Welcome Message

On behalf of the ESTS 2005 Organizing Committee, it is my privilege to welcome all participants to the first IEEE Electric Ship Technologies Symposium (ESTS 2005).

ESTS 2005 is one of the outcomes of a recent fast-track initiative by the IEEE Technical Activities Board (TAB) to address important technological challenges (e.g., electric ship technologies) that cut across the fields of multiple IEEE societies as well as societies outside IEEE. The goal of these integrated initiatives is to enhance technological advances and applications in selected key areas by combining the collective expertise of various entities and societies who otherwise individually address only parts of the overall problem.

ESTS 2005 is co-sponsored by six IEEE societies PES (Power Engineering Society), PELS (Power Electronics Society), IAS (Industry Applications Society), OES (Ocean Engineering Society), DEIS (Dielectrics and Electrical Insulation Society) and VTS (Vehicular Technology Society) with participation from ASNE (American Society of Naval Engineers) and IMarEST (Institute of Marine Engineering, Science and Technology). Corporate sponsors of ESTS 2005 are General Electric, L-3 Communications / Power Paragon, Inc., Raytheon, and Siemens. At the time of this letter, sponsorship from the Office of Naval Research is pending.

The symposium is focusing on the progress and future of electric ship technologies. By mixing traditional oral paper presentations with invited special and panel discussions, we hope to establish a permanent forum for the exchange of a broad spectrum of view points (end users, designers, manufacturers, researchers, etc.) and to bring together the knowledge of the entire scientific and technical community working in the field.

I thank all the authors and panelists for the high technical quality of their presentations, the session chairs for their technical expertise, and the members of the Organizing and Technical Committees for their excellent work in reviewing and selecting the papers received.

> Dr. Yuri Khersonsky
> IEEE ESTS 2005 TC Chair
> July 5, 2005

Organizing Committee

Co-Chairs

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Dr. Robert Hebner	University of Texas at Austin (DEIS)

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Dr. James Irvine	University of Strathclyde, Scotland (VTS)
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Cmdr. Timothy McCoy	US Navy at MIT (ASNE)
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Dr. Steven Pekarek	Purdue University (PELS)
Dr. Noel Schulz	Mississippi State University (PES)
Dr. Scott Sudhoff	Purdue University (PES)
Dr. Fred Wang	Virginia Tech (PELS)
Dr. Cliff Whitcomb	Naval Postgraduate School (NPS)

July 25, 2005, Monday

7:00 pm   **Welcome Reception** *(Salons I-III)*

July 26, 2005, Tuesday

7:00-8:00 am   **Breakfast** *(Salons V-VIII)*

8:00-8:30 am   <u>**Plenary Session**</u> *(Salons I-II)*

Welcome and Opening Remarks

Dr. John Reagan, Dr. Robert Hebner**,** Co-Chairs
Dr. Yuri Khersonsky, Technical Chair

Keynote Address

8:30-10:30 am   <u>**Plenary Panel Session: Industrial Electric Ship Technologies and Standards Today**</u> *(Salons I-II)*

    <u>**Chair**</u>**:**   Moni Islam, *Project Manager, Northrop Grumman Ship Systems, Research & Dev.*

Panelists:

Matti Lehti, *ABB Marine and Turbocharging*
Jonathan D. Sauer, *ALSTOM Power Conversion*
Sean Loddick, *Marine Electrical Systems, Rolls-Royce*
Dan Wise, *Siemens EA*
Micheal Roa, *American Bureau of Shipping (ABS)*
H.R. Stewart, *IEEE Marine Industries Subcommittee*
Sue Vogel, *IEEE Standards Activities*

10:30-10:45 am   **Break**

10:45-12:45 pm   <u>**Parallel Sessions**</u>

Panel Session 1: Real Time Simulation Tools *(Salons I-II)*

    <u>**Chairs**</u>**:**   Michael Steurer, *Center for Advanced Power Systems (CAPS) / Florida State University*
Joe Sullivan, *NSWC*

Panelists:

Stephen Woodruff, *Florida State University*
Olav Egeland, *Norwegian University of Science and Technology (NTNU) (Norway)*
Antonello Monti, *University of South Carolina*
Roy Crosbie, *California State University, Chico*

