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ABSTRACT BOOK

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Abhishek Bansal
Principal Consultant, New Era Consultancy Services

Novel Perspective of Contemplating Existing Principles of Scientific Truth : Novel B-Unified Theory, Postulates, Propositions And Models With Applications in Impedance, Transformers, Inverters, Generators, Pumps, Solar, Machinery, Turbines, Batteries, SMPS and Short Circuit Analysis

Abstract

In this session, I m going to present my novel perspective of contemplating the existing principles which have been established or viewed as fixed eternal truth beyond which it is believed there is nothing to explore. I have revisited the concept of electrical current and circuit theory w.r.t quantum mechanics and electrodynamics, and its application in short circuit.
I also provide insight, significance of complex-domain impedance and the work and results developed in this research is also the practical implementation for the open unsolved problem in mathematics. This research aims to examine aspects of impedance in hypercomplex and higher dimension planes. My research studies questions - What is distinctive about j'' that makes it special in defining impedance? What impact the representation of impedance in hyper-complex planes will lead on critical calculations in electrical engg. especially in short-circuit, transmission lines voltage drop or voltage induced, synchnronous motors ? What such interpretation leads to ? I also present the sinusoidal significance as needed by inverters. In electronics \& electrical engineering, being a `pure sine wave' can be understood from the power quality, power factor and designing of expensive pure sine wave inverters. In many practical applications,not pure-sine(modified) wave or quasi-sine waveform in not acceptable

as performance gets degraded.In these three-part paper series,four questions are studied. What makes a sine wave,a special wave?

I also present my model/method in analysis of transformer,SMPS, BLDC.(Should not be uploaded in this form as work still ongoing).

Biography

Abhishek Bansal is an amateur scholar, fully self-studied various engineering, medical & mathematical specializations, and has been working for the past 20 years in R & D(machine designing). He is also involved in non-engg. works. He is fighting himself his litigation matters in Courts. He is the founder of New Era Consultancy Services and Learn Yourself Easy Solutions. His profile can be seen at ORCiD with identification number 0000-0002-2572-9004.

Hitesh Bindra
School of Nuclear Engineering, Purdue University, IN 47906, USA

Unlocking Flexibility: Modeling Nuclear–Renewable Synergy for a Decarbonized Grid

Abstract

The rapid growth of renewable energy sources, such as wind power, has transformed power systems but also introduced unprecedented variability in electricity supply. Balancing this variability with clean and reliable energy is a central challenge for achieving a resilient, low-carbon grid. Nuclear power offers unmatched reliability and carbon-free baseload generation, yet its operational inflexibility limits its ability to fully complement fluctuating renewables. Energy storage is therefore emerging as a critical component of future integrated energy systems.

This talk introduces a continuous-time stochastic modeling framework for co-optimizing nuclear power, wind energy, and energy storage in microgrids. Using real demand and wind generation data, we explore scenarios with varying renewable penetration, nuclear flexibility, and storage configurations. Results highlight how strategic storage deployment and modest improvements in nuclear ramping capability can significantly reduce curtailment, increase renewable utilization, and improve overall system efficiency. Among multiple storage technologies, thermal energy storage consistently demonstrates superior performance, offering smaller capacity requirements and higher utilization factors.

By reframing energy planning as a stochastic optimization challenge, this work emphasizes the role of advanced modeling and system integration in achieving a reliable, flexible, and decarbonized grid. The findings are relevant for policy, industry, and research efforts seeking to combine nuclear and renewable energy at scale.

Biography

Dr. Hitesh Bindra is Associate Professor of Nuclear Engineering at Purdue University. He is the director of the Nuclear Energy Systems Transport (NuEST) laboratory, where he has led multiple projects involving thermal-fluid sciences with applications in advanced nuclear reactors and heat storage systems. Dr. Bindra has also invented and developed novel high temperature heat storage technologies which have been licensed and commercialized. He is He has several years of industrial experience as a reactor engineer and thermal systems engineer in Nuclear Power and Solar Power industry. He is one of the six PIs from US involved in NEA's Nuclear Energy Skills and Training program for SMRs. He is also currently serving has Vice-Chair for the Operations and Power Division of American Nuclear Society.

Ziyodulla Yusupov
Electrical and Electronic Department, Karabuk university, Karabük 78050, Türkiye

Optimal power control of grid-connected Microgrid in a hierarchical framework based on nonlinear model predictive control

Abstract

Managing Microgrids in real-time is a complex challenge, requiring a balance of technical and economic considerations. This study introduces a framework for the real-time control of islanded and grid-connected microgrids using a “preserving network” structure. This structure incorporates various distributed generation sources, including rotating and non-rotating resources and energy storage systems. The system employs model predictive control (MPC) to optimize key network parameters like frequency and voltage, while also addressing real-time economic and technical goals. To improve accuracy and handle uncertainties in generation and consumption, the framework incorporates continuous power flow and the preserving network model. This approach aims to create a more realistic model of microgrid dynamics. The proposed structure demonstrates significant improvements in both technical and economic performance compared to standard MPC and adaptive MPC, highlighting its potential for more efficient islanded and grid-connected microgrid management. In islanded mode, the proposed framework achieves notable reductions in total voltage deviation of 85.87% and 87.62% compared to standard MPC and adaptive MPC, respectively. Economically, the proposed framework significantly outperforms both, reducing costs by 39.29% compared to standard MPC and by 28.12% compared to adaptive MPC. In grid-connected mode, the proposed framework achieves significant reductions in total voltage deviation of 37.5% compared to adaptive MPC and 73.68% compared to standard MPC. Economically, the proposed framework also outperforms both, reducing costs by 24.19% compared to standard MPC and by 35.83% compared to adaptive MPC.

