Achievements for local industry creation

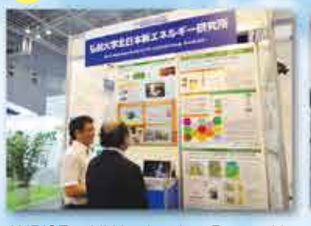
To date, several innovative technologies for sustainable energy production developed by our institute have been utilized by local industries. NJRISE is aiming to translate more of its R&D achievements and fundamental technologies on green and sustainable energy into practical applications for the energy market.

Growing strawberries
with geothermal heat (Kuroishi, Aomori)

No-heat-pump type snow-melting system using geothermal heat (Hirosei Co.: a venture company launched by Hirosaki University)

Road direction flash lamp powered by wind even at low velocities (Japan Parts Center Co.)

Education / Public Relations



NJRISE exhibition booth at Renewable Energy 2016 (July 2016)

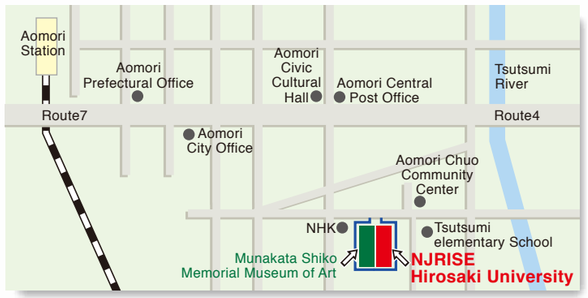
JST Sakura Science Plan in NJRISE (Nov. 2016)

Forum on Renewable Energy for Citizen (Feb. 2017)

Forum on Renewable Energy for Citizen (Mar. 2017)

Equipments

- ＊Advanced evaluation system for fuel cells
- ＊Set-ups for biomass gasification
- ＊High-temperature electric furnaces
- ＊Gas supply system
- ＊Gas analysis system
- ＊Various control and measurement machines
- ＊Desktop-type precise pressurization module
- ＊Press pressure system
- ＊Low-temperature cooling system
- ＊Pulverization/Mixing machines
- ＊Scanning Probe Microscopy (SPM)
- ＊3D precision molding machine
- ＊Combinatorial silica reduction set-up
- ＊Infrared camera
- ＊Hydrogen purification system
- ＊Multi-channel digital signal measurement system
- ＊Heat flux type differential scanning calorimeter
- ＊Ultrafine particle production set-up
- ＊Inductively Coupled Plasma Atomic Emission Spectrometer (ICP-AES)
- ＊Ultrapure Water Systems
- ＊High-energy planetary ball milling apparatus
- ＊Vacuum heat treatment equipment with press
- ＊Combinatorial Energy Materials Synthesis Equipment
- ＊Catalyst Analysis System
- ＊Micromeritics Automatic Surface Area and porosimetry Analyzer
- ＊Fourier Transform Infrared Spectrometer
- ＊Electrochemical Measurement Apparatus
- ＊D/δ^{18}O Isotopic Water Analyzer
- ＊Ion Chromatograph System for Anions and Cations analysis
- ＊Ultra-pure Water and Pure Water System
- ＊Electric Vehicle System
- ＊Bio-gas Engine Generation-efficiency Management Unit
- ＊Inverter Analyzer
- ＊Generated Electric Power-utilization Efficiency Measuring System
- ＊Bio-gas-engine Exhaust Emission Measuring Equipment
- ＊Evaluation System for Devices on Electrified Vehicle
- ＊Speciation analysis system of arsenic and selenium
- ＊Evaluation System of Energy Efficiency Technology
- ＊Thermal Diffusivity Measurement System
- ＊RHEED　Monitoring System
- ＊Electrode Depositoin System
- ＊Scanning Electron Microscope with Energy-dispersive X-ray Spectroscopy
- ＊In-Plane-type X-ray Analyzing System
- ＊Energy　Conversion　Analysis　System
- ＊Web-based e-Learning System (WebELS®)



North Japan Research Institute for Sustainable Energy (NJRISE)