Papers:

Interface Issues in Hardware-in-the-Loop Simulation
A. Monti, H. Figueroa, S. Lintijo, X. Wu, and R. Dougal, *University of South Carolina*

Low-Cost, High-Speed, Real-Time Simulation for Electric Ship Power Systems
Roy E. Crosbie, *California State University, Chico*

Technical Session 1: Power Systems Analysis *(Salon III)*

Chair: Roger Dougal, *University of South Carolina*

The Impact of Standardized Models, Programming Interfaces, and Protocols on Shipboard Power System
Jian Wu, Yong Cheng, Noel N. Schulz, and Herbert L. Ginn, III, *Mississippi State University*

Optimal Shipboard Power System Management via Mixed Integer Dynamic Programming
Harry G. Kwatny, Edoe Mensah, Dagmar Niebur, *Drexel University*, and Carole Teolis, *Techno-Sciences, Inc.*

Ship Electrical System Simulation
Swarn S. Kalsi, *American Superconductor Corporation,* and Om Nayak, *Nayak Corporation*

Electric Ship Power System Integration Analyses through Modeling and Simulation
Hamid Ouroua, Lori Domaschk, and Joseph H. Beno, *Center for Electromechanics, University of Texas at Austin*

Investigating Singularities of the Observability Jacobian for Nonlinear Power Systems
Chris J. Dafis, *NAVSEA-Philadelphia,* and Chika O. Nwankpa, *Center for Electric Power Engineering, Drexel University*

Technical Session 2: Systems Reconfiguration *(Salon IV)*

Chair: Tim McCoy, *MIT*

Reconfiguration: A Tool for Designing New Ships
Kent R. Davey and Robert E. Hebner, *Center for Electromechanics, University of Texas at Austin*

System Reconfiguration on Shipboard DC Zonal Electrical System
Mesut E. Baran and Nikhil Mahajan, *North Carolina State University*

**A Reconfigurable Induction Motor Drive with
Harmonic Cancellation Feature**
Lewei Qian, David Cartes, Hui Li, and
Sanjeev K. Srivastava, *Florida State University*

**A Pre-Hit Probabilistic Reconfiguration
Methodology for Shipboard Power Systems**
Sanjeev K. Srivastava, *Center for Advanced
Power Systems, Florida State University*, and
Karen L. Butler-Purry, *Texas A&M University*

Dynamic Reconfiguration Preserving Stability
Johnson Carroll, Keerthi C. Nagaraj,
Ari Arapostathis, W. Mack Grady, and
Edward J. Powers, *University of Texas at Austin*

12:45-1:45 pm   Lunch

1:45-4:00 pm   Parallel Sessions

Panel Session 2: University Research Centers Activities
(Salons I-II)
    Chair: Terry Ericsen, *Program Officer for
Electrical Science & Technology,
Office of Naval Research*

Panelists:

    Robert Hebner, *University of Texas at Austin*
    Steinar Dale, *Florida State University*
    William Colson, *Naval Postgraduate School*
    Roger Dougal, *University of South Carolina*
    Thomas Lipo, *University of Wisconsin*
    Fred Wang, *Center for Power Electronics Systems
      (CPES) Virginia Tech*
    Noel Schulz, *Mississippi State University*
    Kevin Carpentier, *ATI*

Papers:

**The Electric Ship Integration Initiative –
An Overview**
Kevin Carpentier, *ATI*

Design Tools for Electric Ship Systems
Roger A. Dougal, *University of South Carolina*

**Analysis and Modeling of Future Electrical
Propulsion and Launch Systems at the
University of Wisconsin-Madison**
P. Tenca, G. Stumberger, and T.A. Lipo,
University of Wisconsin-Madison

**Electric Ship Research Activities and Capabilities
at Mississippi State University and Its Partners**
Noel N. Schulz, Herbert L. Ginn, III, *Mississippi
State University*, and S. Mark Halpin, *Auburn
University*

Overview of Research Activities at Center for Power Electronics Systems
F. Wang, C.J. Cass, D. Boroyevich, and F.C. Lee, *Polytechnic Institute and State University*

