Preface

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EEEP (International Conference on Energy Engineering and Environmental Protection) is an annually held conference for all researchers home and abroad since 2016, aiming to provide a good platform for scholars and researchers in the field of energy and environmental protection to discuss the latest developments and achievements, work out good solutions, and make contributions.

The Fifth International Conference on Energy Engineering and Environmental Protection (EEEP2020) was planned to be held in Xiamen, China on November 17-19, 2020. Due to the epidemic of COVID-19, the meeting had to be changed from onsite to online during November 17-19, 2020 for academic exchanges & discussions. EEEP2020 online conference was divided into 2 sessions: Energy Session on Nov. 18 and Environment Session on Nov. 19, 2020.

International Conference on Energy Material and Energy Technology (EMET 2020) was scheduled to be held in Sanya, China during December 16-18, 2020. However, the outbreak of COVID-19 brought great changes to the schedule of EMET 2020. EMET2020 onsite conference was changed to online format and merged into EEEP2020 online conference – Energy Session on November 18, 2020 for the safety of the participants and for better academic exchanges.

There were about 90 experts and scholars from 7 countries and regions, including China, USA, Russian Federation, Italy, Republic of Korea, Malaysia and India, attending EEEP2020 Energy Session and Environment Session. Each session consisted of 3 parts: keynote speeches, oral presentations and poster presentations and discussions, covering a wide range of energy engineering and environmental protection. There were 14 keynote speakers, 14 oral presenters and 14 poster presenters sharing their latest research results and ideas with the audience. Details about the presentations can be found in the Conference Overview part.

The conference proceedings consisted of 221 accepted articles selected from 419 submissions, including a special session on Intelligent Integrated Energy Systems.

We would like to express our gratitude to the reviewers of these manuscripts, who provided their time and expertise to review papers and facilitate the smooth running of EEEP. We are extremely grateful for organizers, technical program committee and editors and extend our most sincere thanks to all the authors for their excellent contribution and work and participants for their active attending. Our sincere thanks also go to the IOP Publishing editors and managers for their helpful cooperation during the preparation of the proceedings.

On behalf of the Organizing Committee of EEEP 2020
Conference Overview

EEEP2020 online conference was divided into 2 sessions: Energy Session on Nov. 18 and Environment Session on Nov. 19. Each session consisted of 3 parts: keynote speeches, oral presentations and poster presentations.

There were about 90 experts and scholars from 7 countries and regions, including China, USA, Russian Federation, Italy, Republic of Korea, Malaysia and India, attending EEEP2020 online conference. Prof. Wenzhe Tang from Tsinghua University, Prof. Bin Chen from Xi’an Jiaotong University, Prof. Chongchong Qi from Central South University and Prof. Rajesh Kumar Jyothi from Convergence Research Center for Development of Mineral Resources (DMR), Korea Institute of Geoscience and Mineral Resources (KIGAM), presided over the conference.

Conference Schedule

| Date                | Time                | Program                     | Online Platform                      |
|---------------------|---------------------|-----------------------------|-------------------------------------|
| November 17, 2020   | 10:00-17:00         | Online Registration         | VooV Meeting (腾讯会议)             |
|                     | 9:00-9:10           | Opening Ceremony            | Conference No:742 2836 5000         |
|                     | 9:10-15:20          | Keynote Speech              | Poster Voting (http://www.iceeep.org/) |
|                     | 15:30-17:30         | Oral Presentation           |                                     |
|                     | 17:30-18:00         | Poster Presentation         |                                     |
| November 18, 2020   | 9:00-9:10           | Opening Ceremony            |                                     |
| (Energy Session)    | 9:10-12:00          | Keynote Speech              |                                     |
|                     | 14:00-15:00         | Oral Presentation           |                                     |
|                     | 15:00-15:30         | Poster Presentation         |                                     |
| November 19, 2020   | 9:00-9:10           | Opening Ceremony            |                                     |
| (Environment Session)| 9:10-12:00          | Keynote Speech              |                                     |
|                     | 14:00-15:00         | Oral Presentation           |                                     |
|                     | 15:00-15:30         | Poster Presentation         |                                     |
Energy Session—Keynote Presentations

It was our great honor to have the following impressive keynote speeches in Energy Session of EEEP2020 online conference.

