International Conference on Ubiquitous Power Internet of Things

UPIOT 2019

In Conjunction with SGESG 2019

Conference Programme

http://www.upiot.org/

http://www.sgesg.org/

Conference organized by

Asia Pacific Institute of Science and Engineering(APISE)

Sponsored by

IEEE Industrial Electronics Society Shanghai Chapter

Member Center of Shanghai Jiao Tong University, Chinese Society For Electrical Engineering, CSEE

Hong Kong Society of Mechanical Engineers(HKSME)

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2019.08.21-08.23●Chongqing● China

CONTENTS

WELCOME MESSAGE

The integration of energy revolution and digital revolution is the trend and characteristic of the fourth industrial revolution. Using modern information technology to break through the bottleneck of electric power development, Ubiquitous power Internet of things (UPIOT) and smart grid are the future development trend of power grid. UPIOT and smart grid accomplish the deep coupling of energy flow, information flow and business flow. By means of informationization, digitalization and modernization, the power grid can be enabled to realize the comprehensive state awareness, information exchange and data sharing of equipment and customers in all aspects of energy production, transmission, storage, trading and consumption, and to provide more safe, high-quality, low-carbon and sustainable power services for the society. Through the demand for funds, technology, equipment and talents, the grid itself plays a role of open and sharing platform to form an industrial ecology of multi-participation, win-win cooperation.

The conference UPIOT & SGESG 2019 will bring together researchers and practitioners giving them opportunities to present new ideas, learn and discuss latest research results, and network with key players from academia, industry, and government. The conference will take place in Chongqing, which is located in the southwest of China. It is a beautiful city and also famous of hotpot. On behalf of the organizing committee, I am pleased to invite you to participate in UPIOT & SGESG 2019. We are nearing completion of an exciting and engrossing program covering several key aspects of Ubiquitous power Internet of things, Green Energy and Smart Grid.

I look forward to your contribution to making UPIOT & SGESG 2019 a success, and to meeting you in Chongqing!

Conference Chair

Guojie Li, Shanghai Jiao Tong University, China

CONFERENCE SPEAKERS

Keynote Speakers

Prof. Chen Shen
Tsinghua University, China

Biography: Chen Shen received the B.E. and Ph.D. degrees in electrical engineering from Tsinghua University, Beijing, China, in 1993 and 1998, respectively. He was a postdoctoral research fellow with the University of Missouri-Rolla from 1998 to 2001. He served as a senior application developer in ISO New England, USA, during 2001-2002. He has been a professor of the Electrical Engineering Department of Tsinghua University since 2009. He is currently the Director of Research Center of Cloud Computing and Intelligent Decision-making, Sichuan Energy Internet Research Institute, Tsinghua University. He was supported by the Ministry of Education's Program for New Century Excellent Talents in Universities in 2009. His researches focus on power system analysis and control, including fast modeling and simulation of smart grids, cloud computing and AI application in power systems, stability analysis of power systems with renewable energy generation, emergency control and risk assessment of power systems, operation and control for micro-grids. He has led more than 20 projects, such as National Natural Science Foundation of China, the National High-Tech Research and Development Program (863) of China, Key Project of Chinese National Programs for Fundamental Research and Development (973), National Key Research and Development Program of China, etc. Chen Shen has more than 150 journal and conference publications, owns 22 patents and has authored 1 book.

Keynote Lecture: Digital Twin of Integrated Energy System and its Application

As the increase of energy consumption in both quantity and type, the multi-carrier energy system, including cold, heat, electricity and others is gradually replace conventional simple energy system. By the coordination of multiple energy, including energy conversion and energy storage/releasing, a multi -carrier energy system becomes an integrated energy system (IES), where electricity which can convert into cold and heat is the hub of the conversion of multiple energy carriers. With the optimization of coordination, higher economic performance can be obtained in the IES. However, due to the complexity of IES and the randomness of environment, it's hard to optimize the operation of an IES.

A digital twin can be defined, fundamentally, as an evolving digital profile of the historical and current behavior of a physical object or process that helps optimize business performance. The digital twin is based on massive, cumulative, real-time, real-world data measurements across an array of dimensions. These measurements, together with the physical equations, can create an evolving profile of the object or process in the digital world that may provide important insights on system performance, leading to actions in the physical world such as control of the object or process.

This talk introduces how the digital twin concept is applied to optimize the operation of a heat-pump-based heating supply system.

Prof. Gehao Sheng
Shanghai Jiao Tong University, China

Biography: Dr. Gehao Sheng is full professor of electrical engineering at Shanghai Jiao Tong University. He received his B.S.，M.S. degrees and Ph.D. degree in electrical engineering from Huazhong University of Science and Technology(HUST),Wuhan, China in 1996，1999 and 2003, respectively. He joined SJTU since 2003 and is currently professor of electrical engineering. His research interests include condition monitoring and fault diagnosis of power equipment, smart power equipment and big data analysis to smart grid. He has published 2 books, more than 160 journal articles, obtained 52 patents and has been principal investigator or co-principal investigator on more than 10 research grants from NSFC, the National Priority Basic Research of China (973), The National High Technology Research and Development Program (863), the National Key R&D Program Project and more than 30 research grants from the Science and Technology Project of State Grid Corp. He received Shanghai Science and Technology Progress First Class Award in 2015 and 2017.

Keynote Lecture: Internet of Things for power transmission and distribution equipment

The construction of Internet of Things (IoT) for power transmission and distribution equipment is an important content for upgrading management and maintenance mode of power equipment. And it is a valuable means for making power equipment more intelligent. The background and general idea of IoT for Power Equipment (IoTPE) construction is introduced. The operation characteristics and monitoring requirements of transmission, substation and distribution part are analyzed from the perspective of equipment. Accordingly, the corresponding construction scheme, key technology, application scenario and development trends of IoTPE are proposes and illustrated.