Mohammedsalih Kadie Gobana
Ethiopia

Significance of River Channelization and River Corridor for Surface Water In Terms of Pollution Prevention and Ecological Integration

Abstract

There was a strong relationship between rivers and human settlements from the time human beings started a sedentary lifestyle to the present day. This connection between humans and rivers affects river water quality and its ecology, resulting in human health problem. To solve this problem river channelization and riverside projects are preferred as primary solution in different countries. The objective of this study is to assess the significance of river channelization and river corridors for surface water quality and ecological integration. 12 water quality indicators, namely, temperature, electrical conductivity, pH, dissolved oxygen (DO), BOD, COD, Nitrate, Phosphate, TDS, TSS and faecal coliform were analysed. The findings of this study show that the Awetu River Awetu River channelization contributed to the improvement of water quality, but it is not at the required quality and standard. Many parameters analysed in the channelized segment of the river were not within the permissible limits for the WHO and Ethiopian standards for drinking water as well as the Guideline Surface Water Quality Standards. The average values of the channelized segment for most variables were between those of the two unchannelized segments, indicating a lack of significant change in water quality as a result of the project. A comparison of the water quality after the project with previous data revealed improvements in most of the parameters. The project also significantly contributed to flood risk prevention, solid waste and bad smell reduction. The lack of emphasis on liquid waste prevention, lack of uniformity in riverside free space, and lack of recording baseline data for the water quality status and composition of the ecological flora and fauna constitute the main feedback of the project.

Biography

Mohammedsalih Ethiopian environmentalist completed his BSc in Addis Ababa University 2015, his MSc in International University of Africa (2017) and now PhD candidate at Jimma University. He have published five scientific journals and participated on different scientific conferences and symposium.

José Antonio Rodríguez Artolazábal
Spain

Turning AI Complexity into Actionable Value for Renewable O&M

Abstract

Artificial Intelligence promises to transform how renewable assets are operated and maintained. Yet, despite impressive research results, the gap between AI prototypes and real O&M impact remains wide. At Sense Aeronautics, we focus on bridging this gap by developing AI ecosystems that can handle the complexity of both technology and field operations.

Renewable O&M is inherently challenging: assets are geographically dispersed, environmental conditions are variable, and operational priorities are driven by cost, availability, and safety. AI brings its own challenges: data scarcity, domain shift, validation requirements, integration into workflows, and operator trust. Without a clear strategy, AI can easily remain a proof-of-concept rather than a value-adding tool.

Our approach builds on experience from EU R&D projects and technology transfer and direct contact for end users as Sense Aeronautis. We have applied computer vision and machine learning to aerial imagery obtained from drones for the inspection of critical infrastructure and energy assets. In this talk, we will share lessons learned from developing solar inspection AI—where defect detection and classification must move beyond academic accuracy into actionable insights that inform maintenance scheduling and reduce downtime.

The presentation will highlight:

- How to design an AI development ecosystem that is iterative, data-driven, and aligned with operator needs.
- How to handle domain complexity (different sensors, lighting, geographies) while maintaining robust model performance.
- How to integrate AI outputs into decision-support systems for asset managers, ensuring

transparency and usability.
- How to build trust through progressive validation with operators, moving from pilot studies to scalable deployment.

While solar farms are our starting point, the lessons generalize to wind, storage, and other renewable sectors. The key message: only by addressing the dual complexity of AI technology and O&M practice can we turn innovation into measurable impact for the energy transition.

Biography

José A. Rodríguez holds a PhD in Computer Vision from the University of Surrey's CVSSP, one of the UK's leading centres in vision and machine learning, and an MSc in Telecommunication Engineering from UPM, Madrid. His career began at CRS (now Jenoptik) in the UK, where he developed pioneering embedded systems for vehicle detection and license plate recognition, gaining early experience in bringing cutting-edge research into real products. He then joined Indra Sistemas, contributing for four years to the development of Spain's Navy F-105 Tactical Hull Mounted Sonar, with responsibilities spanning algorithm translation, software development, and system testing at sea. For nearly a decade, José led the Video Analytics team at Gradiant, managing over 20 national and international projects and licensing technologies worldwide. Since 2024, he has served as CTO of Sense Aeronautics, a spin-off dedicated to developing advanced video analytics products for UAV-based inspection and monitoring.

Filippos Proedrou

Faculty of Business and Creative Industries, Business School, University of South Wales, UK

Geopolitical insights into the global energy transition

Abstract

The aim of this presentation is to review the current geopolitical landscape and dissect the main geopolitical trends with an eye to examine how they impact on the advent of the global energy transition. The analysis starts with an overview of the main pillars underpinning current geopolitical thinking, namely a focus on resilience, reliability, autonomy and de-risking. It subsequently delves into what different aspects and pathways of the energy transition mean in geopolitical terms and how they facilitate/ undermine geopolitical goals. It finds that energy efficiency, indigenous clean energy production and reliable clean energy partneships, as well as de-centralization, offer significant security premiums and hence are advisable as means to accelerate and deepen the energy transition. On the other hand, while hydrogen and smart grids hold high promise, they come with substantial geopolitical risks that need to be addressed. Last, abated fossil fuels are dismissed as a meaningful way forward for the global energy transition. The contribution of the presentation lies in unpacking the main geopolitical trends and tying them into the global energy transition, in order to trace risks and premiums, and suggest fruitful ways forward for global decarbonization.