Electric Ship Power Systems – Research at the University of Texas at Austin
Robert E. Hebner, *Center for Electromechanics, University of Texas at Austin*

Technical Session 3: Grounding and Faults Detection
(Salon III)
    Chair: Neal Sondergaard, *NSWC*

Fault Diagnostics in Naval Shipboard Power System for Contingency Management and Survivability
Ranjit Jayabalan and B. Fahimi, *University of Texas at Arlington*

Grounding and Ground Fault Protection of Bussed Stand-Alone Generators
Karan Joshi and Thomas H. Ortmeyer, *Clarkson University*

Evaluation of Grounding and Protection Methods for a Shipboard Power System
Amit Somani, *Schweitzer Engineering Laboratory*, and Brian K. Johnson and Herbert L. Hess, *University of Idaho*

Determination of the Cause of Arcing Faults in Low Voltage Switchboards
H. Bruce Land, III, *John Hopkins University Applied Physics Laboratory*

The Behavior of Arcing Faults in Low Voltage Switchboards
H. Bruce Land, III, *John Hopkins University Applied Physics Laboratory*

Technical Session 4: Modeling *(Salon IV)*

    Chair: Mack Grady, *University of Texas at Austin*

Topology of the Generator Bus in a Warship Integrated Power System
Svetlana Poroseva, Stephen L. Woodruff and M. Yousuff Hussaini, *Florida State University*

Dynamic Modeling of Shipboard Electric Network Compared to Power Flow Problem's Solution
Lamya Abdeljalil, M. Ait Ahmed, and M.F. Benkhoris, *Institut de Recherche en Electronique et Electrotechnique de Nantes Atlantique, France*

Studying Ship Electric Energy Systems with Shaft Generator
John Prousalidis, *National Technical University*, *Greece*, I.K. Hatzilau, *Hellenic Naval Academy, Greece*, P. Michalopoulos, *Hellenic Navy, Greece*, I. Pavlou, *National Technical University, School of Naval Architecture and Marine Engineering*, *Greece,* and D. Muthumuni, *Manitoba HVDC Center, Canada*

Physical Phase Variable Models of Electrical Equipments and their Applications in Integrated Drive Simulation for Shipboard Power System
O.A. Mohammed, S. Liu, Z. Liu, and N. Abed, *Energy Systems Laboratory, Florida International University*

Augmenting E-ship Power System Evaluation and Converter Controller Design by Means of Real-time Hardware-In-Loop Simulation
Wei Ren, M. Steurer, and S. Woodruff, *Florida State University*, and P.F. Ribeiro, *Calvin College*

4:00-4:15 pm   **Break**

4:15-6:30 pm   **Parallel Sessions**

Panel Session 3: Power Electronics Building Blocks (PEBB) – Applications to Marine Systems *(Salons I-II)*

     Chair: Nari Hingorani, *IEEE WG i8 "PEBB Concept"*

     Panelists:

         Dushan Borojevic and Fred Wang, *Virginia Tech*
         Ani Gole, *University of Manitoba*
         Hans Krattiger, *ABB*
         Perry Schugart, *AMSC*
         John Schwartzenberg, *SPCO*
         Joe Sullivan, *NSWC*
         Mohammad Zahzah, *L-3 Communications / Power Paragon, Inc.*

Technical Session 5: Testing *(Salon III)*

     Chair: Jim Barbera, *IEEE OES*

     System Impact of Pulsed Power Loads on a Laboratory Scale Integrated Fight Through Power (IFTP) System
B. Cassimere, C. Rodriguez Valdez, Scott Sudhoff, and S. Pekarek, *Purdue University*, B. Kuhn, *SmartSpark Energy Systems*, D. Delisle, *Naval Sea Systems Command*, and E. Zivi, *U.S. Naval Academy*

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Operational Experience with Intelligent Software Agents for Shipboard Diesel and Gas Turbine Engine Health Monitoring
Kevin P. Logan, *MACSEA, Ltd.*

Testing of Shipboard Power Systems: A Case for Remote Testing and Measurement
Karen Miu, Dagmar Niebur, and Chika Nwankpa, *Drexel University*, Venkat Ajjarapu, *Iowa State University*, Karen Butler-Purry, *Texas A&M University*, Noel Schulz, *Mississippi State University*, and Alex Stankovic, *Northeastern University*