Prof. Wei Gu
Southeast University, China

Biography: Dr. Wei Gu is a Professor, Doctoral Supervisor and Associate Dean of the School of Electrical Engineering, Southeast University. He is also the Director of Research Institute of Distributed Generations and Active Distribution Networks, and Vice Director of the Power System Simulation Committee of China Simulation Federation. His research interests include distributed generations, microgrids, active distribution network and integrated energy system. He has presided over one key project (NSFC-SGCC Joint Fund for Smart Grid) and three General/Youth projects of the National Natural Science Foundation of China, one Sub Project of the National Key Research and Development Program. He has published over 90 SCI papers, and 5 papers are ESI Highly Cited Papers (Top 1%). His H-index is 27 and the total citation is 2979 (based on Google Scholar), 773 of which are cited by SCI papers. He has more than 30 China National Invention Patents and 1 United States Invention Patent, all granted. As the first completer, he won the First Prize of Science and Technology of China Simulation Federation, and the Golden Prize of the 48th International Exhibition of Inventions Geneva. His research output has been successfully applied to over 20 projects of distributed generation, micro-grid and active distribution network systems.

Keynote Lecture: Planning Methodologies for Distributed Integrated Energy Systems

The optimal planning of distributed integrated energy systems is of great significance to facilitate the accommodation of renewable energy and satisfy various energy demands of the end-users. However, balancing the financial expectations and energy demands of different stakeholders of

distributed integrated energy systems is always challenging. The proposed planning methodologies can provide robustly planning scheme for distributed integrated energy system stakeholders considering the multiple energy demand uncertainties, payback periods, investment risks and local natural wealth. An online planning platform for distributed integrated energy systems is also developed with user-friendly interface for both energy system plan & design beginners and professionals.

Prof. Ming Zhou
North China Electric Power University, China

Biography: Ms Zhou got her BS., MS., and Ph.D degree all in electrical engineering in North China Electric Power University (NCEPU) in 1989, 1992 and 2006, respectively. Now she is a professor of Power Systems and Its Automation at NCEPU.
Professor Zhou's research experience lies in renewables integrated power system planning and operation, competitive electricity market and demand response. She hosted two NSFC projects on optimal dispatch of power systems with high wind power penetration and transmission capability assessment on hybrid HVAC/HVDC system. Now she is conducting a Smart Grid Joint Foundation Program of NSFC and State Grid Corporation on Dispatch Operation for the AC/DC Hybrid Power System with Large Scale Renewables, and a NSFC project on demand response. She is also involved two National Key Research and Development Programs of China, as well hosting several utility financially supported projects on electricity market. She has published more than 150 SCI/EI indexed papers, got 8 patents of invention.

Keynote Lecture: On the Application of Ubiquitous Power Internet of Things to Distributed Energy Resources Trading

With the rapid development of communication technology, the concept of energy internet has attracted tremendous attention and interest form both industry and academia in the past few years. The smart gridcentered energy internet promotes the integration of multi-energy and application of advanced information technology, which can facilitate the penetration of renewable energy. In 2016, China government formally put forward the concept of "Internet+ Smart Energy", a new form of energy industry development that integrates the internet with energy production, transmission, storage, consumption and energy markets, aiming at improving the accommodation of renewable energy. China's first batch of 55 "Internet+ Smart Energy" projects were announced in 2017 to further promote the practice and development of energy internet in China. Meanwhile, some other projects around the world are also exploring the potential benefits of the application of energy internet, e.g. distributed clean energy management platform in USA, smart energy hub in Switzerland.

The internet of things, as an important technology towards energy internet transition, can promote the synergy of cyber physical systems and envision the seamless interconnection of the physical world and cyberspace and their pervasive presence around us. At the technology level of IoT, some studies focus on the core technologies of IoT, e.g. big data analysis, cloud computing, topology control in wireless sensor networks. Besides, recent IEEE Standards also provided a foundation for the application of IoT. At the economic application aspects, a detailed architecture and an implementation of a "last-meter" smart grid embedded in IoT platform is proposed. Moreover, the IoT has also been applied in manufacturing as well as in transportation system to realize information exchange. In 2019, for the first time, the "three-type and two-network" strategy was proposed as well as the construction outline of "Ubiquitous Power Internet of Things" (UPIoT). The

Ubiquitous Power Internet of Things came into being, bearing the great hope of grid transformation and aiming at creating an energy internet industry ecosystem.

With the extensive use of advanced information and communication technology (ICT) in smart grids, a smart grid is a highly informative power system with mass measurement, control unit and advanced communication technology, which is a typical cyber-physical system (CPS). In recent years, distributed energy resources (DERs) have played an increasing important role in electrical industry, which imposes great challenges in both the economic operation as well as the reliable of power grids. Due to the limited controllability of DERs and the poor flexibility of power grid, the DERs cannot be fully accommodated, which significantly reduces the utilization of DERs. However, with the support of IoT, the controllability for DERs can be greatly improved, and effectively respond to dispatch signals and submit offers for energy or reserve capacity in electricity market. A wide variety of studies have focus on the IoT-based DERs scheduling and energy trading. This report will address the following the UPIoT based DERs trading:

(1) A home energy management strategy considering comfort preference of residents is developed to coordinate residential demand response to contribute the grid's peak regulation, relevant incentive mechanism is exploited to serve the time of use pricing. (2) The trading mode and settlement mechanism of electric vehicles actively participating in electricity balance market is presented to provide more flexible balance service with promoting variable renewable resources accommodation. (3) An optimal bidding framework for a V2G-enabled regional energy internet (REI) is proposed to participate in day-ahead markets considering carbon trading. The REI operator aims to maximize the net profits from day-ahead markets while anticipating the real-time adjustments. (4) A DER sharing scheme is proposed considering communication topology, the proposed model and method will provide important references for construction of Ubiquitous Power Internet of Things.