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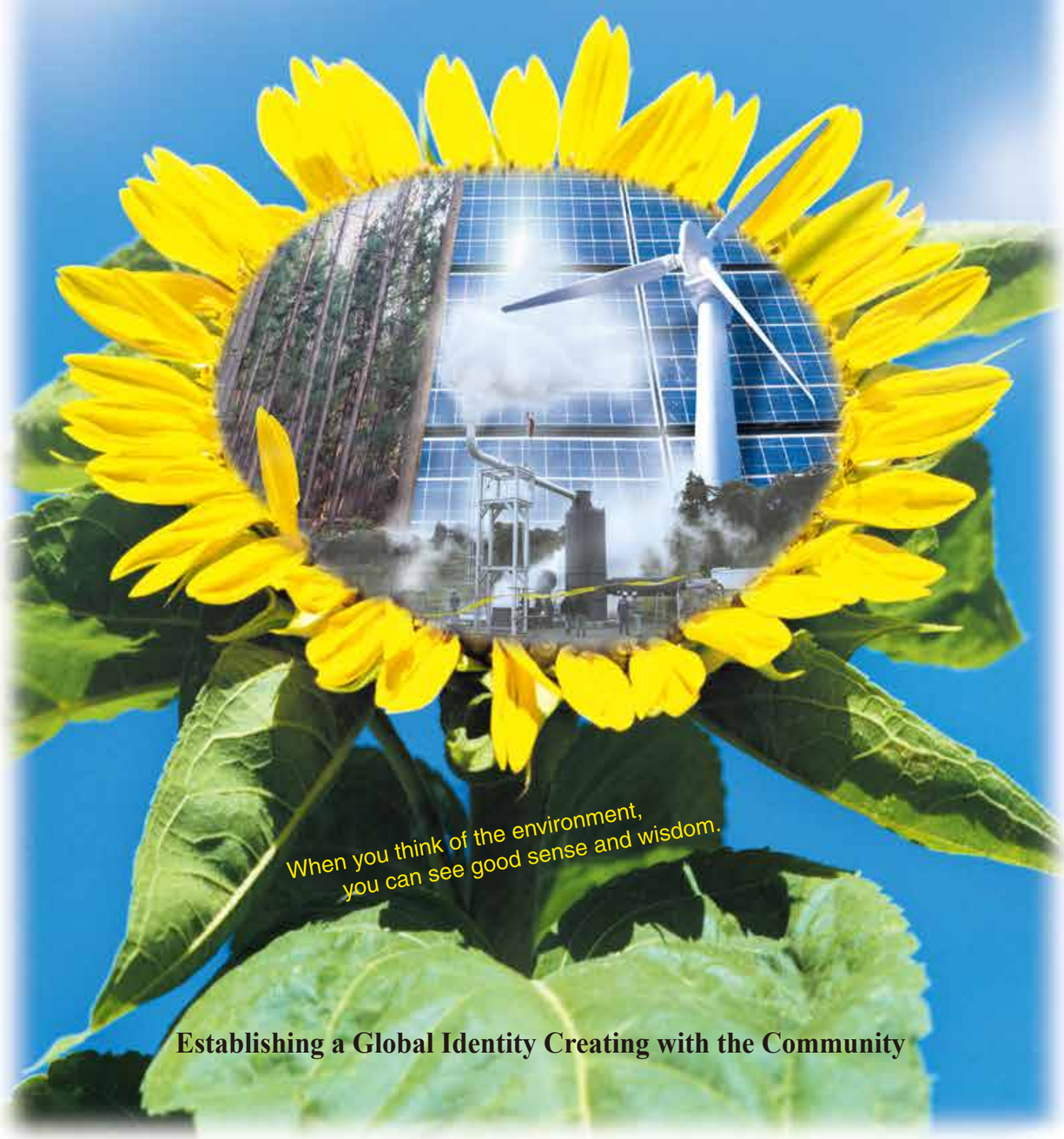
2017.7.1

HIROSAKI UNIVERSITY

North Japan Research Institute for Sustainable Energy (NJRISE)