[1]**Ship Power System Testing and Simulation**
Steinar J. Dale, *Center for Advanced Power Systems, Florida State University*

Testing a 5 MW High-Temperature Superconducting Propulsion Motor
Stephen Woodruff, H. Boenig, F. Bogdan, M. Sloderbeck, and M. Steurer, *Florida State University*, T. Fikse, *NSWCCD*, L. Petersen, *ONR*, and G. Snitchler, *American Superconductor Corporation*

Technical Session 6: Protection *(Salon IV)*

Chair: H.R. Stewart, *Marine Industries Subcommittee*

MEMS Based Electronic Circuit Breaker as a Possible Component for an Electrical Ship
George G. Karady and Gerald T. Heydt, *Arizona State University*

A Wide Area Differential Backup Protection Scheme for Shipboard Application
J. Tang and Peter G. McLaren, *Florida State University*

MEMS Circuit Breakers for Integrated Shipboard Power System
Rahim Kasim, *Arizona State University*, Bruce C. Kim, *University of Alabama*, and Josef Drobnik, *Power Paragon, Inc.*

Real-time Assessment of Relay Protection Schemes on Integrated Full Electric Propulsion Systems
Andrew MacKay, S. Galloway, C. Booth, J.R. McDonald, *University of Strathclyde, Scotland*

Integrated Protection System Design for Shipboard Power System
Yanfeng Gong, Yan Huang, and Noel Schulz, *Mississippi State University*

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[1] This material will be presented in Panel Session 2: University Research Centers.

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7:30 pm   **Dinner Reception & Recognition Ceremony** *(Salons V-VIII)*

July 27, 2005, Wednesday

7:00-8:00 am   **Breakfast** *(Salons V-VII)*

8:00-10:00 am   <u>**All-hands Dialog with Electric Ship Technologies Users**</u> *(Salons I-II)*

     <u>**Chair:**</u>   Yuri Khersonsky,
                       IEEE ESTS 2005 TC Chair

     <u>**Panelists:**</u>

         Norbert Doerry, USN, *SEA 05DB Technical Director, Future Concepts and Surface Ship Design*
         Doug Russell, USCG, *Program Manager, Integrated Deepwater System*
         Pete Deverill, MOD UK, *Head of Power Group 1, Defence Logistics Organization*
         Mirko Maksimcev, *Canada National Defence Headquarter*s, *Marine Propulsion Systems Engineer, Directorate Maritime Ship Support*

10:00-10:15 am   **Break**

10:15-12:30 pm   <u>**Parallel Sessions**</u>

<u>**Technical Session 7: Power Quality**</u> *(Salon III)*

     <u>**Chair:**</u>   Noel Schulz, *Mississippi State University*

     Real and Reactive Power Analysis for Interharmonics
     Taekhyun Kim, Edward J. Powers, W. Mack Grady, and Ari Arapostathis, *University of Texas at Austin*

     Parallel Operation of Shunt Active Power Filters for Damping of Harmonic Propagation in Electric Ship Power Systems
     Ting Qian, Brad Lehman, and Anindita Bhattacharya, *Northeastern University*, Herbert L. Ginn, III and G. Marshall Molen, *Mississippi State University*

     Accurate Method to Measure Harmonics and Interharmonics in Shipboard Power Quality Analysis
     Anil K. Kondabathini, Herbert L. Ginn, III, and G. Marshall Molen, *Mississippi State University*

The Load as an Energy Asset in a Distributed Architecture
Robert S. Balog, Wayne W. Weaver, Philip T. Krein, *University of Illinois at Urbana-Champaign*

Active Compensator Prototyping Tools for Electric Ship Applications
Yong Cheng, Jian Wu, and Herbert L. Ginn, III, *Mississippi State University*

Technical Session 8: Integration *(Salons I-II)*

Chair: Dave Clayton, *NAVSEA*

Shipboard Electrical Power Quality of Service
Norbert H. Doerry and David H. Clayton, *Naval Sea Systems Command*