Prof. Shaoyong Guo
Beijing university of posts and telecommunications, China

Biography: Shaoyong Guo received the Ph.D. degree at Beijing University of Posts and Telecommunication. And he received the B.S. degree in Information and Computing Science from HeBei University. He won 2 provincial and ministerial second prizes, 1 first prize of the Power Innovation and 1 second prize of the Communication Society. Leading one international standard project and participating in 3 other international/industry standards. His research interests include blockchain Application technology, mobile edge computing, and IoT in energy Internet.

His main contributions to the Blockchain applications are:

- The "Decentralized IoT Communication Architecture based on Information Centric Networking and Blockchain" document, which he led, was approved to be a new international standard in ITU-T. The standard combines ICN and blockchain technologies to provide decentralized, secure, trusted, real-time data communication capabilities for the Internet of Things, enabling data sharing between IoT devices and application systems across IoT domains over non-secure trusted networks. It is the first real-time IoT communication technology standard based on blockchain proposed on a global scale.
- The Ppk open source community (http://www.ppkpub.org/), in which he is an initiating member, was established and an open naming identification system was proposed. He is committed to creating a decentralized DNS resolution model, constructing a credible future information and communication infrastructure platform.

He transformed these blockchain results into trusted ubiquitous access terminals, trusted

authentication systems, network trusted real-time sharing platforms, and smart contract-based trusted service systems, and conducted pilot verification in State Grid Zhejiang Electric Power Company, State Grid Henan Electric Power Company, State Grid Hebei Electric Power Company, Shenzhen Power Supply Company, etc.

Keynote Lecture: Block chain Network& Data Trust Sharing for UPIoT

In this talk, we present Blockchain Network & Data Trust Sharing for UPIoT. The blockchain is integrated with the value stream, business flow, and data stream of the energy Internet. Based on the research results of the State Grid Corporation in the blockchain, we introduce the basic concept of blockchain, and introduce the combination of blockchain and energy internet in detail, including the characteristics of blockchain and energy Internet, the application ideas of blockchain in the energy internet, and the application status of blockchain in energy internet. At the same time, according to the results of different blockchain-related projects of energy companies, the energy system value services driven by energy data sharing is launched, the four technologies-distributed security trusted authentication, data trusted collection, data trusted slice sharing, and data privileged trusted service were discussed. we also conduct detailed case analysis on the cases of State Grid Zhejiang Electric Power Company, State Grid Henan Electric Power Company, Beijing China-Power Information Technology Company, Beijing University of Posts and Telecommunications and other units, and we work hard to jointly build a credible and secure power information and communication infrastructure.

Invited Speakers

Prof. Keyou Wang
Shanghai Jiao Tong University, China

Biography: Keyou Wang is professor and associate chair of department of electrical engineering at Shanghai Jiao Tong University. He received his B.S. and M.S. degrees in electrical engineering from Shanghai Jiao Tong University and his Ph.D. degree in electrical engineering from Missouri S&T (formerly University of Missouri-Rolla). He joined SJTU since 2012 and is currently the associate chair of electrical engineering. His area of professional interests include high performance computing and power electronics applications to renewable energy systems, microgrids, and active distribution grids. He serves as Associate Editor of IET Generation, Transmission & Distribution and Academic Editor of CSEE Journal of Power and Energy Systems.

Keynote Lecture: General Power Electronics Real-time Digital Simulator and its Applications from A Cyber-Physical Systems Perspective

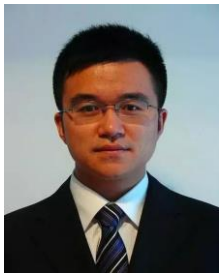
Power electronics have proven a significant technology for the modern and future power grid. This talk will introduce a general power electronics real-time digital simulator. The challenges mainly come from the fast switching characteristic and the large amount of power converters. Achieving real-time simulations with such small time-steps like 500ns requires not only the great computing power of hardware but also the high efficiency of models and simulation algorithms. This speech will discuss recent efforts to develop new models and the associated real-time simulation technology. The current and future applications of this simulator are discussed from a cyber-physical systems (CPS) perspective.

Prof. Shuai Lu
Chongqing University, China

Biography: Shuai Lu received the B.S.E.E. degree from Chongqing University, Chongqing, China, in 1997, the M.S.E.E. degree from the University of Wisconsin, Milwaukee, in 2003, and the Ph.D. degree in electrical engineering from the University of Missouri–Rolla, Rolla, in 2007. During his Ph.D. research, he authored or coauthored 20 technical papers, including 7 IEEE TRANSACTIONS papers. In February 2007, he joined MTS Systems Corporation, Eden Prairie, MN, where he was the lead power electronics and motor drive engineer for the successful development of the world's first generation of the hybrid electric system for Formula-1 cars in the 2009 race season (also known as "KERS: Kinetic Energy Recovery System"), which is arguably the highest power density and performance hybrid electric system in the world. In the late 2012, he joined the Chongqing University as a professor, where he established 7 laboratories and accomplished numerous industrial R&D projects in various areas of power electronics and motor drives, with the particular focus on the applications in hybrid and electric vehicles and renewable energy systems.

Keynote Lecture: Integration of Electric Vechicles with the Smart Grid

The need for rapid charging of the electric vehicle (EV) gave rise to the widespread construction of the EV fast dc charger infrastructure. From the grid perspective, there are two main aspects to be investigated. Firstly, the high power ratings of the rapid chargers pose a tremendous challenge to the distribution grid; different options have been proposed over the years to alleviate the issues. Secondly, potential advantages of using EV to interact with the power grid (V2G) have been widely investigated; obviously, it requires the bi-directional power conversion capabilities; however, the cost of the EV battery is overwhelmingly high, and V2G is currently not cost effective to justify the bi-directional EV charger as it reduces the battery cycle life; also, the owners of the EVs come to the rapid charging stations to enjoy lightning fast energy supply, instead of waiting for hours to participate in the power flow control in the grid. This seminar is to discuss the above two aspects with some of the presenter's own R&D experiences.



