

The 13th International Stirling Engine Conference

Final Program

Technical Sessions

Technical session: 20 min. Presentation + 10 min. Discussion

Monday, 24 September 2007

[Ibuka Hall]

14:00-15:00 Special Lecture 1

S01 Status of Electric Power Industry and Molten Carbonate Fuel Cells in Japan

Takao Watanabe, Central Research Institute of Electric Power Industry, Japan

Chairman: Makoto Tanaka, Nihon Univ., Japan

[Room 1]

9:00-10:30 Stirling Engine 1 - Development & Evaluation (1)

Chairmen: Masafumi Katsuta, Waseda Univ., Japan

Makoto Takeuchi, SUCTION GAS ENGINE MFG. Co., Ltd., Japan

A01 History and Modern Lines of Development of Stirling -Technologies in Russia

Kirillov N.G., Stirling Technologies Ltd., Russia

A02 The Experimental Study of Atmospheric Stirling Engines Using Pin-Fin Arrays' Heat Exchangers

Seita Isshiki, Fukushima National College of Technology, Japan, *Hidekazu Sato*, *Shoji Konno*, *Hiroaki Shiraishi*,

Alpse electric Co., Ltd., Japan, *Naotsugu Isshiki*, Tokyo Institute of Technology, Japan and *Iwane Fujii*, Meiji Univ., Japan

A03 Development of a Compact 3-kW Stirling Engine Generator

Noboru Kagawa, National Defence Academy, Japan, *Atsushi Matsuguchi*, *Souichiro Furutani*, Japan Self Defence

Force, Japan, *Katsumasa Araoka*, Jonan Corp., Japan and *Tomohisa Kurita*, Toshiba Corp., Japan

10:45-12:15 Stirling Engine 2 - Development & Evaluation (2)

Chairmen: Masafumi Katsuta, Waseda Univ., Japan

Makoto Takeuchi, SUCTION GAS ENGINE MFG. Co., Ltd., Japan

A04 Development of a Small-Size Pressurized Stirling Engine in Ukraine (*No presentation)

Alexei Stefanovskiy, Tavriyan State Agritechnical Academy, Ukraine and *Yevgheniy Snizhko*

A05 New Experimental Plan of Two "Parallel Cylinders Stirling Engine with Isshiki's New Z-Crank"

Naotsugu Isshiki, Tokyo Institute of Technology, Japan, *Jin Soo Kim*, Korean Institute of Energy Research, Korea and

Hiroshi Kojima, Natural Energy Research Center, Japan

A06 A Prototype a-Type Stirling Engine for Low Temperature Heat Recovery Power Generation

Tor-Martin Tveit, Single-Phase Power AS, Norway, *Arne Høeg* and *Trond-Atle Asphjell*

15:15-16:45 Stirling Engine 3 - Development & Evaluation (3)

Chairmen: Noboru Kagawa, National Defence Academy, Japan

Seita Isshiki, Fukushima National College of Technology, Japan

A07 Development of 1 kW Class Low Temperature Difference Indirect Heating Stirling Engine

Using a⁺-Type Mechanism

Makoto Takeuchi, SUCTION GAS ENGINE MFG. Co., Ltd., Japan, *Shinji Suzuki*, *Yutaka Abe* and *Atsuo Kitahara*

A08 Development of 10 kW Class Low Temperature Difference Indirect Heating Stirling Engine

Using a⁺-Type Mechanism

Makoto Takeuchi, SUCTION GAS ENGINE MFG. Co., Ltd., Japan, *Yutaka Abe*, *Shinji Suzuki* and *Atsuo Kitahara*

A09 Development of Low-Temperature Difference Stirling Engine

- Behavior of the mechanism efficiency for the performance prediction method -

Fujio Toda, Utsunomiya Univ., Japan, *Shoichi Iwamoto*, Saitama Univ., Japan and *Katsuaki Nakajima*, Utsunomiya

Univ., Japan

17:00-18:00 Stirling Engine 4 - Design & Analysis (1)

Chairmen: Noboru Kagawa, National Defence Academy, Japan
Seita Isshiki, Fukushima National College of Technology, Japan

A10 Turning Cycle Analysis into Insight (*No presentation)

Allan J Organ, mRT – Regenerative Thermal Machines, UK

A11 The FP32 Stirling Free Piston Prototype: theoretical and experimental analysis

