes in traditional cooking practices or behaviour, the adoption of cleaner energy sources, and a decrease in or complete abandonment of wood fuel consumption are all necessary to reduce these effects. Developing countries have long valued improved stoves and clean fuel. However, limited success has been achieved in adopting improved cookstoves, highlighting the challenges in the energy transition from traditional fuel practices to clean energy. In this study, we present a systematic review to identify the energy transition towards increased use of clean energy in cooking and observe who owns the clean cooking agenda by examining the originality of the lead authors of all articles published between 2014 and 2023 from East Africa. We examined articles across East Africa and evaluated and synthesized 308 publications after searching the key terms of this study using Scopus database. The following search phrases or words were important: firewood, charcoal, kerosene, liquefied petroleum gas (LPG), electric stoves, natural gas, wind energy for cooking, solar energy for cooking, biogas for cooking, biomass

fuel (cow dung, crop or agricultural residues), and improved cook-stoves in East Africa. We then use these studies to provide a detailed account of the examined household clean energy, unclean cooking fuels/stoves, and cooking stove technologies in East Africa. About 44% energy studied was clean use of clean home energy and cooking fuels/stoves in the following areas: technological advancement, socioeconomic and marketing plans, and institutional growth. Based on the findings of our review, we have developed a conceptual framework for household energy consumption decision and the factors influencing them. Our results show that about 63.6% of East African publications with lead authors from outside East Africa address clean cooking from various energy sources and technologies. This implies that the clean cooking research agenda largely originates from outside East Africa and may be the reason for the low adoption of clean cooking technology in the region.

Keywords: Wood energy; clean energy; cooking stove; clean cooking.

Biography:

Dr. Yusuph J. Kulindwa is a senior Lecturer at Moshi Co-operative University (MoCU). He received his Ph.D. in Economics from a collaborative Ph.D. program at Dar es Salaam University, Tanzania, and Chalmers University, Sweden, in November 2017. His research focuses on Environmental and Energy economics, Resource Economics, Agricultural Economics, Behavioral Economics and Impact Evaluation studies. He is a team member and coordinator in the Pedagogy result area at MoCU in the Sustainable Employability through Innovative Pedagogy of Higher Education Institutions project, supported by the Finnish Ministry of Foreign Affairs. Dr. Kulindwa has experience in international research projects, including the impact of externally funded climate adaptation projects on women's empowerment, funded by Sida Sarec, as Co-PI in 2022-2024. Dr. Kulindwa has involved in the project, namely, Higher Education Partnership for Climate Change Mitigation through Socio-technical Transition, funded by the ministry for foreign affairs of Finland in in 2020-2024. He has published widely on environmental economics, energy economics and sustainable resource management. His experience includes teaching and supervising research work for students. He is a research fellow of the EfD-Tanzania. He also serves as an internal and External Ph.D. examiner and peer reviewer of the journal called Energy Efficiency– Springer and Clean Energy and Sustainability– sciepublish.com.

Evaluating the Energy Flexibility Potential of Residential Consumers in Automated Distribution Networks: Application to a 20 KV Medium Voltage System

Caterina Lamanna
Polytechnic University of Valencia, Spain

Abstract:

The objective of this research is to design a tool to evaluate the flexibility potential that residential consumers connected to the network can offer to the Distribution System Operator, from the perspective of the Smart Grid. In particular, the analysis is focused on evaluating how consumers can adapt their energy demand in response to external signals, whether prices or direct orders from the network operator. By means of this tool, flexibility users (such as the distribution grid operator) could dynamically evaluate the flexibility of demand that, at a given time, may be required to solve operating problems or carry out short-term planning of the necessary energy resources. To do so, the main energy-consuming end-uses have been modelled, especially those that have a certain capacity to modify their usual consumption pattern, characterizing the different management actions that can be carried out based on standard parameters.

The methodology and tool developed have been validated with information from consumers of the 20 kV distribution network of a 30.000 inhabitants town located in Eastern Spain.

Keywords: Flexibility; residential consumers; distribution grid; demand response.

Biography:

Caterina Lamanna graduated with a bachelor's degree in electrical engineering from the Polytechnic University of Bari, Italy, where she studied from 2019 to 2022. Previously, she attended scientific high school and, during this time, she spent three months in Belgium for a cultural exchange program with AFS, attending a secondary school in Kontich near Antwerp. More-

over, during her bachelor's studies, she completed a three-month internship at Pro Energy in Monopoli, a company specialized in the design of photovoltaic systems. She also completed a thesis on the implementation of dead time for a half bridge in Matlab/Simulink. At present, she pursues her master's degree in electrical engineering at the Polytechnic University of Turin (Italy), finishing her last academic year at the Polytechnic University of Valencia (Spain) in the framework of an Erasmus internship, where she is completing now her Thesis of Master. In this thesis, she participates in the design of a tool to evaluate the flexibility potential of residential consumers connected to a 20 kV distribution microgrid, which will be validated in the Digital Twin of the distribution system operator of this network.