Prof. Rongfu Sun
State Grid Hebei Power Control Center, China

Biography: Dr. Rongfu Sun joined North China Grid Company and Jibei Electric Power Company successively in the past 10 years, currently is a renewable energy dispatch engineer. He received his B.S., M.S. degrees and Ph.D. degree from Shanghai University of Electric Power, Wuhan University and Tsinghua University in 2002, 2005 and 2009. His research interests include renewable energy forecasting and generation scheduling, active power coordinated control. He has published 2 books, 35 journal articles, obtained 19 patents, one journal article was included by F5000 – Top Articles in Outstanding S&T Journals of China. He has been the technical director of the National Priority Basic Research of China (973), the National High Technology Research and Development Program (863), and research projects of SGCC, and received 11 provincial level Science and Technology Progress Awards.

Keynote Lecture: Integration and Dispatch Techniques of High-Penetration Renewable Energy

Renewable energy development and high curtailment rate have been a nationwide consensus, market mechanism and dispatch techniques are important to improve accommodation capacity in

the past five years. A brief introduction of market countermeasures and dispatch methods is put forward in this presentation. Firstly, operational characteristics of wind and solar power were analyzed, which are the main factors of China's renewable energy curtailment. Secondly, some market countermeasures to release curtailment problems in different provinces are introduced, such as ancillary service market, thermal unit flexibility transformation, electricity spot market, and so on. Then, a whole-process renewable energy dispatch system was established, which is composed of real-time monitoring, power prediction system, reserve optimization, dynamic scheduling and coordinated control functions. Finally, some suggestions to ubiquitous power dispatch and distributed renewable energy management were proposed for further discussion.

Prof. Bo Hu
Chongqing University, China

Biography: Bo Hu was born in 1983 in Henan, P.R. China. He received the Ph.D. degree in Power System and Its Automation at Chongqing University, Chongqing, China, in 2010. Currently, he is a full professor in the School of Electrical Engineering, Chongqing University, China. His main research interests focus on the areas of power system reliability, planning and analysis.
He is the team leader of more than 40 academic projects, including two projects under the National Natural Science Foundation of China, and two projects under the National key Research and Development Program of China. He is the recipient of five academic awards, such as Science and Technology Advancement Award of China Electric Power Industry (first prize, the third recipient of the awarded group, 2018), Science and Technology Advancement Award of Chongqing City (first prize, the second recipient of the awarded group, 2016), Natural Science Award of the Ministry of Education (second prize, the third recipient of the awarded group, 2016), Natural Science Award of Chongqing City (first prize, the fourth recipient of the awarded group, 2011), Natural Science Award of Chongqing City (third prize, the fifth recipient of the awarded group, 2009).
He is a session chair of the PMAPS-2016; a member of the editorial board of Electrical Science & Engineering and a member of the Technical Committee of ISGT ASIA 2019. He is the author and co-author of over 80 academic papers and two books.

Keynote Lecture: Power System Reliability Assessment under the Background of Rapid Development of Ubiquitous Power Internet of Things

The lecture is divided into three parts. The first part introduces the reliability assessment of traditional power systems, including the definition of reliability, the classification of reliability assessment, the procedures of reliability assessment, and main influencing factors of power system reliability. The second part introduces the technical characteristics of power systems under the background of rapid development of ubiquitous power internet of things (UPIOT). The third part discusses relevant thoughts on the reliability assessment of power system under the background of rapid development of UPIOT, which involves virtual power plant, cyber-physical attacks and so on.

PROGRAMME OVERVIEW

Date	Time	Programme	Location
Aug. 21, 2019	14:00-17:00	Registration	Lobby
	18:00-19:00	Welcome Dinner	TBA
Aug. 22, 2019	08:30-09:00	Opening Ceremony+ Group Photo	Conference Room: Birmingham Hall (3rd Floor)
	09:00-09:40	**Keynote Lecture** Prof. Chen Shen	
	09:40-10:10	**Invited Lecture** Prof. Rongfu Sun	
	10:10-10:40	**Coffee Break+ Poster Session I**	Foyer of Cambridge Hall
	10:40-11:20	**Keynote Lecture** Prof. Shaoyong Guo	Conference Room: Birmingham Hall (3rd Floor)
	11:20-11:50	**Invited Lecture** Prof. Shuai Lu	
	11:50-12:20	**Invited Lecture** Prof. Keyou Wang	
	12:20-14:00	Lunch	Queen Western Restaurant (2nd Floor)
	Track 1		
	14:00-14:40	**Keynote Lecture** Prof. Gehao Sheng	Conference Room: Birmingham Hall (3rd Floor)
	14:40-15:20	**Keynote Lecture** Prof. Wei Gu	
	15:20-15:40	Coffee Break	
	15:40-16:40	Technical Session I	
	Track 2		
	14:00-14:40	**Keynote Lecture** Prof. Ming Zhou	Conference Room: Cambridge Hall (3rd Floor)
	14:40-15:10	**Invited Lecture** Prof. Bo Hu	
	15:10-15:30	Coffee Break	
	15:30-16:45	Technical Session II	
	16:45-17:30	**Poster Session II**	Foyer of Cambridge Hall
	18:00-19:00	Dinner	JiuLongTan Restaurant (-1st Floor)
Aug. 23, 2019	10:00-11:00	Technical Tour	Chongqing University

TECHNICAL SESSION

Keynote & Invited Speech Session I Session chair: Guojie Li Aug.22 Thursday, Conference Room: Birmingham Hall			
Time	**No.**	**Content**	**Page**
09:00-09:40	K1	Digital Twin of Integrated Energy System and its Application ***Chen Shen,*** Tsinghua University, China	4
09:40-10:10	I1	Integration and Dispatch Techniques of High-Penetration Renewable Energy ***Rongfu Sun***, State Grid Hebei Power Control Center, China	9
10:10-10:40	**Poster Session I + Coffee Break**		