Antonello Binni, Università di Roma, Italy, *Katiuscia Cipri*, *Federio Marca* and *Vincenzo Naso*

[Room 2]**9:00-10:30 Thermoacoustic Heat Engine 1**

Chairmen: Tetsushi Biwa, Tohoku Univ., Japan
Makoto Nohtomi, Waseda Univ., Japan

C01 Study on the Performance Characteristics of the Water-Type Stirling Engine

Seiichi Takeuchi, College of Industrial Technology, Japan, *Noriyoshi Douhara* and *Yoshiro Fruishi*

C02 Regenerator Performance of Single Piston Type Stirling Engine

Yusuke TAKAI, Nihon Univ., Japan and *Makoto TANAKA*

C03 Prototype Stirling Engines Comprising One Single Free Piston and a Resonance Tube

(*No presentation)

Jean-Pierre Budliger, Consultant, Switzerland

10:45-12:15 Thermoacoustic Heat Engine 2

Chairmen: Tetsushi Biwa, Tohoku Univ., Japan
Makoto Nohtomi, Waseda Univ., Japan

C04 The Thermoacoustic Perspective, or, the Relationships between Thermoacoustic, Stirling, and Pulse-Tube Devices

Philip S. Spoor, CFIC-Qdrive, USA and *John A. Corey*

C05 How Does Stirling Engine Work?

Tetsushi Biwa, Tohoku Univ., Japan, *Yusuke Tashiro*, Nagoya Univ., Japan and *Taichi Yazaki*, Aichi Univ. of Education, Japan

C06 Measurement of Work Generation and Improvement of Performance in Pulse Tube Engine

Hiroaki Futagi, Meisei Univ., Japan, *Kazuhiro Hamaguchi*, *Taichi Yazaki*, Aichi Univ. of Education, Japan and *Yoshikatsu Hiratsuka*, Shonan Institute of Technology, Japan

15:15-17:15 Thermoacoustic Heat Engine 3

Chairmen: Tetsushi Biwa, Tohoku Univ., Japan
Makoto Nohtomi, Waseda Univ., Japan

C07 Observation of Thermoacoustic Energy Conversion

Yusuke Tashiro, Nagoya Univ., Japan, *Tetsushi Biwa*, Tohoku Univ., Japan and *Taichi Yazaki*, Aichi Univ. of Education, Japan

C08 A Thermoacoustically-Driven Micro-Miniature Pulse Tube Cooler Operating with High Frequency Around 300Hz

E. C. Luo, Technical Institute of Physics and Chemistry, P. R. China, *G. Y. Yu*, *W. Dai*, *S. L. Zhu* and *Z. H. Wu*

C10 Calculation Method for the Prediction of the Performance of a Traveling-Wave Thermoacoustic Cooler

Yuki Ueda, Tokyo Univ. of Agriculture and Technology, Japan

C11 A Thermoacoustically-Driven Two-Stage Pulse Tube Cryocooler Operating Below 20K

E. C. Luo, Technical Institute of Physics and Chemistry, P. R. China, *J. Y. Hu*, *Z. H. Wu*, *W. Dai* and *Y. Zhou*

[Room 3]**9:00-10:30 Application 1 - Biomass Energy (1)**

Chairmen: Hiroshi Sekiya, E&E SYSTEM Co., Ltd., Japan
Norio Ohiwa, Chubu Electric Power Co., Ltd, Japan

D01 A System for the Effective Utilization of Woody Biomass Fuels by the Practical Stirling Engine

Nobutoshi Tezuka, Stirling Engine Co., Ltd., Japan, *Akira Hoshi*, Ichinoseki National College of Technology, Japan and *Seizi Sasaki*

D02 Stirling Engine (1kW_e) Integrated into a Pellet Stove

Karl Wolfgang Stanzel, Stirling Power Module Energieumwandlungs GmbH, Austria

D03 Experiences with a 35 kW_d Wood Powder Fuelled Stirling CHP Unit

Magnus Pålsson, Lund Univ., Sweden

10:45-12:15 Application 2 - Biomass Energy (2)

Chairmen: Hiroshi Sekiya, E&E SYSTEM Co., Ltd., Japan
Norio Ohiwa, Chubu Electric Power Co., Ltd, Japan