Prof. Efstathios E. (Stathis) Michaelides, our first keynote speaker, from Department of Engineering, Texas Christian University, USA, delivered a keynote speech on Technical Problems and Resolutions for the Substitution of Fossil Fuels with Renewables. His presentation examined the energy storage requirements for the substitution with renewable solar and wind energy of 3 examples and made thermodynamic analysis based on hourly data for electricity demand and averaged hourly data of the availability of solar and wind energy, revealing the hourly, daily and seasonal electricity demand and supply as well as the energy storage requirements for the fossil-with-renewables-substitution process.

Prof. Wenzhe Tang from Tsinghua University made a keynote speech entitled Sustainable Hydropower Development. After a brief introduction to the energy status of China, in view of the key unanswered question: how to align the multiple or conflicting objectives of hydropower development from a holistic perspective, he presented solutions to sustainable hydropower development for China on three governance levels: national level, project level and international level.
The third keynote speaker, Prof. Alam Md. Mahbub representing Harbin Institute of Technology, gave a speech on Theoretical and numerical analysis of the origin of thrust of pitching hydrofoil. In his speech, theoretical and numerical analysis of the origin of the thrust on a forced pitching hydrofoil was done, and a theoretical model was developed to understand the origin of thrust produced by oscillating hydrofoil. The analysis provides theoretical relationships of thrust, power, and efficiency as functions of Strouhal number and/or amplitude ratio. The data from the numerical simulation tangibly support the relationships.

Prof. Bin Chen from Xi’an Jiaotong University made a speech on Roadmap to the hydrogen based sustainable energy system. His speech introduced a roadmap and technologies to the hydrogen based environmentally-friendly sustainable energy system with the advantages of large-scale and low-cost. Based on these technologies, hydrogen based sustainable energy system can be achieved in the foreseeable future.

Then Prof. Gangtao Liang, from Dalian University of Technology, China, delivered a wonderful speech on Universal Predicting Methods for Boiling Critical Heat Flux and Heat Transfer on Micro-Pit Surfaces. The keynote lecture reviewed different CHF models and associated mechanisms and parametric trends, as well as universal predicting methods for CHF. Also, pool boiling heat transfer enhancement on the micro-pit surfaces were reported systematically.
As the last keynote speaker in the morning, Prof. Dezhi Ning from Dalian University of Technology, made the speech of Hydrodynamic Investigation on an Offshore Cylindrical Oscillating Water Column Wave Energy Converter. In their study, the hydrodynamic performance of a floating OWC WEC was investigated experimentally and numerically. It was found that the mooring stiffness has a great influence on the hydrodynamics, i.e., the hydrodynamic efficiency and the effective frequency bandwidth increasing with the mooring stiffness. The HOBEM model can enable the structural design of the floating OWC device.

Following the keynote speakers in the morning, Prof. Alexander Lukin, Principal Research Scientist & Executive Director, Western-Caucasus Research Center, Russian Federation, gave his keynote lecture in the afternoon. His speech title is New Insights in Control of Properties of the Hybridized Carbyne-Based Nanofilms through Manipulating by Self-Organized Patterns Excitation at the Ion-Assisted Plasma-Driven Synthesis. In the lecture he reported the laboratory ion-assisted plasma-driven synthesis and plasma functionalization toolkit of hybridized carbyne-based nanofilms with embedded atoms of various chemical elements. A new nano-engineering strategy opened potential for improved advanced energy storage.

Next, Prof. Dongsheng Li representing Shantou University gave a speech on Structural Health Monitoring and Damage Identification of Floating Offshore Wind Turbines. His speech was quite interesting and deep in thoughts, initiating lively discussions among scholars during the Q&A Section.
As the last keynote speaker of Energy Session, Prof. Benedetto Nastasi from Sapienza University of Rome, Italy, ended the keynote speech section by making an excellent presentation on Hydrogen energy in Island and Off-grid Energy Systems. Through his speech, audience could learn that Islands and rural areas have been considered a challenge environment to test renewable energy integration strategies as well as cutting-edge technologies and that Hydrogen technologies could be the pathway to mitigate the afore-mentioned issues providing bidirectional energy exchange.