Keynote & Invited Speech Session II Session chair: Chen Shen Aug.22 Thursday, Conference Room: Birmingham Hall			
Time	**No.**	**Content**	**Page**
10:40-11:20	K2	Block chain Network& Data Trust Sharing for UPIoT ***Shaoyong Guo,*** Beijing university of posts and telecommunications, China	7
11:20-11:50	I2	Integration of Electric Vechicles with the Smart Grid ***Shuai Lu,*** Chongqing University, China	9
11:50-12:20	I3	General Power Electronics Real-time Digital Simulator and its Applications from A Cyber-Physical Systems Perspective ***Keyou Wang,*** Shanghai Jiao Tong University, China	8

Poster Session I Session Chair: Ming Zhou 10:10-10:40 Aug.22 Thursday, Foyer of Cambridge Hall	
S302	Generalized Load Modeling Considering Inverter Capacity Limitation ***Yu Zhipeng,*** Shanghai Water Planning and Design Research Institute, Shanghai Bibo Water Design and Research Center, China
S305	Urban distribution network operation risk index system and calculationmethod ***PEI Chao,*** State Grid Chongqing Jiangbei Power Supply Company, China

S309	Spatial-temporal distribution prediction of charging load for electric vehicle based on dynamic traffic flow ***Yunong SONG,*** South China University of Technology, China
S312	PSO-based Siting and Sizing of Electric Vehicle Charging Stations ***Han Chen,*** State Grid Electric Vehicle Service (Fujian) Company Limited, China
S315	The substation internet of things system based on edge computing ***Fayu Chong,*** Shandong University, China
S2003	Research on Characteristics of Grounding Electrode of HVDC Transmission ***Bozhong Wang,*** State Grid Hunan Electric Power Corporation Maintenance company, China
S2012	Research on Parallel Operation Characteristics and Current Sharing Method of High Power IGBT ***TANG YONG,*** Wuhan Donghu University, China
S2014	Energy Efficiency Optimization for Ubiquitous Power Internet of Things ***Wang Jijun,*** Jiangsu Electric Power Information Technology Co.,LTD, China
S2015	Research on SaaS layer application architecture for DCCP considering ubiquitous internet of things ***Hongjun Liu,*** Power Dispatching and Control Center, State Grid Shandong Electric Power Company, China
S2016	Identification of hidden dangers in transmission line corridors based on hybrid algorithms ***Wenjie Zheng,*** State Grid Shandong Electric Power Research Institute, China
S004	Optimal operation management in a micro-grid system using particle swarm optimization ***Zhu Zengwei,*** College of Mechanical and Electrical Engineering, Hohai University, , China
S1005	Electric Field Simulation of Equipotential Live-line Work in 500kV Cup-type-tower ***Yongxin Liu,*** Wuhan University, China
S1007	Research on Low Power Sensor Networking Technology of Transformer Equipment Based on Node Energy ***Demeng Bai,*** State Grid Shandong Electric Power Research Institute, China
S1011	Design and Implementation of a Multi-sensor PD Online Monitoring System in GIS ***Yongpeng Xu,*** Shanghai Jiao Tong University, China
S1012	Study on Characteristics of Different Internal UHF Sensors in GIS ***Yongpeng Xu,*** Shanghai Jiao Tong University, China
S1013	Application of Improved BPNN Algorithm in GIS Insulation Defect Type Identification ***Yongpeng Xu,*** Shanghai Jiao Tong University, China
S1020	The Development of Mobile On-line Partial Discharge Monitoring System of XLPE Cable ***ZHANG Yue,*** Shanghai Jiao Tong University, China

S1025	Concepts, technical characteristics and Construction Experiences of Energy Internet: A review ***Yunlu YANG,*** State Grid Zhejiang Economic and Technological Research Institution, China
S1030	Realization of Sequential Control Function Based on Bay Level Equipment in Smart Substation ***Bo Wen,*** State Grid Hubei Electric Power Company Limited Research Institute, China
S1033	Study on Minimum Inertia Demand of System Considering Frequency Stability of MIDC Power Grid ***XU Guang,*** State Grid Electric Power Research Institute（NARI Group Corporation, China
S1034	Comparative Study on Power Oscillation Disturbance Source Location Method Based on Oscillation Energy Flow ***Siyuan Guo,*** State Grid Hunan Electric Power Company Limited Research Institute, China

Track 1: Keynote Speech Session III

Session Chair: Keyou Wang

Aug.22 Thursday, Conference Room: Birmingham Hall

Time	No.	Content	Page
14:00-14:40	K3	Internet of Things for power transmission and distribution equipment ***Gehao Sheng,*** Shanghai Jiao Tong University, China	5
14:40-15:20	K4	Planning Methodologies for Distributed Integrated Energy Systems ***Wei Gu,*** Southeast University, China	5
15:20-15:40	**Coffee Break**		

Technical Session I

Session Chair: Keyou Wang

Aug.22 Thursday, Conference Room: Birmingham Hall

15:40-15:55	S308	Analysis of Power Service Bandwidth based on AHP and Clustering ***Xu Jie,*** University of Electronic Science and Technology of China, China	18
15:55-16:10	S1028	On the Necessity to Integrate Power Flexibility in Cooling Systems ***Didier Vuarnoz,*** University of Apllied Sciences of Western Switzerland HES-SO, Switzerland	18
16:10-16:25	S318	UPIoT Intellisense Laboratory Scenarios ***Wang Shaojing,*** Electric Power Research Institute, State Grid Shanghai Electric Power Company, China	18