D06 Operating Experiences with Biomass Driven Stirling Engines; 3kW and 30kW

M. Zeiler, JOANNEUM RESEARCH, Institute of Energy Research, Austria, *R. Padinger*, *J. Spitzer* and *E. Podesser*

D07 Development of Small-Scale CHP Plant with Wood Powder Fueled Stirling Engine

Katsura Satou, Chubu Electric Power Co., Ltd, Japan, *Norio Ohiwa*, *Akira Ishikawa*, *Hidetoshi Shimojima*, C-Tech Corp. Ltd., Japan, *Akio Nishiyama* and *Yoichi Moriya*, First, Inc. Japan

D08 Evaluation of the Viebach ST 05 - G Stirling Engine Coupled to a Biomass Furnace

Rafael Bergamasco e Paula, NEST, Federal Univ. of Itajubá, Brazil, *Electo Silva Lora* and *Vladimir Melian Cobas*

15:15-16:45 Application 3 - Solar Energy (1)

Chairmen: Kazuhiro Hamaguchi, Meisei Univ., Japan
Akira Hoshi, Ichinoseki National College of Technology, Japan

D10 The Comparison for Different Type of Drive Mechanism for Small Solar Stirling Engine 500 W in Thailand

Suravut, Snidvongs, Naraesuan Univ., Thailand and *Sirinuth, Chindaruksa*

D11 The Design of Small Solar Thermal Dish Stirling 500 W Stand Alone in Thailand

Suravut, Snidvongs, Naraesuan Univ., Thailand and *Sirinuth, Chindaruksa*

D12 Water Supply Using a Solar Fluid Piston Stirling Engine

K. Mahkamov, Durham Univ., UK, *I. Makhkamove*, *E. P. Orda*, Uzbek Academy of Sciences, Uzbekistan and *A. P. Korobkov*

17:00-18:00 Application 4 - Solar Energy (2)

Chairmen: Kazuhiro Hamaguchi, Meisei Univ., Japan
Akira Hoshi, Ichinoseki National College of Technology, Japan

D13 Development of an Advanced Stirling Engine Generator for Solar Application

Tetsumi Watanabe, Energy Technology Management Ltd., UK and *Isoroku Kubo*, The Petroleum Institute, Abu Dhabi

D14 Analysis and Design Consideration of Mean Temperature Differential Stirling Engine for Solar Application

Iskander Tlili, Ecole Nationale d'Ingénieurs, Tunisie, *Youssef Timoumi* and *Sassi Ben Nasrallah*

Tuesday, 25 September 2007

[Ibuka Hall]

13:00-14:00 Special Lecture 2

S02 The Fuel Cell World - Matsushita's vision for fuel cell co-generation –

Yuji Hato, Matsushita Electric Industrial Co., Ltd, Japan

Chairman: Yoshihiko Haramura, Kanagawa Univ., Japan

[Room 1]

9:00-10:30 Stirling Engine 5 - Design & Analysis (2)

Chairmen: Yoshihiko Haramura, Kanagawa Univ. Japan

Masatoshi Shinoki, Fukushima National College of Technology, Japan

A12 The Multi-Cylinder Free-Piston Stirling Engine Scaled to a Megawatt-Class Conceptual Design

Maurice A. White, Infinia Corp., USA, *Songgang Qiu, Joel Wacknov*, MAGicALL Inc. , USA, *Rebecca J. Wehrer*, Bechtel Bettis Inc. , USA, *Robert G. Mahorter and Michael F. Dufalla*

A13 Increasing Power Output from a Stirling Engine Micro CHP Unit

G. Airoidi, Durham Univ., UK, *C. Lim and K. Mahkamov*

A14 Design and Thermodynamics Modelling of a Low Temperature Differential Solar Stirling Engine

Ali Reza Tavakolpour, Shiraz Univ., Iran and *Jafar Zarinchang*

10:45-12:15 Stirling Engine 6 - Design & Analysis (3)

Chairmen: Yoshihiko Haramura, Kanagawa Univ. Japan

Masatoshi Shinoki, Fukushima National College of Technology, Japan

A15 Non Ideal Quasi Steady Flow Analysis of γ -Type Stirling Engines

Andreas Wagner, Univ. of Applied Sciences, Germany, *Michael Elsner and Nick Syred*, Univ. of Cardiff, Great Britain