Energy Session—Oral Presentations

Following the keynote speakers, 9 scholars made oral presentations respectively in Energy Session in the afternoon. Information of speakers and their speeches, as well as screenshots are list as below.

**Dr. Zhengfei Li from Huazhong University of Science and Technology** made a speech on Fault Diagnosis Model of Refrigeration System Combining Boruta and LightGBM Methods for Energy Saving.

**Dr. Ping Lu from Northwest University** gave a speech entitled Evaluation of Carbon Dioxide Storage in the Deep Saline Layer of the Ordovician Majiagou Formation in the Ordos Basin.

**Dr. Mwaura Anselim Mwangi from Harbin Engineering University** made an oral presentation on Small Break Loss of Coolant Accident (SB-LOCA) Fault Diagnosis Scheme Using Adaptive Neuro-Fuzzy Inference System (ANFIS).
Dr. Yanpeng Li from East China University of Technology gave a presentation on Novel Slicing Fabrication of High-Performance Fiber-Shaped All-Solid-State Asymmetric Supercapacitors.

Dr. Jiajun Zhang from Nanjing University of Science and Technology made a speech entitled Research on Factors and Performance of Solar Thermoelectric Radiant Window.

Dr. Wei Huang from General Research Institute for Nonferrous Metals / University of Science & Technology Beijing gave a presentation on High Valence Ion Doping Enables Superior Cycling of Ni-rich Layered Oxides Cathode for Lithium-ion Batteries.

Dr. Fan Zhao China Aerodynamics Research and Development Center made a speech entitled Design and Development of CEWES Software for Complex Environment Wind Engineering Simulation.

In the last, Adede Simon Ochieng from Harbin Engineering University made a speech on Prospects of Functionalized Porous Materials towards Extraction of Spent Nuclear Fuel Radionuclides.

Dr. Haotian Shi from Southwest University of Science and Technology ended the oral presentation section with his speech entitled Online Full-Parameter Identification and SOC Estimation of Lithium-ion Battery Pack based on Composite Electrochemical-dual circuit Polarization Modeling.
Energy Session—Poster Presentations

Ten poster presentations came after oral presentations. Below is a brief list of presenters and their poster titles.

| Presenter     | Affiliation                                                   | Presentation Title                                                                 |
|---------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Gaoyuan Ma    | Wuhan University                                             | Physical Fusion Method of Power Grid Information Based on Power Flow Calculation    |
| Zhongjie Guo  | Tsinghua University                                          | Optimal Power and Energy Sizing of Compressed Air Energy Storage in Distribution Network Using Multiparametric Programming |
| Chenyiyang Jia| Wuhan University                                             | Power Flow Calculation of AC/DC Hybrid Distribution Network Considering Energy Router |
| Libo Jiang    | Sichuan Energy Internet Research Institute, Tsinghua University | Business Models Analysis for Micro Compressed Air Energy Storage Considering the Comprehensive Cost in its Life-Cycle |
| Xiaohua Wu    | Anhui Jiyuan Software Co., Ltd                               | Research on Health Assessment of Electric Power Information System based on Deep Belief Networks and Cluster Analysis |
| Rongdan Diao, Mengting Zhu | Wenzhou University | Study on The Influence of Key Parameters of Exterior Window Structure on Building Energy Saving Effect |
| Qingming Zhang| Jiangsu University Of Technology                             | Numerical and Experimental Studies on Thermophysical Properties of 2D Layered Anisotropic Material |
| Wenbo Lu      | Huazhong University of Science and Technology                | Research of a PEMFC Experimental Platform with Dynamic Precise Reaction Gas Control |
| Yanzhi Duan   | Natural Gas Economic Research Institute of PetroChina Southwest Oil&Gas Field Company | Forecasting the Short-term Urban Gas Daily Demand in Winter Based on the XGBoost Algorithm |
| Shuyu Chen    | Huazhong University of Science and Technology                | Numerical Study on the Impact of Interface Contact Resistance on the Performance of a PEMFC with Serpentine Flow Field |