16:25-16:40	S1022	A power transformer fault diagnosis method based on hierarchical classification and ensemble learning ***Yu Cui,*** Department of Electrical Engineering, Shanghai Jiao Tong University, China	19
Track 2:Keynote & Invited Speech Session IV **Session Chair: Shuai Lu** **Aug.22 Thursday, Conference Room: Cambridge Hall**			
14:00-14:40	K5	On the Application of Ubiquitous Power Internet of Things to Distributed Energy Resources Trading ***Ming Zhou,*** North China Electric Power University, China	6
14:40-15:10	I4	Power System Reliability Assessment under the Background of Rapid Development of Ubiquitous Power Internet of Things ***Bo Hu,*** Chongqing University, China	10
15:10-15:30	**Poster Session II+ Coffee Break**		
Technical Session II **Session Chair: Shuai Lu** **Aug.22 Thursday, Conference Room: Cambridge Hall**			
15:30-15:45	S311	The influence of distributed energy storage on voltage distribution ***Gao Xu,*** Shandong University, China	19
15:45-16:00	S314	Comprehensive evaluation of two-side voltage sag based on local state variable weight and complex correlation coefficient method ***Zhang Tianhao,*** Shandong University, China	19
16:00-16:15	S2001	An Improved Variable Step Size P&O MPPT Algorithm Based on Constant Voltage and K division Technology ***ZHANG Peng,*** Shandong University, China	20
16:15-16:30	S2004	PV prediction based on PSO-GS-SVM hybrid model ***KONG Hongmei,*** ShandongUniversity, China	20
16:30-16:45	S1024	Operating elements of UK electricity contract market and its enlightenment to China ***Sun Renjie,*** Nanjing Normal University, China	20

Poster Session II **Session Chair: Wei Gu** **16:45-17:30 Aug.22 Thursday, Foyer of Cambridge Hall**	
S303	A Prediction Method for Power Transformer State Parameters Based on Grid Long Short-Term Memory Network

	Hui Song, Shanghai Jiao tong University, China
S304	Energy Analysis of Integrated Energy Based on Cloud Computing ***Du Yan,*** State Grid ShanDong Electric Power Research Institute, China
S310	Voltage harmonic and interharmonic detection method for DC microgrid based on Hanning window interpolation ***ZHU Hanlin,*** Shandong University, China
S313	The Reactive Power Compensation Planning for N-1 Line Outage Based on Line Fault Betweenness ***Bichao Ye,*** State Grid Electric Vehicle Service (Fujian) Company Limited, China
S317	Research on Loop Closing Operation of 10kV Distribution Network Based on Distribution Automation ***Zhuoran Li,*** Zhejiang University, China
S2002	Fast reliability assessment algorithm of distribution network based on topological similarity analysis ***Hao Liu,*** Foshan Power Supply Bureau of Guangdong Power Grid Limited Liability Company, China
S2007	Study of Voltage Distribution and Radial Electric Field under Different Pollution Conditions of 500kV MOA ***Hui Wang,*** Shanghai Jiao Tong University, China
S2010	Two-stage Planning of Integrated Energy System Considering Investment Flexibility ***Yue Qiu,*** Southeast University, Nanjing, China
S001	Polytype Dynamic Reactive Power Equipment Planning Method for Receiving-end Power Grid ***LIU Gao-wei,*** East China Electric Power Esign Institute CO., LTD., China
S002	Study on Application of Optimum Index Factor in the Electric Power Benchmarking ***Wang Yao ping,*** Wuhan University, China
S003	Preparation of flower-like Zn-Al layered double hydroxides as anode materials with improved electrochemical performance ***Xinyu Yan,*** University of Electronic Science and Technology of China, China
S1001	Reactive molecular dynamics simulation of transformer oil pyrolysis ***Xuelei Wang,*** State Grid Electric Power Company Shandong Electric Power Research Institute, , China
S1008	High Performance Secondary Index Design for Complex Queries in Smart Grid System ***Qin Jiafeng,*** State Grid Shandong Electric Power Research Institute, China
S1016	Capacity Credit Algorithm and Index of the New Energy of Wind Energy and Solar Energy based on Big Data ***Zhang Yifan,*** Wuhan University, China
S1018	Micro-mismatch loss analysis based on solar cell IV curve ***Liu Fuguang,*** Hohai University, China

S1019	Research and Practice on Course Design of Medical Physiology and Engineering under the Background of Cultivating Innovative Talents ***Liu Yingjiu,*** Basic Medical of Beihua University, China
S1021	ANALYSIS OF NATURAL HAZARD EVENTS AT PACIFIC ISLAND COUNTRIES WITH WAVE ENERGY POTENTIAL ***Borges Posterari Jessica,*** The University of Tokyo, Japan
S1023	Research on the application value of Wireless Mesh Network in Power Equipment of the UPIOT ***Si Meng Song,*** Shanghai Jiao Tong University, China
S1029	Research on smart grid data management scheme based on sovereign blockchain ***Xueyong Tang,*** Wuhan University, China
S1032	Strategies to fabricate flexible SnO_2 based perovskite solar cells using pre-crystallized SnO_2 ***Detao Liu,*** University of Electronic Science and Technology of China, China
S1035	Analysis on operation modes of regional integrated energy system based on interests exchange relationship ***ZHANG Chen,*** State Grid Energy Research Institute Co., Ltd,China
S1036	Study of Temperature Field and Ampacity of 110kV AC Submarine Cables under Different Laying Conditions ***Tingting He,*** Chongqing Univercity, China
S2017	Neural Network Model of Wind Farm Based on DFIGs ***Bingtao Guo,*** Shanghai Jiao Tong University, China