Biography

Dr Proedrou's areas of expertise are Black Sea and Eastern Mediterranean geopolitics, energy transition and politics, and energy and climate policy. He has worked for the University of South Wales, Queen Mary University of London, the Institute of International Relations in Prague, the American College of Thessaloniki, the International Hellenic University and VUZF University in Sofia, among others. Dr Proedrou has an outstanding publications record with over 50 publications. His monograph Energy Policy and Security under Climate Change has been named among the 20 best books of all time in the categories of Energy Policy (9th) and Renewable Energy (20th) by BookAuthority. Dr Proedrou has also advised the Welsh Parliament on climate policy, has secured funding from the British Academy and the Leverhulme Trust and serves as external expert for the European Commission.

Gideon Friedmann
Net Zero Technology Ventures, Herzlia, Israel

Energy Storage is not only Li-Ion - Overview of Israeli Innovation

Abstract

Today's variable renewable energy – Solar and Wind - requires storage. Storage is means for making renewables dispatchable, but also for energy transport. There is a wide range of needs for energy storage – short term, long term, in the form of electricity for power, or as heat. The talk will describe the basic forms of energy storage – physical, chemical, mechanical, heat. In each segment a few examples will be presented, and in particular specific novel solutions offered by Israeli startups or academic researchers. A new national research institute for storage was established, which is a unique collaboration between government and academia. It's activity and goals will be described.

Biography

Dr. Gideon Friedmann is the former Chief Scientist of the Ministry of Energy of Israel with expertise in Energy Policy, Renewable energy technologies, the electricity market, Energy Efficiency, and electric transportation. Currently working as CTO at NetZero Technology Ventures – an early stage deep tech Climate VC.

Dr. Friedmann has a strong academic background with a Stanford University Ph.D. in Physics, Purdue University M.Sc. in Economics, Tel Aviv University B.Sc. (Magna Cum Laude) in Mathematics & Physics, and Diploma in Bioinformatics.
In addition over 15 years of industry experience in both management and R&D in semiconductor metrology, medical instrumentation, biotechnology, and energy efficiency.

Dr. Friedmann publishes opinion articles in Israel's media, including Yediot Aharonot, Calcalist and Globes.

He is a social activist involved in local government in Mevasseret Zion near Jerusalem, mainly in education and transportation issues.

Mr. Guna Raj Dhakal
Chairperson of GREAT Nepal Pvt. Ltd, Nepal

Developing Micro-Grid Technology for Solar Irrigation Pumps

Abstract

The agriculture sector is the single largest employer in the world, sustaining the livelihood of 40% of the population, many of whom live in poverty (United Nations, 2015). Increasing productivity in the agriculture sector is widely recognized as one of the most effective ways to fight poverty and stimulate socio-economic development. In fact, for every 10% increase in farm yield, there has been an estimated 7% reduction in poverty in Africa and more than 5% in Asia (United Nations Environment Programme (UNEP), 2012).

In this context developing a micro grid for solar water pumping is a very appropriate technology to enhance agriculture productivity and to achieve Sustainable Development Goals (SDG). As the human population expands to more than 9 billion people by 2050 and as diets shift toward more animal protein, we will be compelled to find a way to adequately meet rising demand for food while also meeting increased demand for other agricultural products such as biofuel feed stocks. A path toward resilient and sustainable agriculture must meet food and development needs from local to global scales without destabilizing the Earth system. To achieve this, we will need to resist the trend to focus on single solutions, globally applied, and instead move towards a diversity of solutions operating across scales. Therefore development of micro grid for solar water pumping can improve food security and maintain a livable planet.

Scope of the study

Solar-powered irrigation systems are devices that use the 'solar cell from the sun's radiation to generate electricity for driving the pump'. They usually insist of an array of photovoltaic cells, a controller, a motor pump-set that pump water from a well or a reservoir for irrigation. This project examines the effectiveness of localized micro grid solar-powered (PVPs) in poverty reduction, environmental conservation and gender empowerment in Province 2. It enhance farmers' adaptive capacity by raising agricultural productivity and their incomes. In addition

it also help mitigate climate change by reducing CO2 emissions.

Innovation

The grid Voltage in most of Terai region of Nepal is poor. The voltage is even poor (Minimum up to 120 Volt instead of 220 Volt) in agricultural areas due to long distance from transformer. The voltage quality will continue to be of poor quality, even if electricity will be surplus in near future. Thus farmers are suffering from motor burn cases frequently. Many farmers are repairing motor in every six months which is decreasing the efficiency and power factor too. There is a huge loss in electricity. In off-grid Irrigation land, farmers are using diesel pump to lift groundwater, which has implications to climate change.