Environment Session—Keynote Presentations

Prof. Rajesh Kumar Jyothi, the first keynote speaker of Environment Session, from Convergence Research Center for Development of Mineral Resources (DMR), Korea Institute of Geoscience and Mineral Resources (KIGAM), delivered a keynote speech on Clean Energy Applications: Recovery of Rare Earths from e-Waste. In his speech, he introduced land filling problem causing by manufacturing waste, then proposed three primary routes for metal recovery. Besides environmental protection function, rare earths processing were also good for energy saving.
Prof. Chongchong Qi from Central South University, China made a keynote speech entitled Innovative Strategies for Industrial Solid Waste Recycling. In his presentation, different recycling methods were introduced for the disposal of industrial solid waste, which is possibly the most daunting challenge faced by the modern industry. With the application of the mentioned methods, the solid waste minimization and cleaner production in the modern industry will be promoted.

The third keynote speaker, Prof. Hooi Hooi Lean representing Universiti Sains Malaysia, gave a speech on Non-Linear Effect of Financial Development and Urbanization on Carbon Emissions. Her presentation examined the non-linear effects of financial development and urbanization on carbon emissions in 31 African countries for the 1990-2016 period, and the implication of this finding is that African countries can reduce carbon emissions through the acceleration of real GDP. The results also show an inverted U-shaped relationship between financial development and carbon emissions, albeit the non-linear relationship between urbanization and carbon emissions is tenuous.

Dr. G.Velvizhi from CO2 Research and Green Technologies Centre, VIT Vellore, India gave a recorded video presentation entitled CO2 as a Potential Feed Stock for the Production of Value Added Products through Bioelectrochemical Systems, for network connection problem. Her research revealed that the microbial sequestering of CO2 through bioelectrochemical systems are effective methods to convert CO2 to multi carbon organic compounds through biologically driven electrode potential to stimulate the selected electro-active microbial communities to produce the organic molecules. The research has wider applications to use industrial gas, anaerobic gases and syngas as substrate to convert into commercial viable products through an integrated refinery concept.
As the last keynote speaker of Environment Session, Prof. Liang Anhui from Shandong University of Science and Technology, ended the keynote speech section by making an excellent presentation on Golden Ratios of Temperature, Color and Water and Superlattice Structures of Chloroplast Granums. Science is everywhere in life, so is Golden Ratios theory, just as Prof. Liang mentioned in his interesting presentation. Besides, he and his team first proposed granum lamellae form superlattice/multiple quantum well structures which are also existed in outer segments of cones and rods of human eyes.

Environment Session—Oral Presentations
Following the keynote speakers, 5 scholars made oral presentations respectively in Environment Session in the afternoon. Information of speakers and their speeches, as well as screenshots are list as below.

Prof. Yan Zhao from Tianjin University made a speech on “Scenes” Updating the Cultural Landscape of Villages along the Grand Canal under the All Media Communication.

Dr. Yan Li from Xiamen University gave a speech entitled The Effect of Thermal Hysteresis on the Performance of A Regenerative Ericsson Refrigeration Cycle with MnFe-based Composite Material.

Dr. Chenghuan Xiao from Central South University made an oral presentation on A CFD Model for High-Pressure Liquid CO₂ Decompression.
In the last, Hongpu Xue from Xi’an University of Science and Technology made a speech on Study on Degradation of Reactive Brilliant red X-3B by Three-Dimensional Biofilm Electrode Reactor.

Dr. Dengfei Qiu from Xi’an University of Science and Technology ended the oral presentation section with his speech entitled Degradation of Azo Dye Wastewater by the Combination Process of 3D BER and CW-MFC.