ABSTRACT

Technical Session I	
Time	**Content**
15:40-15:55 Aug.22	**S308:** Analysis of Power Service Bandwidth based on AHP and Clustering **Presenter:** Xu Jie, University of Electronic Science and Technology of China, China **Abstract:** The current method of analyzing the relationship between communication service and bandwidth requirement in the power communication network is simple. It uses a single formula with predetermined constant parameters to calculate the bandwidth of each communication service for a given site which can not show the relative bandwidth demand of different services. This paper proposes a combined AHP and hierarchical clustering method to analyze the relative bandwidth requirement of each service. This method is based on AHP to analyze the impact of different factors on bandwidth and use hierarchical clustering method to aggregate services with similar communication needs into the same class, and it shows different services' relative bandwidth requirement clearly. Experiments on data of various site shows that all the services with similar bandwidth requirements are grouped into the same class.
15:55-16:10 Aug.22	**S1028:** On the Necessity to Integrate Power Flexibility in Cooling Systems **Presenter:** Didier Vuarnoz, University of Apllied Sciences of Western Switzerland HES-SO, Switzerland **Abstract:** Today, cooling systems are widely used, notably with the unprecedented growth of data centres and building space cooling. These thermodynamic systems are powered mainly with electricity, and their peak loads are generally associated with very high carbon footprints. At the same time, congestion of the grid due to high load or renewable power injection is becoming an issue for all actors involved with electricity (producers, providers, consumers, and prosumers). Actually, both the price and associated carbon footprint of electricity usually fluctuates along with the charge of the network. This paper discusses the integration of power flexibility (PF) in new and existing cooling systems to avoid a possible cold crunch in the near future. After defining PF, several cooling systems archetypes are presented. Three possible ways to integrate PF are explained: flexibility by thermal inertia and energy storage (thermal and electrochemical). While PF principally targets the reduction of stress on the electric grid, other benefits can also be achieved, e.g. mitigation of direct carbon emissions and decrease of costs related to operating the refrigeration system. We explain how better management of energy transits and possible imbalance in electricity networks can be achieved by thermal inertia. The choice of integrating thermal storage or electric battery is discussed, and both solutions are considered in a specific case study. The study aims at better management of power loads on electricity network caused by the cooling system and could be useful for anyone involved with grid management and/or refrigeration systems.
16:10-16:25 Aug.22	**S318:** UPIoT Intellisense Laboratory Scenarios **Presenter:** Wang Shaojing, Electric Power Research Institute, State Grid Shanghai Electric Power Company, China

	Abstract: To improve the quality of intellisense facilities, UPIoT intellisense laboratory, the very first lab of UPIoT field, is found. The principles of laboratory including standard test, defined procedure, transparent process, shared information, open construction and international practice. Based on the principles, five main research directions are confirmed. The omnibearing performance verification of intellisense facility and performance criterion and verification of new facility are the cores of laboratory. The laboratory is the quality control basis of UPIoT.
16:25-16:40 Aug.22	**S1022:** A power transformer fault diagnosis method based on hierarchical classification and ensemble learning **Presenter:** Yu Cui, Department of Electrical Engineering, Shanghai Jiao Tong University, China **Abstract:** Since conventional machine learning methods often result in low diagnostic accuracy and non-negligible recognition difference among fault types with imbalanced class distribution among transformer fault types, a multi-level hierarchical power transformer fault diagnostic model is proposed based on hierarchical classification and ensemble learning, where classifiers are hierarchically constructed for level-by-level diagnosis according to the imbalance extent on each level. The Level I neural network classifier extracts 3 generalized feature labels of normal, discharge fault and thermal fault for feature fusion with original data input, to guide classification among 9 detailed operation status under DL/T 722-2014 standard. The Level II classifier adopts EasyEnsemble, generating balanced training subsets by undersampling majority classes and training sub-classifiers in parallel for parameter synthesis in ultimate classifier, to balance information between major fault types and minor ones. Experimental result shows that: compared to traditional methods, our proposed method improves the generalization ability on minority class faults and the overall accuracy by 7%.

Technical Session II	
Time	**Content**
15:30-15:45 Aug.22	**S311:** The influence of distributed energy storage on voltage distribution **Presenter:** Gao Xu, Shandong University, China **Abstract:** Distributed energy storage in the distribution network is mainly responsible for the peak load shifting, and it will also affect the voltage of the distribution network at the same time.Build the ieee33-node model with MATLAB/SIMULINK,and the distributed energy storage is connected to the node with weak voltage stability.Then analysis the influence of distributed energy storage from three aspects of access location, access capacity and access quantity.The simulation results show that the distributed energy storage connected to the distribution network can obviously improve the voltage stability and reduce line loss.
15:45-16:00 Aug.22	**S314:** Comprehensive evaluation of two-side voltage sag based on local state variable weight and complex correlation coefficient method **Presenter:** Zhang Tianhao, Shandong University, China **Abstract:** The severity assessment of voltage sag is one of the important basis to measure power quality.At present, voltage sag assessment is mostly based on