Modern, High-Converter-Populations Argue for Changing How to Design Naval Electric Power Systems
John V. Amy, Jr., *Power Systems at BMT Syntek Technologies*

Improved Ship Power System - Generation, Distribution, and Fault Control for Electric Propulsion and Ship Service
James Vander Meer, Ashish Bendre, Slobodan Krstic, *DRS Power & Control Technologies, Inc*., and Deepak Divan, *Georgia Institute of Technology*

Ship Power System Control: A Technology Assessment
Antonello Monti, F. Ponci, E. Santi, and R. Dougal, *University of South Carolina*, G. Monnat, W. Shutt, and R. Hebner, *University of Texas at Austin*, D. Cartes, *Florida State University*, N. Schulz and Herbert L. Ginn, III, *Mississippi State University*, F. Wang and D. Boroyevich, *Virginia Tech*, and S. Pekarek and S. Sudhoff, *Purdue University*

Solid State Transfer Switches and Current Interrupters for Mission-Critical Shipboard Power Systems
John Commerton and Mohammad Zahzah, *L-3 Communications / Power Paragon, Inc.*, and Dr. Yuri Khersonsky, *Consultant*

Chair: Scott Sudhoff, *Purdue University*

Introduction of the Concept of Friendliness Power to Characterize the Harmonic Emission of Nonlinear Loads
Gregory Tilte and Jacques Lobry, *Faculte Polytechnique de Mons, Belgium*, W. Mack Grady, Edward J. Powers, and Ari Araposthathis, *University of Texas at Austin*

Constant Power Loads and Negative Impedance Instability in Sea and Undersea Vehicles: Statement of the Problem and Comprehensive Large-Signal Solution
Claudio Rivetta, Geoffrey A. Williamson, and Ali Emadi, *Illinois Institute of Technology*

A Voltage Sag-Based Procedure for Determining Transient Stability Models of Conventional Loads
Matthew Rylander, W. Mack Grady, Ari Arapostathis, and Edward Powers, *University of Texas at Austin*

Stability Analysis and Assessment of Integrated Power Systems using RTDS
Li Qi and S. Woodruff, *Florida State University*

Study of the Energy Flow Characteristics in Power Electronic Conversion Systems
Sebastian Rosado, Anish Prasai, Fred Wang, and Dushan Boroyevich, *Virginia Polytechnic Institute and State University*

12:30-1:30 pm   **Lunch** *(Salons V-VIII)*

1:30-3:45 pm   **Parallel Sessions**

Technical Session 10: Propulsion Drives *(Salons I-II)*

Chair: Tom Lipo, *WEMPEC University of Wisconsin*

Pulse Load Capability of VVVF Propulsion Drives
Thomas H. Ortmeyer and Xia Yan, *Clarkson University*

Variable Speed Electric Drive Options for Electric Ships
David Gritter, Swarn S. Kalsi, and Nancy Henderson, *American Superconductor Corporation*

Comparison of Hybrid Propulsion Drive Schemes
Keith A. Corzine and Shuai Lu,
University of Missouri-Rolla

Multilevel Multi-Phase Propulsion Drives
Shuai Lu and Keith A. Corzine,
University of Missouri-Rolla

Five-phase Permanent Magnet Motor Drives for Ship Propulsion Applications
Leila Parsa, *Rensselaer Polytechnic Institute*, and Hamid A. Toliyat, *Texas A&M University*

Technical Session 11: Ship Service *(Salon III)*

Chair: Bob Ashton, *Naval Postgraduate School*

Advanced High-Speed Flywheel Energy Storage System for Pulsed Power Applications
Hamid A. Toliyat and Salman Talebi, *Texas A&M University*, and Patrick McMullen, Co Huynh, and Alexei Filatov, *Calnetix, Inc.*

Electro-Mechanical Actuators for the Navy's Ships
Del Tesar, *University of Texas at Austin*

[2]**Optimization of the Ship Service Converter Module and System Capacitances in the Naval Combat Survivability DC Distribution System**
Yongon Lee, *U.S. Naval Academy*

PEBB-Based Shunt Active Power Filter for Shipboard Power Systems
Qinghua Huang, Konstantin Borisov, and Herbert L. Ginn, III, *Mississippi State University*

