

# Urban Smart Energy Network

Much research is being carried out to realize a flexible interchange of electricity and heat for smart communities.

To secure a stable energy supply, low carbon usage and emergency electricity and energy sources for existing urban areas, we are doing research to build regional highly efficient distributed energy resource systems that enable new and old large buildings to use renewable energy.

- ① Power routing technology that gives consumers the possibility to trade energy with suppliers
- ② Heat packet transport technology that gives consumers the possibility to trade heat with suppliers.
- ③ IT-technology for electricity and heat transfer (Chaos CDMA)
- ④ High-precision sensor technology necessary for smart energy supply and demand systems

The City of Osaka is promoting the ‘Sakashima District Smart Community Demonstration Project’ as part of its energy policy within the Kansai Innovation International Strategic Comprehensive Special Zone. One of the aims is to stimulate the area by involving new players in this energy project. By laying heat and energy transport pipelines along a train line in the urban Sakashima district, Osaka can build an electricity and heat transfer infrastructure at low cost and test CO2 reduction effects, wide-area operability and disaster prevention aspects.

## Sakashima Smart Community project plan and the involved R&D

**Tsuyoshi Nagahiro** (Special Appointment Professor,Osaka City University Graduate School of Engineering, President of Sakishima-Asia Smart Community Alliance)



Nagahiro started his career at the Energy Plant Department of Toshiba Fuchu Factory in 1989. Using his subsequent experience working at the Power Generation and Transmission Department, he then transferred to architectural design office Sakurai System. There, he was in charge of architectural facilities and mechanical design and worked on the urban redevelopment of the Amagasaki station area. He is now President of the Sakishima-Asia Smart Community Alliance, which offers concrete solutions to implement smart communities. The Sakishima Smart Community uses railroads and stations as infrastructure for the flexible transfer of heat and energy and demonstrates the effects on the revitalization of an existing urban area that is transformed in an energy saving low carbon community.

The smart community project is demonstrated in various cities across the world including Japan, though it is not the solution to the world’s energy problem yet.

The Sakishima Smart Community develops and demonstrates of essential technologies to enable a flexible exchange between heat and electricity supply and demand. This is an unparalleled project because it not only transforms an existing urban area into a smart community using its existing facilities, but it simultaneously contributes to low carbon usage and stimulates the area.

## Thermal Grids

**Masaki Nakao** (Special Appointment Professor, Osaka City University Graduate School of Engineering)



Education: B.S. in Mechanical Engineering from Waseda University and M.S. in Control Engineering from Tokyo Institute of Technology  
Experience: After extensive research and business accomplishment in NTT, NTT Facilities and Sokon Consulting Corporation, joined in Osaka city University faculty in 2004 as professor in the graduate school of Engineering. Has served as an active member of the national committee by Ministry of Economy, Trade and Industry and that of Osaka city and local government in the field of urban efficient energy utilization in Japan. Current chairman of Heat Island Institute International and a fellow of The Society of Heating, Air-conditioning and Sanitary Engineers of Japan  
Awards: The Architectural Institute of Japan Award ( Technical)  
The Society of Heating, Air-Conditioning and Sanitary Engineers of Japan Award  
Publications: "Countermeasure of Heat Island" joint author

We are carrying out R&D on thermal grids transporting hot and cold water within or between buildings by routing packets of heat. Through this technology it would become possible to save energy by using hot and cold water cascades within or between buildings.

## Power routing systems for EoD (Energy on Demand) and PoD (Power on demand)

**Yutaka Fueki** (Fuji Electric Co. Ltd. Power & Social infrastructure Business Group Smart Community Grand Design Department)



Joined Fuji Electric Co., Ltd. in 1982 Developed Iron manufacture, Logistic, Medical treatment systems.  
Take charge designing and planning of a smart community in Japan and in Southeast Asia from 2009.  
These days, take charge construction of the smart community of industrial complex and Urban development in Southeast Asia and the Middle East.

He will present smart community case studies in Japan, illustrating the features of power routing systems for EoD to optimize supply and workload and PoD to optimize the balance between interphase and workload.

## Next generation communication technology: Chaos CMDA for smart energy systems

**Ken Umeno** (Professor, Kyoto University)



He received his BSc degree in electronic communication from Waseda University, Japan in 1990. He received his MSc and PhD degrees in physics from the University of Tokyo, Japan in 1992 and 1995, respectively. Currently, he is a professor at Graduate School of Informatics, Kyoto University. Prior to joining Kyoto University in 2012, he worked for the Ministry of Posts and Telecommunications, Communications Research Laboratory (currently National Institute of Information and Communications Technology of Japan, NICT) . From 2004 to 2012, he was the CEO and the president of ChaosWare, Inc, a first spin-off company of NICT as well as a principal investigator of NICT. He received the LSI IP Award in 2003, the Telecom-System Awards in 2003 and 2008 respectively. He holds 46 registered Japanese patents, 23 registered US patents, and 2 registered Chinese patents in the fields of telecommunications, security, and financial engineering. His research interests include ergodic theory, statistical computing, coding theory, chaos theory and its applications to communications and computing.

By using Chaos as a communication code we can efficiently transport large amounts of energy and information. Additionally, Chaos CDMA also solves security problems. We will explain the suitability of Chaos CMDA for smart energy networks.

## High-precision power sensors using micro magnetic devices

**Hiroaki Tsujimoto** (Professor, Osaka City University Graduate School of Engineering)



Education: B.Sc. in Engineering Science, Osaka University Ph.D. in Engineering, Osaka University  
Experiences: Worked as an assistant, lecturer, and assistant professor at Osaka University. Joined Osaka City University in 1999, and is now a professor.  
Research interests: Electronic Devices, Mechanical Engineering, Electric Power Engineering

After the Great East Japan Earthquake and the accident in Fukushima I Nuclear Power Plant, Japan was in critical condition, there was a shortage of power supply. It severely affected the Japanese economy and the national life of Japan.

On the other hand, photovoltaic power generation, wind power generation and the power by utilizing recyclable energy and new energy of fuel cell etc. were actively developed. The electric power supply and demand changed the overconcentration system to the distributed system. The accommodated energy management system for it was strongly demanded.

The thin film power sensor by using magneto resistance effect is able to detect total electricity consumption, power factor, harmonic power, electricity consumption for each frequency for DC and AC. And the size of its sensor is a very small. Therefore its sensor can be set in a narrow place where we could not arrange a big size sensor before. So we can measure the accurate electricity consumption.

Therefore the thin film power sensor by using magnetoresistance effect is able to bring an innovative and electric power saving technology.