Establishing a Global Identity Creating with the Community

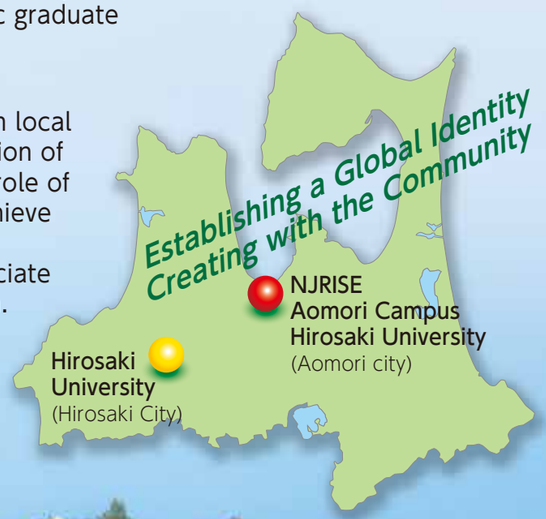
Hirofumi Muraoka
Director, Professor,
North Japan Research Institute for Sustainable Energy
(NJRISE), Hirosaki University

Message from Director

Abnormal weather related to global warming is already going on a rampage as seen in the appearance of the global-scale arctic oscillation and frequent strikes of tornadoes which used to be very rare in Japan. Nevertheless, short-term policy tends to take first priority economy rather than environment. This obviously shifts the environmental loads onto future generations. Thoughtful Japanese mind, which won general applause when we faced the Great East Japan Earthquake, should also lead mitigation of global warming.

North Japan Research Institute for Sustainable Energy (NJRISE), Hirosaki University, was established in October 2010 to overcome negative characteristics such as heavy snowfall and cold weather in northern Japan through research and development on renewable and saving energy, and to contribute to construct indigenous and dispersive type local energy industries. The succeeding Great East Japan Earthquake unintentionally demonstrated the foresight of establishment of NJRISE. An institute of universities labeled with the two keywords, "North Japan" and "Sustainable Energy", is only one base in Japan so far. Since the establishment of NJRISE, we needed a few years to introduce fundamental facilities. However, it is time to come into produce a variety of outcomes. Hirosaki University launched Sustainable Energy Course, the Graduate School of Science and Technology in April 2013 where NJRISE has been in charge of the systematic graduate education on sustainable energy.

The times call for advanced innovation from local districts in Japan, particularly for regeneration of local economy. NJRISE is willing to play a role of a local research platform conducting to achieve innovation in collaboration with local communities in northern Japan. We appreciate your widespread support and collaboration.



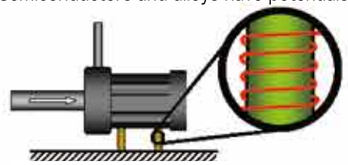
Advanced Energy Materials Group

"The challenge to the future energy society by advanced materials"

What kind of material technology tows future Japan?

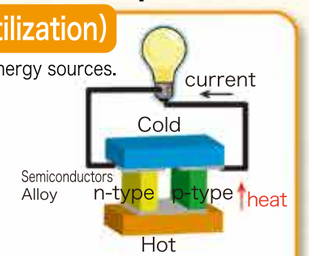
Energy Application Engineering (Electrical generation・Heat utilization)

Semiconductors and alloys have potentials which generate the electric power from various energy sources.



Vibration Power generation using magnetostriction alloys
Energy Harvesting

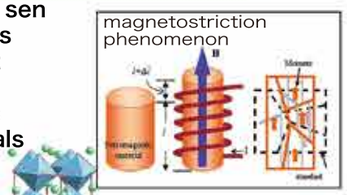
Development of Silica Reduction Process for Solar cells

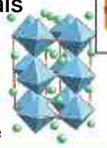


Themoelectric Materials

Smart sensor application (Power Saving/Secure/Safty)

1) new materials for sen sors and actuators
2) original intelligent materials/devices
3) perovskite oxides (Dielectric materials and functional materials)





Perovsikite

High sensitive torque magnetostriction sensor for automobiles

High sensitive Multiferroics MagneticSensors

Overview

One of the weak point of renewable energy has quite low energy density, that causes large increase of its cost. Since the energy conversion using a semiconductor and metal including a solar battery can carry out direct conversion to the electrical and electric equipment and there is almost no flexible region, it is suitable for exploitation of renewable energy with a low energy density. The goal of our research is the realization of energy-saving and safe society with our advanced energy and smart materials. Our research fields are energy application engineering and energy harvesting application as follows:

(1) Energy Application Engineering
The study of silica reduction process for solar cells, combinatorial material exploration for thermoelectric materials, the development of oscillating generating devices.

(2) Application to energy harvesting
Development of the piezoelectric, magnetostrictive, or dielectric materials. We work on the investigation of new functional materials for energy conversion and their process with our core technology based on combinatorial material technology and levitation method.