A16 Numerical Prediction of Performance of Water Type Stirling Engine Considering Heat Exchange with Heat Sources

Yoshiyuki Yamaguchi, Univ. of Hyogo, Japan and *Tetsuya Higuchi*

A17 Analytical Expression for an Optimised Link Bar Mechanism for a Beta-Type Stirling Engine

Henrik Carlsen, Technical Univ. of Denmark, Denmark and *Jonas K. Bovin*, Stirling Denmark, Denmark

14:15-15:45 Stirling Engine 7 - Dynamics & Control

Chairmen: Makoto TANAKA, Nihon Univ., Japan

Atsushi Matsuguchi, National Defence Academy, Japan

A18 Theoretical Study on Reduction of Torque Irregularity through Combination of Two α -Type Stirling Units

Takahiro Miura, Niigata Univ., Japan, *Koji Matsubara, Itaru Kourakata, Kazumasa Kawasaki and Mutsuo Kobayashi*

A19 Designing of Power Control System for Stirling Engine to Improve the Response Speed

Ali Ghaffari, Toosi Univ. of Technology, Iran, *Abbas Aliabadi and N. Hossengholi Arbab*

A20 Dynamic Performance Simulation of a Waste Heat Recovery Stirling Engine

Shigeji Tsukahara, National Maritime Research Institute, Japan, *Koichi Hirata, Eiko Ishimura and Masakuni Kawada*

16:00-17:30 Stirling Engine 8 - Regenerators

Chairmen: Makoto TANAKA, Nihon Univ., Japan

Atsushi Matsuguchi, National Defence Academy, Japan

A21 3-D Numerical Analysis of Thermal/Fluid Characteristics of Woven Mesh Structures as Heat Regenerators

Ali Akbar Golneshan, Shiraz Univ., Iran, *Jafar Zarinchang and Hamid Reza Mortazvy*

A22 The Optimum Design of New Matrixes for the Stirling Engine Regenerator

Atsushi Matsuguchi, National Defence Academy, Japan, *Jun Kamada*, Japan Grand Self Defence Force, Japan, *Yusuke Yamauchi*, Japan Maritime Self Defence Force, Japan, *Souichiro Furutani and Noboru Kagawa*, National Defence Academy, Japan

A23 The Numerical Simulation on the Influence of Regenerator Inlet Shape

Donghan Jin, Micropowers Ltd., P. R. China, *Weiming Pan and Genxiang Gu*

[Room 2]**9:00-10:30 Refrigerator 1**

Chairmen: *Tatsuo Inoue*, AISIN SEIKI Co.,Ltd., Japan
Toshio Otaka, Kokushikan Univ. Japan

B01 Fundamental Study of Small-Size Stirling Refrigerator with Active-Type Regenerator

Toshio Otaka, Kokushikan Univ. Japan, *Shu Ogasawara*, Tokyo Metropolitan Univ., Japan, *Kazuhiko Murakami and Masahiro Ota*

B02 Multiple Cylinder Free-Piston Stirling Machinery

David M. Berchowitz, Global Cooling BV, The Netherlands and *Yong-Rak KWON*, Global Cooling Manf. Co., Inc., USA

B03 Development of a Miniature Pulse Tube Cryocooler of 2.5W at 65K for Telecommunication Applications

Noboru Matsumoto, Fuji Electric Systems, Japan, *Yukio Yasukawa*, *Keishi Ohshima*, *Takayuki Takeuchi*, *Tomoyuki Matsushita and Yoshinori Mizoguchi*

10:45-12:15 Refrigerator 2

Chairmen: *Tatsuo Inoue*, AISIN SEIKI Co.,Ltd., Japan
Toshio Otaka, Kokushikan Univ. Japan

B04 Effect of Regenerator Entrance Shape on Performance of Stirling-Type Pulse Tube Cryocooler

Yoshikatsu Hiratsuka, Shonan Institute of Technology, Japan, *Kazuhiro Hamaguchi*, Meisei Univ., Japan and *Akikazu Nemoto*