Due to poor quality of grid voltage, many farmers in grid area are also shifting in diesel pumping to lift groundwater, even though there is potential to use electricity. The cost of individual solar water pumping is very high. In this context solar micro-grid technology for connecting solar irrigation pumps to national grid will replace the existing diesel powered pumping systems for irrigation in agricultural areas. Particularly, the demonstrated pilot project is designed to use solar energy systems (i.e. solar photovoltaic cells) for lifting water for irrigation and daily household consumption purpose in Province 2. On the other hand, connecting the surplus solar energy to the main grid is another aim of this project. When solar generation is equal to the load requirement, water pumps are completely run by solar. Furthermore, when the solar generation is greater than the load requirement, the generated solar power will support the existing load first and the excess will be sent to the grid. Likewise, when solar generation is less than the load requirement, all the solar power is consumed by the pumps and grid will join to support the excess load demand. Lastly, when solar generation is zero (i.e. at night time) grid will supply to meet the load requirement. The Solar Powered Pumping Systems for Irrigation Project's intended goal is to use solar water pumps for irrigation to replace either diesel-generated electricity or grid based electricity generation for water pumping for irrigation. The replacement of the diesel pumps is going to generate certain climate related impacts. A diesel generator emits CO2 during operation and grid based electricity is usually generated with coal, oil or natural gas which also emits considerable quantities of CO2. In contrast, a solar-based water pump system does not result in greenhouse gas emissions. Extensive use of solar water pumps in irrigation would therefore lead to substantial greenhouse gas emission reductions.

Objective

The main objective of the project is to reduce the dependency on imported fossil fuels through the adoption of renewable energy for water supply in irrigation to foster economic and social development by increasing crop production in the agricultural areas around the country and promote peaceful environment for water resources use.

Expected Outcome

- Increased agricultural production and productivity;
- Improved food security and nutritional status of the beneficiaries as a result of the increase in the quantity of food produced once the project becomes operational
- Improved land conditions due to improved land and water management and conservation activities;
- Enhanced livestock production as a result of increased feed supplies; and,
- Improved soil and water conditions resulting in enhanced land conditions.

- Additional positive impacts will be achieved by increased employment opportunities due to increased economic activities and knowledge base of the technical knowledge to local communities which will be enhanced through transfer of technologies and capacity building.

Impact of the Project

The grid Voltage in most of Terai region of Nepal is poor. The voltage is even poor in agricultural areas due to long distance from transformer. Farmers are suffering from motor burn cases frequently. Many farmers are repairing motor in every six months which is decreasing the efficiency and power factor too. This is also providing a challenges to the economically poor family to continue farming. This has increase the working load of women while leading the male members to left the village in search of a good opportunity than farming.

In off-grid Irrigation land, farmers are using diesel pump to lift groundwater, which has implications to climate change. Due to poor quality of grid voltage, many farmers in grid area are also shifting in diesel pumping to lift groundwater, even though there is potential to use electricity. Use of diesel petrol has severe impacts in our environment. They not only emit carbon to the environment leading climate change, global warming at the same they also increase an economic burden to the family causing a large charge of the transportation of those fossil fuels needed. Therefore, if in the place of this if we use solar micro grid then this will compensate all above loss. Firstly, the solar micro grid is one time investment. It doesn't have any impacts to our surrounding rather one can make earning from this technology by selling excess electricity to the GRID. It also generate enough power needed to lift water from underground. When the power is not needed for lifting water, surplus power can be connect to grid and can sell to NEA. Overall, the technology effectively increase the efficiency of agriculture creating a suitable environment for youth to work in the field whereby decreasing the work load of women and marginalized people. Also it reduce the dependency rate on imported fossils fuels, this not only cut down the economic loss but also save the environment from carbon emission.

Biography

Mr. Guna Raj Dhakal is a Renewable Energy technology professional, with more than 15 years of experience. He is the founder Chairperson of Renewable Energy Confederation of Nepal, RECON; and Chairperson of GREAT Nepal Pvt. Ltd, a company that works in the field of Renewable Energy Technologies.

Mr Dhakal is also the founder member and Past Chairperson of Water and Energy Consultants Association of Nepal (WECAN).

Hana Gebremariam Liliso

Department Construction Management and Technology, Collage of Engineering and Technology, Wachemo University, Wachemo, Southern Ethiopia

Understanding Surface Failures in Thick Asphalt Pavement: A 3-D Finite Element Model Analysis

Abstract

This study investigates the factors contributing to the deterioration of thick asphalt pavements, such as rutting and cracking. We focus on the combined influence of traffic loads and pavement structure. This study uses a three-dimensional finite element model with a Mohr-Coulomb failure criterion to analyze the stress levels near the pavement's surface under realistic conditions. Our model considers various factors, including tire- pavement contact stresses, asphalt properties, moving loads, and dynamic analysis. This research suggests that cracking tends to occur between dual tires. Some key discoveries include: the risk of cracking increases as temperatures rise; surface cracking at high temperatures is associated with distortional deformation; using a uniform contact stress distribution underestimates the risk of failure compared to realistic three-dimensional tire contact stress, particularly at high temperatures; the risk of failure is higher near the surface when there is a negative temperature gradient in the asphalt layer; and debonding beneath the surface layer leads to increased shear stress and premature failure around the interface.

Keywords: Asphalt pavement, Surface failure, 3D finite element model, Multiaxial stress states, Mohr-Coulomb failure criterion.

Kalaivani Kumarasamy

Department of Civil Engineeering, SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu, Inida

Nature's Gift: Coconut Husk as an Eco-Focused Resource for Sustainable Solutions

Abstract

Coconut husk, a common agricultural waste product, has a lot of potential as a sustainable resource for several environmentally beneficial applications. Previously thought of as a byproduct, the coconut fruit's fibrous outer covering may now be used for its useful qualities. Coconut husk may be processed in novel ways to provide important products including coconut coir, coco peat, and bio-composites. Numerous industries, including agriculture, horticulture, soil improvement, packaging, and construction, use these products. Waste can be reduced and sustainable alternatives to current products may be offered by reusing coconut husk. The importance of using renewable resources like coconut husk is to support a circular economy that is more ecologically friendly. In the experimental investigation, trial mixes were created with the goal of achieving the requisite strength for Coconut Husk Mortar, and conventional mortar was created for comparison. To accomplish this, 32 different experimental mixes were developed. The study has a focus on the development of novel sustainable infrastructure solutions through extensive testing and several admixture combinations.