Professor
Kenji ITAKA

Research Interests:

Development of new materials and process research on energy conversion materials
- Development of the low-cost high-purity silica reduction process for solar cells
- Exploration of thermoelectric materials, dielectric materials for capacitors, electric double layer devices with combinatorial technique
- Research of semiconductor devices connected with energy saving and saving resources

Selected publications:

(1) Kenji Itaka, Takuya Ogasawara, Abderahmane Boucetta, Rabie Benioub, Masatomo Sumiya, Takuya Hashimoto, Hideomi Koinuma, Yasubumi Furuya "Direct Carbothermic Silica Reduction from Purified Silica to Solar- Grade Silicon", Journal of Physics: Conference Series, 2015, 596, 012015.
(2) Masatomo Sumiya, Tomohiro Akizuki, Kenji Itaka, Makoto Kubota, Kenta Tsubouchi, Takamasa Ishigaki, Hideomi Koinuma, "Effect of hydrogen radical on decomposition of chlorosilane source gases", "Journal of Physics : Conference Series, 2013, 441(1), 012003.
(3) K. Taniguchi, T. Fukamichi, K. Itaka, H. Takagi, "Programmable Persistent Interfacial Metallic State Induced by Frozen Ions in Inorganic-Glass Solid Electrolyte", Advanced Functional Materials, 2015, 25(20), 3043-3048.

Associate Professor
Hidekazu KOBATAKE

Research Interests:

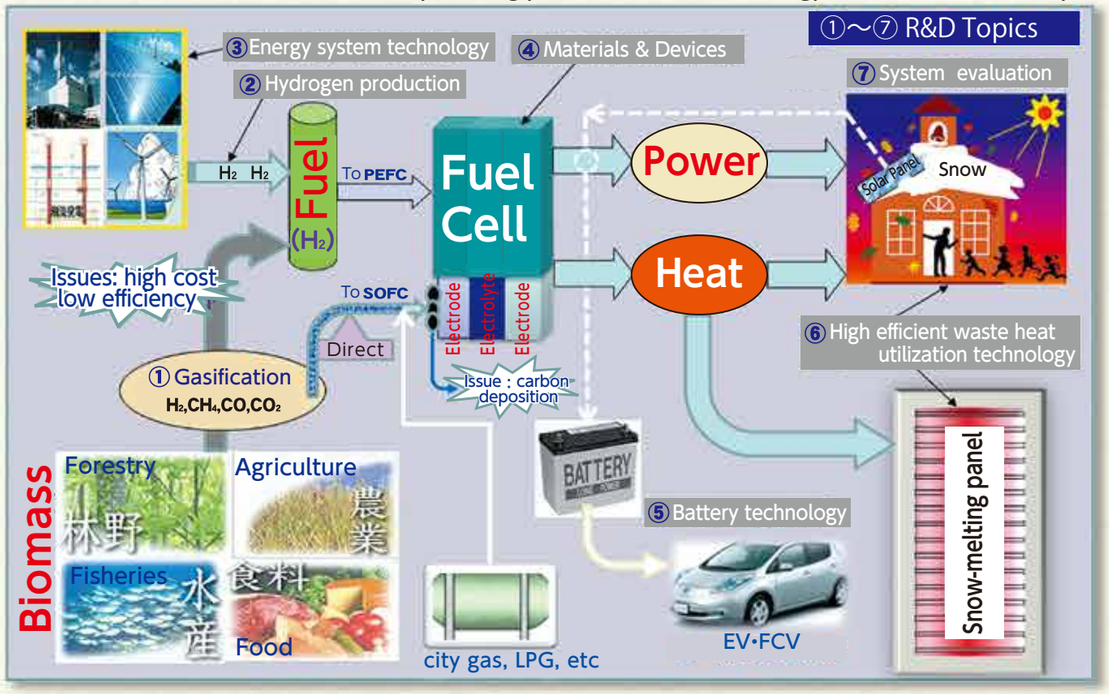
Development of novel material processing for functional materials utilizing container-less processing achieved by for fabrication of the energy converting materials such as solar power device, thermoelectric materials, piezoelectric materials. Contribution for the sustainable society through the new designed energy converting materials

Selected publications:

(1) Y.Plevachuk, V.Sklyarchuk, I.Shtablavyi, S.Mudry, J.Brillo, H.Kobatake, A.Yakymovych, S.Fürtauer, B.S.Kühberger, K.W Richter, H.Flandorfer, H.Ipser "Liquid Co–Sn alloys at high temperatures: structure and physical properties", Phy. Chem. Liq, 54, (2016) 440 – 453.
(2) H.L.Peng, Th.Voigtmann, G.Kolland, H.Kobatake, J.Brillo, "Structural and dynamical properties of liquid Al-Au alloys" Phys. Rev. B., 92, (2015) 184201-1-13.
(3) H.Kobatake, J.Brillo, S.Julianna, P-Y.Pichon, "Surface tension of binary Al–Si liquid alloys" Journal of Materials Science, 50, (2015) 3351-3360.

Energy Conversion Engineering Group

Toward sustainable low carbon society utilizing potential renewable energy resources in North Japan



Overview

Utilization of renewable energy resources is beneficial to our environment as well as to local community. However, due to its low energy density, high cost and instability of the supply, it has been still difficult to be used in a large-scale for the realization of low carbon society to date. Therefore, the development of advanced technologies and systems for achieving wide application and optimized combination of renewable energy resources in accordance with the regional characteristics is essential. Development of innovative green technologies for highly efficient utilization of biomass, production of hydrogen, and conversion and storage of various energies may contribute to the optimized consumption of energy resources especially in snowy cold regions by maximizing local energy resource utilization. In our group, biomass, hydrogen, energy materials and environmental catalysts are main research topics. It is expected to achieve our objectives with the cooperation of affiliated local governments, industries, domestic and foreign academic organizations.

Professor
Guoqing GUAN

Research Interests:

High-efficiency biomass/coal conversion technology; Catalysts for gasification and Biorefinery; Gasification process design; Oil derived from biomass/coal; Fuel gas purification and CO2 adsorption and conversion technology; Energy materials for battery, fuel cells and supercapacitor; Separation/recovery of value-added metal ions from wastes

Selected publications:

(1) Guoqing Guan*, M. Kaewpanha, X. Hao, A. Abudula, "Catalytic steam reforming of biomass tar : Prospects and challenges," Renewable & Sustainable Energy Reviews, 58(2016)450-461.

(2) X. Li, X. Hao, Z. Wang, A.Abudula and Guoqing Guan*, "In-situ intercalation of NiFe LDH materials: an efficient approach to improve electrocatalytic activity and stability for water splitting," Journal of Power Sources, 347(2017)193-200.

Associate Professor
Akihiro YOSHIDA

Research Interests:

For realization of the sustainable energy society as well as for contributing regional vitalization by utilizing biomass typical of the region, catalysts for conversion of biomass to high-value added chemicals, environmental catalysts and novel energy storage materials are aimed to be developed.

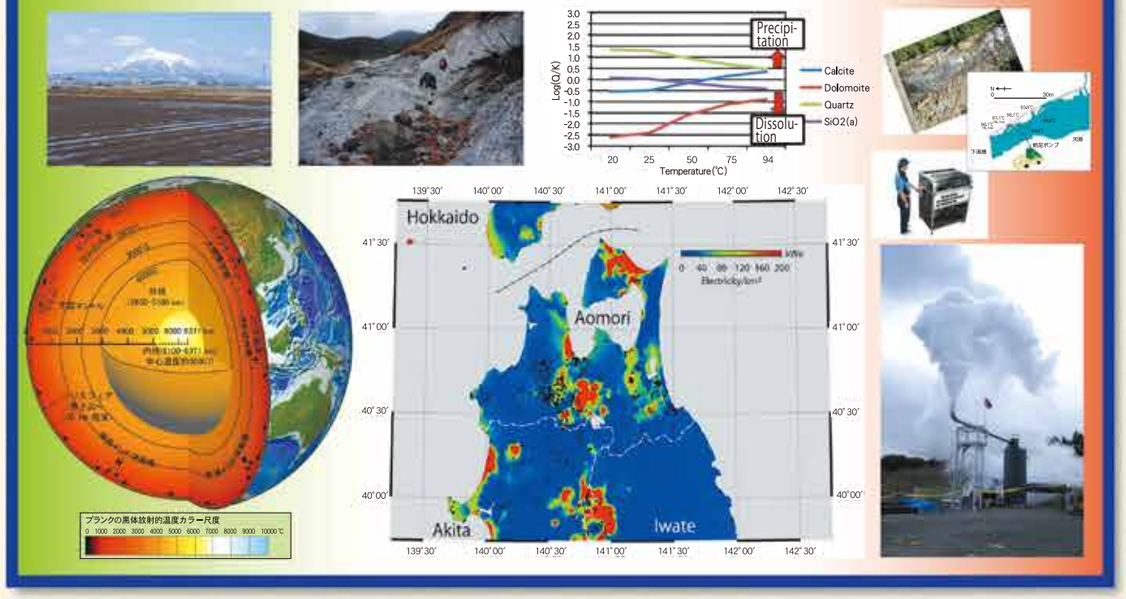
Selected publications:

(1) T. Nozawa, Y. Mizukoshi, A. Yoshida, S. Hikichi, S. Naito, "Formation of Ru active species by ion-exchange method for aqueous phase reforming of acetic acid", International Journal of Hydrogen Energy, 42(2017)168-176.

(2) A. Yoshida*, T. Okuyama, Y. Mori, N. Saito, S. Naito, "Hydrogen storage material composed of polyacetylene and LiH and investigation of its mechanisms", Chemistry of Materials, 26(2014)4076-4081.

Geothermal Engineering Group

To construct thermo-electric energy infrastructure of heavy snowfall northen Japan by abundant geothermal resources,we conduct inventory surveys,assessments,characterization and thermo-electric utilization research of geothermal resources.



Overview

Japan is poor in most of natural resources, but has ca. 8 % of world active volcanoes so that Japan is blessed with the third largest hydrothermal resources in the world. North Japan is particularly dominant in geothermal resources. Geothermal resources can be used not only for power generation but also for direct thermal application. Some sort of a geothermal utopia can be seen in Iceland where space heating is a life line which is fully protected by abundant geothermal power generation and geothermal space heating. However, geothermal resources are not necessarily used in North Japan. For instance, none of geothermal power plants have been built in Aomori Prefecture up to now. Our group aims at research accelerating geothermal utilization as follows:
(1) Investigation on the distribution of geothermal resources in North Japan.
(2) Studies on short-term applications such as direct geothermal use and hot spring power generation. (3) Studies on long-term applications such as the feasibility of relatively large-scale geothermal power plants and the next-generation geothermal power exploitation methods.

Associate Professor
Seiichiro IOKA

Research Interests:

The use of shallow geothermal heat is considered effective in melting snow, etc. Therefore, we study the mechanism of thermal conductivity in shallow ground and evaluate heat exchange resources.
Then, we study shallow geothermal potential evaluation and the various aspects involved in it. In addition, we study environmental impact assessment and evaluate geothermal resources for geothermal power generation using hydrological and geochemical methods.

Selected publications:

(1) Ioka, S., Muraoka, H. and Suzuki, Y. (2017) Redox potential of shallow groundwater by 1-month continuous in situ potentiometric measurements. Applied Water Science. doi: 10.1007/s13201-016-0436-x

(2) Matsuda, M., Suzuki, Y., Ioka. S. and Muraoka, H. (2017) Evaluation of chemical characteristics and reservoir temperature of geothermal water around the Shinyu Fault, North Hakkoda Volcanoes. Journal of the Geothermal Research Society of Japan, 39(2), 73-79.

(3) Ioka, S., Muraoka, H., Matsuyama, K., and Tomita, K. (2016) In situ redox potential measurements as a monitoring technique of hot spring water quality. Sustainable Water Resources Management, 2(4), 353–358.

(4) Suzuki, Y., Ioka, S. and Muraoka, H. (2016) Comparative study of the subsurface thermal structure in northern Honshu, Japan, based on normalized temperature data and solute geothermometers. Energies, 9(5), 382; doi:10.3390/en9050382.

(5) Shrestha, G., Uchida, Y., Yoshioka, M., Fujii, H. and Ioka, S. (2015) Assessment of development potential of ground-coupled heat pump system in Tsugaru Plain, Japan. Renewable Energy, 76, 249–257.

(6) Ioka, S. and Muraoka, H. (2014) An estimate of energy availability via microbial sulfate reduction at a Quaternary aquifer in northern Japan considered for low temperature thermal energy storage. Water, 6(4), 858–867.