B05 Development of High Capacity Stirling Type Pulse Tube Cryocooler

Junnosuke Imura, Nihon Univ., Japan, *Shunsuke Shinoki*, *Tomohiko Sato*, *Nobuyuki Iwata*, *Hiroshi Yamamoto*, *Kazuhiko Yasohama*, *Yoshimasa Ohashi*, Aisin Seiki Co., Ltd., Japan, *Hiroyasu Nomachi*, *Nobuo Okumura*, *Shigeo Nagaya*, Chubu Electric Power Co., Inc., Japan, *Tsutomu Tamada and Naoki Hirano*

B06 Numerical Analysis of an Active Buffer Pulse Tube Refrigerator

Naoko Takagi, AIR WATER INC, Japan, *Tomohiro Yoshida and Sumio Kobayashi*

14:15-15:45 Model & Education 1

Chairmen: *Fujio Toda*, Utsunomiya Univ., Japan
Shinji Suzuki, SUCTION GAS ENGINE MFG. Co., Ltd., Japan

M01 Experimental Method of Thermodynamic Optimization for Regenerator Volume of Model Stirling Engine as Engineering Education in Provinces

Yoshitaka Kato, Oita Univ., Japan

M02 Developing and Improving a Small Stirling Engine for Educational Purposes

Shuwei Huang, Hiroshima Kokusai Gakuin Univ., Japan and *Tsutomu Yoshioka*

M03 Use in Education of Model Stirling Engine Having Elastic Heat Exchanger

Yoshiyuki KOBAYASHI, Chuo High School, Omitama, Ibaraki, Japan

16:00-17:00 Model & Education 2

Chairmen: *Fujio Toda*, Utsunomiya Univ., Japan
Shinji Suzuki, SUCTION GAS ENGINE MFG. Co., Ltd., Japan

M04 The Analysis of Ross-Yoke Drive Mechanism - The estimate of piston stroke and phase angle -

Katsuaki Nakajima, Utsunomiya Univ., Japan, *Fujio Toda and Takahiro Isono*

M05 The Performance Prediction Method of a Stirling Engine for Education

Fujio Toda, Utsunomiya Univ., Japan, *Takahiro Isono and Katsuaki Nakajima*

[Room 3]**9:00-10:30 Application 5 - Micro-Cogeneration (1)**

Chairmen: Tetsumi Watanabe, Energy Technology Management Ltd., UK
Koichi Hirata, National Maritime Research Institute, Japan

D15 Prototype of Free Piston Stirling Converter for Household Use

Takeshi Hoshino, JAXA, Japan, Shoichi Yoshihara, Teruyuki Akazawa, e-Stir, Japan and Keiji Murao

D17 Stability Considerations of Grid-Connected Free Piston Stirling Engines

R. R. van der Woude, Energy Research Center, The Netherlands, B. Vriesema, J. G. M. Zutt and G. J. J. Beckers, Enatec micro-cogen, The Netherlands

D18 Development of Linear Alternator for Free Piston Stirling Engine

Takeshi Hoshino, JAXA, Japan, Shoichi Yoshihara, Teruyuki Akazawa, e-Stir, Japan and Keiji Murao

10:45-12:15 Application 6 – Micro-Cogeneration (2) & Vehicle Exhaust Use

Chairmen: Tetsumi Watanabe, Energy Technology Management Ltd., UK
Koichi Hirata, National Maritime Research Institute, Japan

D19 Economic Analysis of Household Application of Microcogeneration Stirling Engines in the European Market

Carlo M. Bartolini, Universita Politecnica delle Marche, Italy, Flavio Caresana, Gabriele Comodi, Leonard Pelagalli and Sandro Vagni

D20 Research and Development on a Co-Generation System for Cold Regions Using a 1kW Class Stirling Engine Generator

Hiroshi Sekiya, E&E SYSTEM Co., Ltd., Japan, Sanyo Takahashi, Kazuhiro Hamaguchi, Meisei Univ., Japan and Iwao Yamashita, Tokyo Denki Univ., Japan

D22 Multi-Cylinder Alpha Free-Piston Stirling Engine for Vehicle Exhaust System

Seon-Young Kim, Sunpower Inc., USA, Neill Lane and David M. Berchowitz, Global Cooling Manf. Co. Inc., USA

14:15-15:45 Application 7 – Portable Generator, Under Water & Waste Heat Use

Chairmen: Masafumi. Nogawa, AISIN SEIKI Co.,Ltd, Japan
Takeshi Hoshino, JAXA, Japan

D23 Diesel Fuel-to-Electric Energy Conversion Using Compact, Portable, Stirling Engine -Based Systems