Biography

Kalaivani Kumarasamy is a dedicated Research Scholar at SRM Institute of Science and Technology, who specializes in harnessing the potential of coconut husk for sustainable solutions in the construction sector. With a Bachelor's and Master's degree in Civil Engineering, followed by a PhD in Structural Engineering, her academic journey has been marked by excellence. She excelled in her studies, achieving first-class distinctions throughout her B.E., M.E., and PhD coursework. Her commitment to research is evident through her six impactful research articles, including a publication in an SCI indexed journal and another in an ESCI indexed journal. Her academic prowess extends to the conference circuit, with presentations at eight conferences, spanning international and national levels. Continuously enhancing her knowledge, she has participated in five training programs, attended numerous seminars, and engaged in webinars focusing on civil engineering. She has also coordinated a symposium event during her undergraduate years and achieved the second rank in Anna University during her B.E. final year, proving her academic and research excellence.

Oliver Kornyo

Department of Computer Science, Kwame Nkrumah University of Science and Technology, Kumasi-Ghana

SmartNET-in-HES: SmartNET metering in Heterogeneous Energy Systems for efficient energy conservation and Infrastructure Management

Abstract

Heterogeneous Energy System (HES), which includes Clean Renewable Energy Technologies (CRET), grid, cold, and gas, plays a crucial role in sustainable energy for global market growth. However, HES is confronted with efficient energy measurement infrastructures, accountability, energy conversation, clean climate sustainability, regulatory policy, and consumption classification. This paper proposes SmartNET-in-HES, an integration of SmartNET metering and IoE devices, which is incorporated into all the energy systems under HES to achieve real-time end-to-end solutions. Furthermore, SmartNET-in-HES applied a deep learning-based algorithm to solve consumption classification and predict demand and supply-side management and control. SmartNET-in-HES can detect and report defective infrastructure, accurately measure energy trading and gives intelligence on the preferred energy source to be in the network route for usage due to the clean carbon energy policy. The performance of the proposed deep learning approach is evaluated through experiments, and it is compared with state-of-the-art methods. The proposed approach produces 99.264% accuracy on Grid Company (GRIDCO) and Mini-off-grid datasets from 2021-2023 and 99.775% accuracy on the Electricity Company of Ghana. (ECG) datasets, respectively, substantially outperform the existing approaches. Promising conceptual design framework and experimental results reveal that SmartNET-in-HES can be used in utility companies for consumption classification and help energy accountability with developing countries attaining the Sustainable Development Goals (SDGs) 7, 8 and 9.

Biography

Mr. Kornyo Oliver (PhD-Candidate, KNUST), MSc Information Technology, KNUST.BSc Mathematical Science (Computer Science Major) "Currently working on Fraud detection in data mining and system
security in electricity distribution using Machine learning" has over a decade of experience in the energy sector/mini- grids, including Advanced Metering Infrastructure (AMI). Solutions and smart metering application management.Seasoned working experience in Database administration and security, Energy Management Systems, End-To-End solutions, training on Energy conservation and Tariff Calculation principles for energy billing systems, and application of Artificial Intelligence (AI) in Smart Metering Solutions and security control systems.

Peter Meusburger
Graz University of Technology, Kopernikusgasse 24/IV, 8010 Graz, Austria

The role of waterpower in decarbonising the energy supply system

Abstract

The decarbonisation of the energy supply system is inevitable to meet the climate change and sustainable development goals and to avoid excessive global warming therefore. The transformation of the energy supply system requires new technologies in the field of sector coupling to allow for bidirectional energy storage beside the further development of renewable energy production. The need of transformation is acutal and urgent as the todays CO2 concentration in the atmosphere already indicates a global warming of more than 1,5°C as agreed on at COP21 in Paris. Already approved carbon-free energy production technologies as waterpower contribute nowadays to the stability of the electrical grids as well as to short and medium term large scale energy storage. Thus facilitating the actual progress in installation of photovoltaics and wind power while developing alternative storage technologies to market-readiness. At the moment hydropower still is the large scale storage technology with both the utmost cycle efficiency wire-to-wire as well as the lowest capital expenditure related to power and especially energy. In this publication the role of waterpower in a future energy supply system will be depicted when the load is mainly supplied by renewable energy production. At this background the special capabilities and limitations of waterpower plants for flexible operation and power-frequency-regulation in the electrical grids are highlighted. And the special demands on the overall design of waterpower plants are presented to fit for the purpose of increasing energy production from volatile, non predictable sources.

Biography

Prof. Dr. Peter Meusburger graduated in Mechanical Engineering from the Graz University of Technology, Austria. He then worked as an Assistant Professor at the Department of Hydraulic Fluid Machinery at this university and completed his doctoral studies in mechanical engineering in June 2009 with the degree of a doctor of technical sciences. Since 1st of December 2020 Prof. Meusburger heads the Institute of Hydraulic Machinery at Graz University of Technology.