Flywheel Energy Storage System for Electric Start and an All Electric Ship
John McGroarty and Jesse Schmeller, *Naval Surface Warfare Center in Philadelphia*, and Richard Hockney and Matthew Polimeno, *Beacon Power Corporation*

Technical Session 12: Diagnostics *(Salon IV)*

Chair: Chris J. Dafis, *NAVSEA-Philadelphia*

Automated Shipboard Diagnostics and Health Evaluation for Power Equipment and Systems: Advanced Techniques Developed for Terrestrial Power Systems
Carl L. Benner and B. Don Russell,
Texas A&M University

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[2] Presentation only, no paper appears in proceedings.

Diagnostics Indicators for Shipboard Systems using Non-Intrusive Load Monitoring
Thomas DeNucci, Robert Cox, Steven B. Leeb, James Paris, Timothy J. McCoy, Christopher Laughman, and William C. Greene, *Massachusetts Institute of Technology*

People Working On or Near Marine Electrical Systems
Mary Capelli-Schellpfeffer and Anne Golding, *CapSchell, Inc.*

Fault Detection, Diagnostics, and Prognostics Software Agent Solutions
Li Liu, *Florida State University*, Kevin P. Logan, *MACSEA Ltd.*, and David A. Cartes, *Center for Advanced Power Systems, Florida State University*

3:45-4:00 pm   Break

4:00-5:30 pm   <u>Parallel Technical Sessions</u>

<u>**Technical Session 13: New Technologies and Design Methods**</u> *(Salons I-II)*

Chair: Chris Hodge, *Institute of Marine Engineering, Science & Technology (IMarEST) and BMT Defence Services Ltd., UK*

The Application of Wavelets to Shipboard Power System Protection
Hugh Douglas, P. Pillay, and T.H. Ortmeyer, *Clarkson University*

Benefits of HTS Technology to Ship Systems
Swarn S. Kalsi, Nancy Henderson, and Dave Gritter, *American Superconductor Corporation*, Om Nayak, *Nayak Corporation*, and Chuck Gallagher, *Northrop Grumman Ship Systems*

Advanced Commercial Power System Protection Practices Applied to Naval Medium Voltage Power Systems
Dave Whitehead and Normann Fischer, *Schweitzer Engineering Laboratories, Inc.*

[3]Advanced Power System Critical Design Methods and Technologies
Cliff Whitcomb, *Naval Postgraduate School* and Chris J. Dafis, *NAVSEA-Philadelphia*

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[3] Presentation only, no paper appears in the proceedings.

Chair: George Robinson, *L-3 Communications Power Paragon Inc.*

Design and Analysis of a Permanent Magnet Generator for Naval Applications
Jonathan E. Rucker, James L. Kirtley, Jr., and Timothy J. McCoy, *Massachusetts Institute of Technology*

Effectiveness of Generator Control Strategies on Meeting Pulsed Load Requirements in Ship Electric Systems
Zimin W. Vilar and Roger A. Dougal, *University of South Carolina*

Two Techniques for Modeling an Induction Motor with Skewed Slots with a Time-Stepping 2D-3D Finite Element Method
Philippe Wendling and Adrian Perregaux, *Magsoft Corporation*, A. Akabar, *EDF, France*, Yann LeFloch and Patrick Lombard, *Cedrat, France*, and L. Sadi-haddad, *L.M.B.E.-Amiens, France*

Technical Session 15: Materials *(Salon IV)*

Chair: Steinar Dale, *Center for Advanced Power Systems (CAPS) / Florida State University*

Study on Health Assessment of Generator Winding Insulation
Tanuj Kumar Mandal, *DR. M. G. R. Educational & Research Institute and DR. M. G. R. Engineering College, Maduravoyal, Chennai, India*

Materials for Advanced Electric Machines: An Overview
Aleta T. Wilder, *University Texas at Austin*

Characterization of Power Losses in Soft Magnetic Materials
Aleta Wilder, *University of Texas at Austin*

[4]**Industrial Applications of HTSC Coils using Next Generation BSCCO Wire**
K. Hayashi, *Sumitomo Electric Industries*

5:30 pm **Closing**

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[4] Presentation only, no paper is available in proceedings.