**Environment Session—Poster Presentations**

Four poster presentations came after oral presentations. Below is a brief list of presenters and their poster titles.

| Presenter          | Affiliation                                      | Presentation Title                                                                 |
|--------------------|--------------------------------------------------|-------------------------------------------------------------------------------------|
| Chutian Zhang      | Northwest A&F University                         | Environmental Protection Measures Significantly Slow down the Increment of Soil Copper Concentration: The Case Study of Daye |
| Jiaming Leng       | Beijing University of Aeronautics and Astronautics| Electrohydrodynamic Thrust with No Combustion Emissions and Noises in a Centimeter-Scale Point-to-grid Configuration |
| Hengyu Hu          | Zaozhuang University                             | Response of Soil Organic Carbon, Total Nitrogen and Carbon Isotope Fractionation to Long-term Tillage |
| Tingting Meng      | Institute of Shaanxi Land Engineering and Technology Co. , Ltd. | Effect of Application Amount of Bio-organic Fertilizer on Soil Organic Carbon Active Components |

We would like to express our sincere gratitude to the Prof. Wenzhe Tang, Prof. Bin Chen, Prof. Chongchong Qi and Prof. Rajesh Kumar Jyothi, the distinguished keynote speakers, oral speakers, poster presenters as well as all the audiences. This conference has made a success because of their supports and assistance. We are expecting more and more experts and scholars from around the world to join this international conference next year.
Special Session on **Intelligent Integrated Energy Systems**

The proceedings of Fifth International Conference on Energy Engineering and Environmental Protection (EEEP2020) included a special session on **Intelligent Integrated Energy Systems** with 11 full papers after peer review. Details can be found as below:

**Session Title:** Intelligent Integrated Energy Systems

**Aim and Scope:** Due to the rapid development of information and communication technology (ICT) and artificial intelligence (AI), as well as the energy transformation, the control and management of energy systems has been changed. A great deal of new technologies, new control algorithms, new models, new problems, and new business modes emerge, which requires intelligence in the systems. This session aims to focus on the intelligent integrated energy systems. The submissions focus on but not limited to intelligent control and management algorithms, fault diagnosis and efficiency analytics, artificial intelligence algorithms, big data analytics, cloud computing, internet of things, mobile internet, distributed control, and digital twins with their application to integrated energy systems, energy internet, electrical internet of things, and other energy systems.

**Acknowledgements**

This special session was organized by Prof. Dongsheng Yang (College of Information Science and Engineering and Intelligent Electrical Science and Technology Research Institute, Northeastern University, Shenyang, 110819, China) and Dr. Bowen Zhou (College of Information Science and Engineering and Intelligent Electrical Science and Technology Research Institute, Northeastern University, Shenyang, 110819, China).

**Introduction to organizers**

**Prof. Dongsheng Yang,** is the doctoral supervisor and deputy director of the Intelligent Electrical Science and Technology Institute at Northeastern University. His research interests mainly include power system analysis based on complex network theory, artificial intelligent & power distribution technology, new energy resources, and the fault detection technology. He is selected in New Century Talent Supporting Project by Ministry of Education, Chair Professor of Liaoning Revitalization Talents Program, and Liaoning Bai-Qian-Wan Talents Program (Hundred-Talent Level).

Prof. Yang co-authored two books and more than 70 papers. He holds more than 80 patents in China and USA. He had undertaken about 30 research projects, sponsored by National Natural Science Foundation of China, State Grid Corporation of China, and so forth. He won the Second Prize of the National Science and Technology Progress Award, and the Gold Award of Geneva International Exhibition of Inventions. He is currently a member of Energy Internet Equipment and Technology Association of China Machinery Industry Federation and the Secretary of IEEE PES China Transformer Committee.

**Dr. Bowen Zhou** received the BSc and MSc degrees from Wuhan University, Wuhan, China, and the PhD degree from Queen’s University Belfast, Belfast, UK, all in electrical engineering. He is currently an associate professor with College of Information Science and Engineering and Intelligent Electrical Science and Technology Institute, Northeastern University. His research interests include power system operation, stability and control, electric vehicles, vehicle to grid, energy storage, demand response, renewable energy, and energy internet. He is the PI and Co-I of more than 20 government and industry sponsored projects. He has published more than 60 SCI or EI indexed papers. He is a member of IEEE PES China Transformers Committee, IEEE PES China Electric Vehicle Committee, and IEEE PES China PSOPE Committee. He is currently a member of IEEE, IET, IAENG, CSEE, CAA, and CCF. He is also a committee member of several international conferences and an active reviewer of some peer reviewed journals and international conferences.