Since 2008 he has worked as an expert for 3D fluid hydraulics and waterhammer calculations at Vorarlberger Illwerke AG. In 2012 he became head of the mechanical engineering department of Vorarlberger Illwerke AG. From 2008 to 2017 he headed numerous waterpower projects responsibly from the mechanical point of view. These projects range from refurbishments and overhauling to the design and erection of completely new pumped storage water power plants.

In 2017 Dr. Peter Meusburger established his own engineering office and technical consultancy with special focus on numerical analysis and the development of new hydropower plants as well as the optimization and improvement of already existing ones.

Dr. Meusburger is authorized affidavit expert and court surveyor on turbines, pumps, penstocks and industrial piping systems.

Philomina M. A. Arthur

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Sustainable Wastewater Management under a Circular Economy – The Water-Energy-Food Nexus Approach

Abstract

Wastewater management is gradually shifting from solely reducing water pollution to encompassing Nutrient-Energy-Water recovery systems, with the integration of circular economy concepts, optimizing resource utilization and promoting sustainable practices. This study assessed the sustainability of a Municipal-scale Upflow Anaerobic Sludge Blanket (UASB) reactor in Accra, Ghana treating domestic sewage. The investigation employed circular economy principles to evaluate resource recovery potential. Biogas flow was measured and analyzed using a portable gas analyzer to determine methane content. Nutrient levels were assessed following standard procedures (APHA 2017), and the energy value of biosolids was determined using a bomb calorimeter.

Findings from the study revealed a biogas production rate of 613 ± 271 Nm3/d, with 65% methane output. The wastewater effluent displayed elevated nitrogen and phosphorus concentrations (0.0836 kgN/m3 and 0.0284 kgP/m3, respectively), while heavy metals concentrations remained within acceptable guidelines defined by the World Health Organization for irrigation purposes. Biosolids exhibited an average calorific value of 9.81 MJ/kg, signifying a high-energy fuel source. The net energy recovery potential from biogas and sludge was estimated at 534.1 MWh/yr, surpassing the actual energy demand of the Mudor Plant (392.7 MWh/yr). Furthermore, the nutrient-rich biosolids can be suitable for compost production, contributing to food production. In conclusion, the UASB reactor presents an opportunity for water, energy, and nutrient recovery, promoting the Water- Energy-Food Nexus within a circular economy

framework for sustainable development in developing countries.

Biography

Philomina M. A. Arthur is a Civil Engineer by profession, having attained a degree in Bachelor of Science in Civil Engineering and a Master of Science in Water Supply and Environmental Sanitation, both at KNUST, Ghana. She worked as a Manager at Zoomlion Ghana Limited, the "Waste Management Giants" in Ghana before pursuing a Doctorate in Sciences and Technologies of Water, Energy and Environment at the International Institute for Water and Environmental Engineering (2iE), Ouagadougou, Burkina Faso. Upon completion of her Doctoral Program, Philomina resumed work with her company as a senior research officer, assisting with advanced research at the Research and Development Department. Her research interests are focused on sustainable waste management, resource recovery from waste, waste-to-energy technologies, and carbon footprints of waste management systems. Philomina desires to build a resounding career as

an Environmental Engineer, researcher and sustainability expert in waste management for sustainable development in emerging economies.

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AI-based forecasting for optimized solar energy management and smart grid efficiency

Abstract

This paper considers two pertinent research inquiries: 'Can an AI-based predictive framework be utilised for the optimisation of solar energy management?' and 'What are the ways in which the AI-based predictive framework can be integrated within the Smart Grid infrastructure to improve grid reliability and efficiency?' The study deploys a Deep Learning model based on Long Short-Term Memory techniques, leading to refined accuracy in solar electricity generation forecasts. Such an AI-supported methodology aids power grid operators in comprehensive planning, thereby ensuring a robust electricity supply. The effectiveness of this framework is tested using performance metrics such as MAE, RMSE, nMAE, nRMSE, and R22. A persistent model is utilised as a reference for comparison. Despite a slight decrease in predictive precision with the expansion of the forecast horizon, the proposed AI-based framework consistently surpasses the persistent model, particularly for horizons beyond two hours. Therefore, this research underscores the potential of AI-based prediction in fostering efficient solar energy management and enhancing Smart Grid reliability and efficiency.

Biography

Pierre is a PhD student at the Center for Transportation & Logistics under the supervision of Dr. Yossi Sheffi.
He worked with Dr. Yossi Sheffi on the impact of AI and automation on supply chains for his Master's thesis.
Pierre received a BSc in Mechanical engineering from the Swiss Federal Institute of Technology in Lausanne (EPFL) in 2020. He obtained a MSc in Mechanical Engineering with a minor in Data Science at the same institution.
His research interests are: Mechanical engineering; Operations; Supply chain; Data Science; Machine Learning; Deep learning.

Rashmi Roy

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Evaluating Solar Energy as a Viable Solution to Bangladesh's Energy and Environmental Challenges: Opportunities, Constraints, and the Path Forward

Abstract

Regarding Bangladesh's ongoing environmental and energy crisis, the desire for ecologically sound and carbon-free energy sources has assumed crucial significance. It is essential to look into feasible alternatives to traditional fossil fuels as the nation struggles with issues including growing urbanization, population growth, and rising emissions of greenhouse gases. Solar energy is eco-friendly technology, a superb energy supply, and also the most significant green and renewable energy source. To address Bangladesh's energy and environmental problems, this study thoroughly reviews the opportunities and constraints of solar energy. The assessment starts with a survey of the nation's existing energy situation, emphasizing its excessive reliance on fossil fuels and its effects on greenhouse gas emissions and climate change. A shift to clean energy sources is urgently required. Then, it explores Bangladesh's enormous solar energy possibility, highlighted by the country's geographic location and year-round sunshine. It looks at how the use of solar energy has increased recently in the nation, covering the rise of solar farms and solar photovoltaic systems. The study analyses the positive aspects of solar energy, including its potential to lower carbon emissions, create jobs, and provide access to electricity in rural locations.