	system or load, lacking of unity on both sides.The evaluation indexes of the voltage sag on the side of the system are divided into the first level and the second level.The load-side evaluation adopts the equipment failure rate based on the comprehensive tolerance curve of sensitive equipment, and the failure probability model is based on the energy function.The complex correlation coefficient method is used to synthesize the indexes of system side and load side to avoid the excessive evaluation caused by the repetition of information in the evaluation.At last, an example analysis is carried out on the proposed method based on the measured data, which verifies the correctness and superiority of the method.
16:00-16:15 Aug.22	**S2001:** An Improved Variable Step Size P&O MPPT Algorithm Based on Constant Voltage and K division Technology **Presenter:** ZHANG Peng, Shandong University, China **Abstract:** In the literature, various techniques have been proposed to achieve the maximum output power of photovoltaic cells, but the fixed step size perturbation and observation and incremental conductance algorithm can't enhance effectively the peculiarity of the PV system, due to their slow tracking speed, big power loss and limited accuracy. An improved variable step size perturbation and observation MPPT algorithm based on the K division method is proposed. The symbol of dp/du before and after the disturbance is judged, if the two adjacent samples have the same symbol, the disturbance step size remains unchanged. On the contrary, the disturbance step size will be divided by K and become the new disturbance step size until achieving the maximum output power. The simulation establish on MATLAB/Simulink reveals that the method has fast response speed, high accuracy, low power loss, and can locate the new maximum power point quickly when environmental conditions change.
16:15-16:30 Aug.22	**S2004:** PV prediction based on PSO-GS-SVM hybrid model **Presenter:** KONG Hongmei, ShandongUniversity, China **Abstract:** Photovoltaic power generation is affected by many factors, with volatility and intermittent characteristics. Large-scale photovoltaic access to the power grid poses great challenges to the safety and stability of power systems. Therefore, accurate prediction of photovoltaic power generation helps dispatchers adjust scheduling schedules in a timely manner, effectively reducing the adverse impact of photovoltaic power generation access on the power grid. This paper proposes a hybrid PV power prediction model based on PSO-GS-SVM. The particle swarm optimization (PSO) method is used to optimize the large step size of the support vector machine (SVM), and the parameter optimization range is obtained. GridSearch Method (GS) refined parameters optimization of PSO-SVM, and obtained PSO-GS-SVM hybrid model. The model is used to train and predict the normalized and dimensional sunny and non-clear working conditions data sets, and compared with BP neural network, SVM and PSO-SVM models. The results show that the PSO-GS-SVM hybrid model has better generalization ability and higher fitting effect.
16:30-16:45 Aug.22	**S1024:** Operating elements of UK electricity contract market and its enlightenment to China **Presenter:** Sun Renjie, Nanjing Normal University, China **Abstract:** The United Kingdom is the birthplace of the world industrial revolution. Its marketization of the power industry has been going on for more than 20 years.

	It is a developed country with a relatively mature power market system. The UK electricity market reform has experienced the Power P00L model, the New Electricity Trading Arrangements model, and the British Electricity Trading and Transmission Arrangements model. Since the NETA model, the UK has formed a power production-transaction-regulatory system centered on bilateral transactions. China is undergoing market-oriented reform of the power system. In order to break the monopoly, the main contents include changes in the development concept of the traditional power industry, the establishment of a new mechanism for direct trading between power generation enterprises and users, the establishment of an independent and reasonable transmission and distribution mechanism, and the opening of private capital into the electricity market, and so on. This paper introduces the reform process of the UK electricity contract market, summarizes the substantive elements and mechanism elements, lists the operation elements of the current UK electricity contract market, and analyses the structure of the UK electricity market and the bilateral electricity trading mechanism deeply. On this basis, some suggestions are put forward to further improve the construction of China's electricity market.

CONFERENCE VENUE

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Tel: +86 15213132727
E-mail: jyyhhotel@126.com

Transportation Information

1. ChongqingJiangbei Airport → Jiayu Emperor Hotel
重庆江北机场→佳宇英皇酒店

A. Taxi (出租车)
About 38mins, 38.9 kilometres
约 38 分钟，38.9 公里

B. Rail Transit（轨道交通）

1) ChongqingJiangbei Airport→walk 600 meters to Jiangbei airport station→Line 3→Niujiaotuo station【Transfer Line 2】→Yangjiaping station→walk 380 meters to Yangjiaping west suburban station→【Transfer No.420 Bus】→Pearl River Garden→walk 520 meters to Jiayu Emperor Hotel
江北国际机场步行约 600 米到达江北机场站—乘坐轨道交通 3 号线—牛角沱站下车（站内换乘）轨道交通 2 号线（6 站）--杨家坪站下车步行 380 米—杨家坪西郊站乘坐 420 路（2 站）--珠江花园站下车步行 520 米—佳宇英皇酒店

2）Bus station of terminal 3→ No.K05 Bus→Sigongli station【Transfer No.833 Bus】→ Shangjiangcheng station→walk 323 meters to Jiayu Emperor Hotel
江北国际机场 T3 航站楼 公交站 乘坐机场快线 K05 路—四公里枢纽站乘坐 833 路公交车—上江城 公交站下车 步行 323 米—佳宇英皇酒店

2. Railway Station → Jiayu Emperor Hotel
火车站→佳宇英皇酒店

重庆西站—佳宇英皇酒店（全程约 13.8 公里 打车约 50 元/31 分钟 ）
重庆西站公交站上车乘坐 441 路—杨家坪人才联盟平台公交站下车（步行 310 米）—杨家坪壹心壹学校公交站乘坐 833 路公交车—上江城站下车步行 338 米—佳宇英皇酒店

重庆北站北广场—佳宇英皇酒店（全程约 16 公里 打车约 40 元/32 分钟）
1)重庆北站北广场 地铁口（1 号口）乘坐轨道交通 10 号线—鲤鱼池 地铁站（3A 口）下车步行 393 米—融景城 公交站乘坐 820 路公交车—上江城 公交站下车 步行 323 米—佳宇英皇酒店
2) 重庆北站北广场 公交站乘坐 820 路公交车—上江城 公交站下车 步行 323 米—佳宇英皇酒店

重庆北站南广场—佳宇英皇酒店（全程约 15 公里 打车约 38 元/31 分钟）
1)重庆北站南广场 地铁站（6 号口）乘坐轨道交通 3 号线—两路口地铁站（7 号口）下车—步行 154 米—两路口公交站乘坐 413 路—珠江花园 公交站下车步行 450 米—佳宇英皇酒

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重庆站—佳宇英皇酒店（全程约6.6公里 打车约14元/11分钟）
菜园坝火车站 公交站乘坐207路公交车—直港大道 公交站下车步行1.1公里—佳宇英皇酒店

沙坪坝站—佳宇英皇酒店（全程约16公里 打车约35元/30分钟）
沙坪坝火车站 公交站乘坐806路—陈家坪长途汽车站 公交站换乘469路公交车—上江城公交站下车 步行151米—佳宇英皇酒店

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