(7) Suzuki, Y., Ioka, S. and Muraoka, H. (2014) Determining the maximum depth of hydrothermal circulation using geothermal mapping and seismicity to delineate the depth to brittle-plastic transition in Northern Honshu, Japan. Energies,7(5), 3503-3511.

Ocean Energy Engineering Group

Overview

North Japan is famous area for enormous resources of Renewable energy. Especially Aomori Prefecture is surrounded by the ocean on three sides and possesses a rich renewable energy potential, including ocean current, wave and tidal power, and offshore/onshore wind power. And the area is also rich region in fishery resources. Research and development will be carried out for the realization of a sustainable society with those widespread resources in that area. We also challenge a technological innovation for localized sustainable energy through comprehensive efforts as an important development factor for utilization strategies such as power conversion and storage as well as direct use of energy.
First, from Aomori. We aim to model building of the community-based energy industry, and social-, regional contribution.

Professor
Akihiro HONDA

Research Interests:
Wind turbine and energy system. Wind, wave and snow load for design of structures. Aerodynamic behavior of slender structures. Site assessment of wind energy. Ocean energy system (tidal, current and wave). Experimental and computational fluid dynamics.
Bluff body aerodynamics

Selected publications:

(1) K. Fukami, K. Karikomi, A. Honda and M. Shibata, "Aeroelastic Stability Analysis of Offshore Wind Turbine Blades at Standstill Condition Considering Unsteady Aerodynamics", Proceedings of the First International Symposium on Flutter and its Application, JAXA-SP-16-008E, 705-707 (2017).
(2) K. Karikomi, T. Koyanagi, M. Ohta, A. Nakamura, S. Iwasaki, Y. Hayashi and A. Honda , "Wind Tunnel Testing on Negative-damped Responses of a 7MW Floating Offshore Wind Turbine", EWEA Offshore 2015, PO-ID: 047 (2015).
(3) H. Imamura, Y. Ueda, K. Karikomi, A. Honda, "Wind Tunnel Measurement of Flow over a Complex Terrain for Evaluation of CFD Code", Proceedings of EWEA2013, paper-ID: 516 (2013).

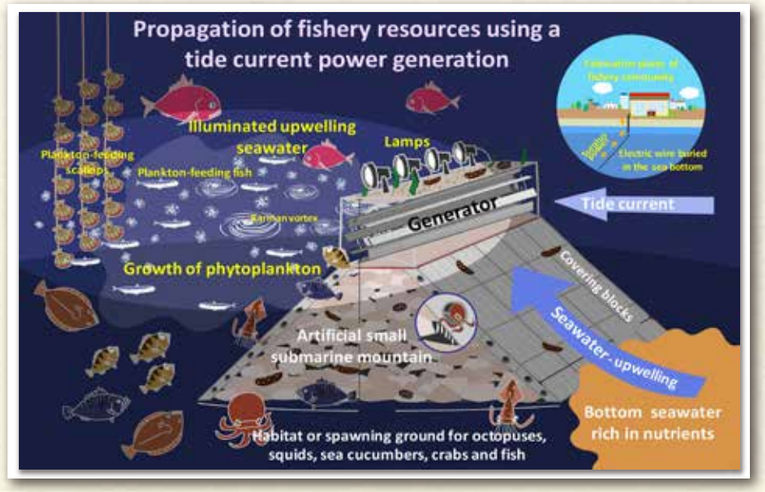
Associate professor
Takeshi KUBOTA

Research Interests:
Fabrication of high performance soft magnetic alloys. Synthesis of soft magnetic materials, non equilibrium metallic materials and multi ferroic materials with functional/useful properties, and their related technology particularly materials processing of amorphous and nanocrystalline alloys with magnetic softness. Formulation and evaluation of electric system for renewable energy. Fabrication of low rotation speed-typed electric generator.