Keywords: eco-friendly, geographic location, greenhouse gases, carbon emissions

Biography

Rashmi Roy finished her undergraduate at 22 years old at The Institute of Engineers, Bangladesh. Now studying M.Sc in Engineering (EEE) at Chittagong University of Engineering & Technology and working as an electrical engineer at Bangladesh Atomic Energy Commission. Dr Mahmud Abdul Matin Bhuiyan, Professor, Department of EEE, Faculty of Electrical & Computer Engineering.CUET. He finished his Ph.D. EE (Solar Energy) Universiti Kebangsaan Malaysia. He has Published in excess of 25 papers on Solar PV Technology, Solar Cells, Thin Films and Photonic Devices.

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Importance of Copper Mining for the Energy Transition in Colombia

Abstract

Currently, Colombia is implementing policies to reduce CO2 emissions, transition to clean energy, diversify its mineral offer, and combat climate change. In this sense, copper (Cu) constitutes a key material, since it is essential for the construction of renewable energy sources, electrical distribution and storage, which allows reducing carbon emissions and therefore contributes to achieving the objectives set. Due to its location within the Andean Metallogenic Belt Colombia has a high potential for Cu deposits. Recent projections indicate that global demand for Cu due to the energy transition would increase from 5% of total refined Cu production in 2020, to 10% in 2030, and then to 15% in 2040. This represents a great opportunity for Colombia in terms of mining-industrial development, and positioning in the global commercial dynamics linked to the energy transition. However, it is crucial to sustainably manage copper extraction and production to minimize its environmental and social impacts, especially in a country with sensitive ecosystems and great ethnic plurality such as Colombia. For this, it is necessary to transfer and adjust the advances in sustainability made by countries with greater Cu mining trajectory such as Chile, in terms of reducing water use and carbon emissions, for example. Developing the copper industry in Colombia could play a central mining and energy role, since it would diversify the country's mining supply and allow the establishment of trade relations that can benefit the implementation of its energy transition. The challenge is to viable manage and minimize the associated impacts, for which sustainability advances made by countries with a longer mining history serve as a starting point.

Biography

Geologist, 28 years old. He is finishing his master's degree in Mineral Resources Engineering at the School of Mines of the National University of Colombia. He has worked in the gold and copper mineral exploration sector, and as a researcher for the Colombian Geological Survey. His main interest is promoting sustainability in the Colombian mining industry and exposing its link with the energy transition.

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Monitoring greenhouse gases emission by ultra-long open-air path dual-comb spectroscopy

Abstract

The greenhouse gas (GHG) emission to the atmosphere and their long-term global effect is a focus topic with disputes in areas like climate change, sustainable energy, country economy, international relations, and social life. We need a clear picture of the amount and process of GHG emissions to understand climate change and make mitigation policies. Therefore, accurate determination and continuous monitoring of GHG fluxes covering a variety of temporal and spatial scales are crucially needed. Dual comb spectroscopy (DCS) could provide a broadband, high-resolution, high-sensitivity amplitude and phase spectrum within a short time, which is believed to be a critical tool for remote gas sensing. Yet, the longest distance that DCS can reach in open air is a dozen kilometer. This limits the application in greenhouse gases monitoring of mega-city regions and large forests. Recently, we have implemented DCS over 100km turbulent horizontal open-air path. CO2 and H2O concentrations were extracted separately from intensity absorption and phase spectrum, with a precision <2ppm for CO2 in 5min. In the future, more kinds of gases (such as CH4 and CO), could be detechted by this technique by extending the spectrum of the comb. We anticipate this technology can find immediate application in greenhouse gas and gaseous pollutants emission monitoring.

Biography

Ruocan Zhao finished his PhD and postdoctoral investigations from University of Science and Technology of China (USTC). He is an associate professor in School of Earth and Space Science of USTC. He studies the advanced technique of optical remote sensing, especially laser active remote sensing technique for atmosphere monitoring. Recently, he mainly engaged in the project of dual-comb spectroscopy of open air path, aiming to monitoring multi-gases of atmosphere. He has Published in excess of 20 papers in JGR, OE, etc.

Sam L. Savage

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From Sandcastles to Lego Blocks: Object Oriented Climate Modeling

Abstract

Climate and Energy Modeling involve significant uncertainty. It is tempting to replace uncertainties with their averages when aggregating the results, but that leads to the Flaw of Averages, a set of systematic model errors. The alternative is to create large monolithic stochastic simulations, which may collapse under their own weight and are hard to maintain. The discipline of probability management embeds uncertainties into data that obey both the laws of arithmetic and the laws of probability. This has the potential to create modeling objects that can be snapped together like Lego blocks.