James Huth, Sunpower Inc., USA and Josh Collins

D24 Anaerobic Power Installations with Stirling Engines and the Liquefied Natural Gas -New Technologies for Underwater Shipbuilding

Kirillov N.G., Stirling Technologies Ltd., Russia

D25 CAE Analysis of Exhaust Gas Flow for Waste Heat Recovery Stirling Engines

Eiko Ishimura, National Maritime Research Institute, Japan, Koichi Hirata and Masakuni Kawada

16:00-17:30 Application 8 – Ship & Deep Space Use

Chairmen: Masafumi. Nogawa, AISIN SEIKI Co.,Ltd, Japan
Takeshi Hoshino, JAXA, Japan

D26 Development of a Marine Heat Recovery System with Stirling Engine Generators

Koichi Hirata, National Maritime Research Institute, Japan, Eiko Ishimura, Masakuni Kawada, Teruyuki Akazawa, e-Stir, Japan and Mitsutoshi Iida, Azuma Ship Co., Ltd., Japan

D27 Study on Interplanetary Nuclear Spaceship Using Stirling Engine Power Generator

Tadashi Narabayashi, Hokkaido Univ., Japan, Yuji Honma, Yutaka Yoshida and Yoichiro Shimazu

D28 Stirling-Based Radioisotope Power Systems for Deep Space Missions

J. Gray Wood, Sunpower Inc., USA, Kyle Wilson and Doug Keiter

Wednesday, 26 September 2007

[Room 1]

9:00-10:30 Stirling Engine 9 - Heat Transfer

Chairmen: Makoto TANAKA, Nihon Univ., Japan
Atsushi Matsuguchi, National Defence Academy, Japan

A24 The Effect of the Separation on Heat Transfer Characteristics

Masatoshi Shinoki, Fukushima National College of Technology, Japan

A25 Heat Transfer on the End Surface of Short Columnar Space due to an Annular Jet and Suction Driven by the Displacer Motion

Yoshihiko Haramura, Kanagawa Univ. Japan and *Kazuhiro Kubota*, Suzuki Motor Corp., Japan

A28 The Regenerated Heat Quantity at Isothermal Model of Stirling Engine (*No presentation)

Jiri Skorpik, Brno Univ. of Technology, Czech Republic

[Room 2]

9:00-11:00 Refrigerator 3

Chairmen: Yoshikatsu Hiratsuka, Shonan Institute of Technology, Japan
Noboru Matsumoto, Fuji Electric Systems, Japan

B07 Orifice Pulse Tube Refrigerator: validation of an analytical model by means of an experimental apparatus

Katiuscia Cipri, Università di Roma, Italy, *Antonello Binni*, *Andrea Michiorri*, Ustinov College, UK and *Vincenzo Naso*, Università di Roma, Italy

B08 Experimental Study on a Stirling Cycle Machine of 100W Design Capacity Used Liquid Nitrogen

Toshio Otaka, Kokushikan Univ., Japan, *Itaru Kodama*, IWATANI Industrial Gases Corp., Japan and *Masahiro Ota*, Tokyo Metropolitan Univ., Japan

B09 Earth-Friendly and Economical Low Temperature Transportation Container "COOL CARGO FZ"

Toshikatsu Nomizu, Twinbird Corp., Japan, *Ryosuke Saito* and *Takeshi Suzuki*

B10 Development and Evaluation of Electronic Cryosurgery - Hyperthermia Combining Treatment System

Daishi Takahashi, Nagaoka Univ. of Technology, Japan, *Kazuya Sone*, Twinbird Corp., Japan and *Ichiro Fukumoto*, Nagaoka Univ. of Technology, Japan

[Room 3]

9:00-10:00 Model & Education 3

Chairmen: Fujio Toda, Utsunomiya Univ., Japan
Shinji Suzuki, SUCTION GAS ENGINE MFG. Co., Ltd., Japan

M06 Report on the 9th and 10th Stirling Techno Rally

Naotsugu Isshiki, Tokyo Institute of Technology, Japan, *Masahiro Matsuo*, Saitama Univ., Japan and *Iwane Fujii*, Meiji Univ., Japan

M07 Unique Design and Production Technique of Model Engines

Masataka Kugimiya, TECHNOPROTO Corp., Japan