Selected publications:

(1) J. Shen, H. Nanjo, S. Kasai, T. Kubota, M. Shimada, "Development of a New Small Sized Water Turbine Generator for Low Flow Velocities", Proceedings of 3rd AWTEC Conference, 3, 196-197 (2016).
(2) T. Shida, S. Jian, T. Kubota, M. Shimada and H. Nanjo, "Development of rotation flow VAWT for pumping system", Proceedings of WWEC2016, paper ID: D-4-2 (4pages) (2016).
(3) N. Kimura, T. Kubota, T. Yamamoto, S Fukuoka and Y. Furuya, "Heat Treatment Effect on Magnetic Properties in Rapidly Solidified Co-Fe Alloy", Journal of Japan Research Institute of Metals and Materials, 79, 441-446 (2015).
(4) T.Kubota, T.Okazaki, N. Endo, K. Mikami and Y. Furuya, "Output characteristics in Fe-Pd/PZT/Fe-Pd magneto-electric composites with Fe-Pd thick layer", Sensor & Actuator A, 200, 11-15 (2013).
(5) T. Shida, S. Jian, T. Kubota, M. Shimada and H. Nanjo, "Development of rotation flow VAWT for pumping system", Proceedings of WWEC2016, paper ID: D-4-2 (4pages) (2016).

Ocean Energy Utilization Group



Overview

Aomori Prefecture is facing to the Sea of Japan, the Tsugaru Strait, Pacific Ocean and the Mutsu Bay. Variety of fisheries have been conducted in these varied marine environments. Recently, fishery production are declining. These are the possible causes, steep rise of fishing materials costs, price declines of fishes, aging of fishermen and oceanic condition changes caused by global-scale environmental changes such as global warming. Fishery industries collapse are raising decline of fishing village. Therefore, we have to activate coastal areas through the promotion of fisheries.
On the other hand, marine environments of Aomori Prefecture is blessed with energy resources such as wind and tidal currents as well as the fishery resources. Therefore, Hirosaki University established a new research group, Ocean Energy Utilization Group, from this fiscal year, in order to contribute regional community. We carry out studies around ocean, fishery and fishing village. Especially we tackle the fishery production increase and development of cost savings technology by utilizing renewable energy, and the harmonization of offshore wind power generation and fisheries.

Professor
Shinji KIRIHARA

Research Interests:
renewable energy utilization technology for fishery production/ harmonization of offshore wind power generation and fisheries/ ecosystem, fisheries propagation and culture on seaweed, seagrass and marine benthonic animals

Selected publications:

(1) Kirihara S., Kon N., Fujita D. and Notoya M., Distributions of Zosteraceae species along the coasts of Aomori Prefecture, locating at the northernmost of Honshu, Japan. Algal Resources, 6, 1-13, (2013).
(2) Kirihara S., Nakamura T., Kon N., Fujita D. and Notoya M., Recent fluctuations in distribution and biomass of cold and warm temperature species of Laminarialean at Cape Ohma, northernmost of Honshu, Japan. ournal of Applied Phycology, 18, 521-527, (2008).

Graduate School
of Science and Technology

Educational Goals

Hirosaki University strives to provide a high level of education to future global and local leaders in a wide range of specialized fields. The university`s general education program instills a strong sense of humanity and social responsibility, while the core curricula in the various specialized academic programs help students develop the know-how and the confidence to grapple with the rapid changes taking place in modern society. All of these academic programs are geared to conform to the university`s commitment to the study of energy, the environment and food production. This commitment extends not only to the hard sciences , but also to the human and social sciences.

MASTER'S COURSE
of Sustainable Energy Engineering

Field of Research
Advanced Energy Materials
Energy Conversion Engineering
Geothermal Engineering
Ocean Energy Engineering

DOCTORAL COURSE

Course	Field of Research
Course of Advanced Materials Science and Technology	Functional Materials Chemistry
	Materials Processing Physics
Course of Safety Science and Technology	Environmental and Safety Sciences
	Safety System Engineering

With the Aim of Advanced Science and Technology Educations

The Graduate School of Science and Technology (Master`s course) considers education as the most important duty, and aims to bring up highly specialized engineers who can adapt themselves to the progress and diversity of science and technology. The course provides advanced science and technology education under the consideration of the importance for the close connection between the education of the undergraduate program and that of the master`s program

Creation of Advanced Science and Technology in the Future

The Graduate School of Science and Technology (Doctoral Course) consists of two courses of Advanced Materials Science and Technology and Safety Science and Technology. The former covers the development of useful materials and their application technology and the latter does crisis-controlling technology for natural and human-originating disasters in the highly developed society. Each course aims to bring up engineers who will be able to solve problems with a flexible and perspective consideration from the whole situation.