Biography

Dr. Sam L. Savage is Executive Director of ProbabilityManagement.org, a 501(c)(3) nonprofit devoted to standardizing the communication and calculation of uncertainty. The organization has received funding from Chevron, Kaiser Permanente, Highmark Health, Lockheed Martin, PG&E, and others, and Harry Markowitz, Nobel Laureate in Economics was a co-founding board member. Dr. Savage is author of The Flaw of Averages: Why We Underestimate Risk in the Face of Uncertainty (John Wiley & Sons, 2009, 2012) and Chancification: Fixing the Flaw of Averages (2022). He is the inventor of the Stochastic Information Packet (SIP), an auditable data array for conveying uncertainty. He is an Adjunct Professor in the Engineering School at Stanford University.

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Design and Testing of Thermal Receiver on Paraboloidal Solar Dish Concentrator

Abstract

A paraboloidal dish solar concentrator is a type of solar thermal energy collector that uses a parabolic dish-shaped reflector to focus the sun's rays onto a small area. The concentrated light is then absorbed by a receiver placed at the focus of the parabola, which converts it into heat. This heat can then be used to generate electricity or for other heating applications. In fact, solar dish with thermal receiver is less studied and in the process of being researched and developed. In this paper, a parabolic dish concentrating system was constructed. A novel thermal receiver is designed, manufactured, and tested. The solar dish has been used as a reflector to track the sun in two axes, and concentrate the sunrays on the thermal receiver, which is fixed at the focal point of solar dish. The thermal receiver was manufactured from thin stainless-steel sheets with a single inlet and single outlet ports. The working fluid used in this work is air and it is heated by the receiver and pumped through the system where heat is transferred to the fluid. The thermal performance of the receiver was experimentally evaluated and documented.

Biography

Dr. Samer is a self-motivated, enthusiastic person with extensive learning, organizational and presentational skills. He has more than 15 years of experience in lecturing, research studies, and feasibility projects across university, industrial management, and manufacturing. He has a commitment for helping university students to develop their full potential in their studies. Strong philosophy of teaching, and knowledge of many different methods to motivate students to develop their expertise in specific areas. He can communicate effectively in both team situations and on own initiative. Co-founder of the Renewable Energy Engineering Department in Middle East University, Jordan. Dr. Samer has expertise in the fields of Solar Thermal Power, Photo-voltaic, Wind systems and Material sciences. He attended several seminars, workshops and conferences in Renewable Energy, Smart Grids and Sustainable Engineering in Germany, USA, Cyprus, Italy, Egypt, Saudi Arabia, UAE and Jordan. His research interests are Solar Thermal Power, Fuel Cells, Photo-voltaic, and Material sciences.

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Fault Tolerant Fuzzy Control System Applied to a Micro-Grids

Abstract

Micro-Grids with artificial intelligence have been the research target in the last decade. In this research have been introduced a fault tolerant fuzzy control system biologically inspired, which use intelligent/virtual sensors developed by neuro-fuzzy models and fuzzy fault detection system based on the trend and dynamical behavior of the error between of the virtual sensor and the real system. The fault tolerant characteristic of the system helps to improve the service, improve the energy quality, save money in maintenance, avoid the critical damages in the devices and subsystems and avoid the damage of the electric and electronic devices of the houses. The simulation of the fault tolerant fuzzy control system applied to a Micro-Grids was over MATLAB/Simulink.

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CRISPR-Cas9 Technology: As an efficient genome modification tool in the cancer diagnosis and treatment

Abstract

Cancer is the second most common cause of death globally and is a major public health concern. Managing this disease is difficult due to its multiple stages and numerous genetic and epigenetic changes. Traditional cancer diagnosis and treatment methods have limitations, making it crucial to develop new modalities to combat the increasing burden of cancer. The clustered regularly interspaced short palindromic repeats (CRISPR)-CRISPR-associated protein 9 (Cas9) system has transformed genetic engineering due to its simplicity, specificity, low cytotoxicity, and cost-effectiveness. It has been proposed as an effective technology to enhance cancer diagnosis and treatment strategies. This article presents the most recent discoveries regarding the structure, mechanism, and delivery methods of the highly powerful genome editing tool, CRISPR-Cas9. In terms of diagnosis, the article examines the role of CRISPR-Cas9 in detecting microRNAs (miRNAs) and DNA methylation, and discusses two popular gene detection techniques that utilize the CRISPR-Cas system: DNA endonuclease targeted CRISPR trans reporter (DETECTR) and specific high sensitivity enzymatic reporter unlocking (SHERLOCK). Regarding treatment, the article explores several genes that have been identified and modified by CRISPR-Cas9 for effective tumorigenesis of common cancers such as breast, lung, and colorectal cancer. The present review also addresses the challenges and ethical issues associated with using CRISPR-Cas9 as a diagnostic and therapeutic tool. Despite some limitations, CRISPR-Cas9-based cancer diagnosis has the potential to become the next generation of cancer diagnostic tools, and the continuous progress of CRISPR-Cas9 can greatly aid in cancer treatment.

Biography

Hey there, I'm Seyedmahdi Hosseini Bafghi. Born and raised in Mashhad, Iran, currently living here too. I'm 42 years old and I am the second son in the family and still single, with two brothers and one sister.

I hold a Ph.D in Microbiology and work as an official employee in the laboratory sciences department at the faculty of medicine in Mashhad University of Medical Sciences. I'm skilled in clinical laboratory diagnostics and have worked in various hospital, academic, and research settings.

In my spare time, I enjoy several of my favorite affordable hobbies, including exercising, taking walks in the park, and biking along the beach. Additionally, I also indulge in slightly pricier activities such as attending concerts and going to the cinema.