A New Class of Materials for Energy Applications

Salah A.M. Elmoselhy
The University of Coimbra, Portugal

Abstract:

For several years, nanotubes showed several merits including high structural strength-to-weight ratio. However, based on mechanics of materials, the tubes geometrical cross-section is less favored for providing high structural stiffness and structural strength. Actually, single-walled nanotubes of diameter >3nm cannot withstand load and tend to flatten due to low radial stiffness. In addition, it was proven that the electronic properties of the nano-strucrture under quasi-static and cyclic loading are affected by its mechanical properties. The nano-I-beam molecular structure is thus proposed for improved properties. Based on Ab-initio computational modeling, novel molecular designs and 2-D material designs of the nano-I-beam-like shaped structure are developed and presented. A conformation analysis, molecular dynamics analysis, First Principles-based optimization, frequency analysis and polarizability have been conducted. The nano-I-beam show some features that are on par with the nanotube and other features that outperform the nanotube. The results show promising characteristics of the proposed nano-I-beam class of materials with several applications including: capacitors, transistors, insulators, quantization-based nano-devices, solid lubricant additive to grease, toughening fibers of nanocomposites, hydrophobic films, emissions adsorbents, catalytic sensors, PAH materials for space, sustainable energy, solid lubricant additive to grease, and toughening fibers of nano-composites.

Keywords: Materials physics; mechanics of materials; DFT; first principles; transport properties; energy applications.

Biography:

Salah A.M. Elmoselhy is a researcher, inventor, scientist, editor, professional engineer, academician, and serial author of SCI indexed publications who is experienced in managing scientific research work, academic teaching, editorial processes and industrial projects. His qualifications portfolio includes: PhD Candidates in Condensed Matter Physics, PhD in

Energy and Environmental Engineering, MS in Quantum Physics and Applied Mechanics, MS in Optimum Design and Fabrication Engineering, MBA in International Fabrication Systems, Postgraduate Diploma in Engineering Design, Postgraduate Diploma in Project Management, Certified Project Manager, and Microsoft Certified Professional. His industrial experience in the manufacturing sector perfectly complements his exceptional expertise. He has several years of academic teaching experience reaching the rank of "Assistant Professor". He has several years of academic research experience with several patented inventions such as "Hybrid Micro-composite E-springs", filed patents and publications in SCI-indexed journals such as Nature journals. He is a Member of the Advisory Board of the SAE Mobility Rxiv, Member of the Boards of several SCI-indexed journals such as "SAE Transactions: International Journal of Materials and Manufacturing", a Member of several scientific societies such as the European Physical Society "EPS".

Solid State Battery: A Way Towards Commercialisation

Sudeshna Sen
University of Warwick, United Kingdom

Abstract:

State of art solid state batteries faces multiple challenges towards commercialisation, including long term performance, energy density, specific power, pressure dependent cell design and economic viability.1 Availability of materials, stability of components, interfacial degradation, favourable ionics and chemo mechanics of cathode composites are key points to be investigated further. On the commercialisation aspects, even with suitable material interfaces (low degradation) problem relies on requirement in high stack pressure. When fundamental physical property needs to be investigated, parallelly scalable routes of material synthesis, cell design with minimal stack pressure, processibility of materials (electrode, electrolytes) are rising to be important research area.

The present lecture will summarise the technological trends in solid state battery research starting from electrolyte development strategies, interface phenomena and commercial trends. As first part, the structure function correlation of electrolyte (inorganic solid, polymer gels, polymer-inorganic composites) will portray the fundamental research on the solid electrolyte. In second part of the talk, key issues in interface problems and mitigation strategies will be introduced. A detail discussion of development of hybrid type solid state batteries will be invoked. Prospect of polymer as interlayers between material surface will be highlighted as basic building block of hybrid solid state batteries. As a third and final part, processibility, scalability aspects of solid-state battery components will be introduced. The presentation will demonstrate the roadmap of polymer, inorganic and composite material research, solve interface challenges utilised various way in SSB. A consecutive idea will be discussed: how the basic material/interface design ideas combined with engineering prospect can lead towards commercial cell concepts.

Keywords: Solid state battery; scalability; interface problems; polymer composites.

Biography:

Dr. Sudeshna Sen is currently working at WMG, developing solid state battery as Assistant professor. Previously I worked with Justus Liebig University, in the research group of Dr. Felix Richter and Prof. Jurgen Janek research project on polymer protective layers for solid state batteries based on Argyrodite type batteries. Before she moved to Germany, she was working at University College London as a part of Faraday Institute, NEXGENNA project, developing ionic liquid electrolytes for sodium-based batteries. She was awarded Royal Society-SERB Newton International Fellowship from University of Glasgow. She studied Solid state electrolytes and their ion transport mechanism by using Muon and Neutron based techniques. As first postdoctoral work, she worked at University of Nottingham on 3D printable polymer exchange membranes.

She graduated from Solid State and Structural Chemistry Unit, Indian Institute of Science, Bangalore with a thesis entitled 'A Few Case Studies of Polymer Conductors for Lithium-Based Batteries'. Her entire research work is on polymer-based materials for solid state batteries. She studied material in- depth and explore structure function properties. Following this she studied interface chemistry of material at solid state battery interface.

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