

APAC Journal

Spring 2013

Sustainable Asia:
Advancements in
Technology, Design, and Policy

APAC 

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Columbia University

The 21_21 Museum in Tokyo, Japan, designed by Tadao Ando celebrates the relationship between building and nature. Built mostly underground, it reveres nature above the built world. The current exhibit "Design Ah!" iterates that idea by relating design to the human mind through interactive exhibitions that enables the viewer to be conscious of his surroundings. This consciousness is the most important aspect of sustainability and the key to altering behavior to combat climate change.

Anthony Abel Sunga
The Sound Monocle at 21_21

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School of International & Public Affairs

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Master of Public Administration, 2013
School of International & Public Affairs

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Writer: Ella Kim

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Graduate School of Arts & Sciences

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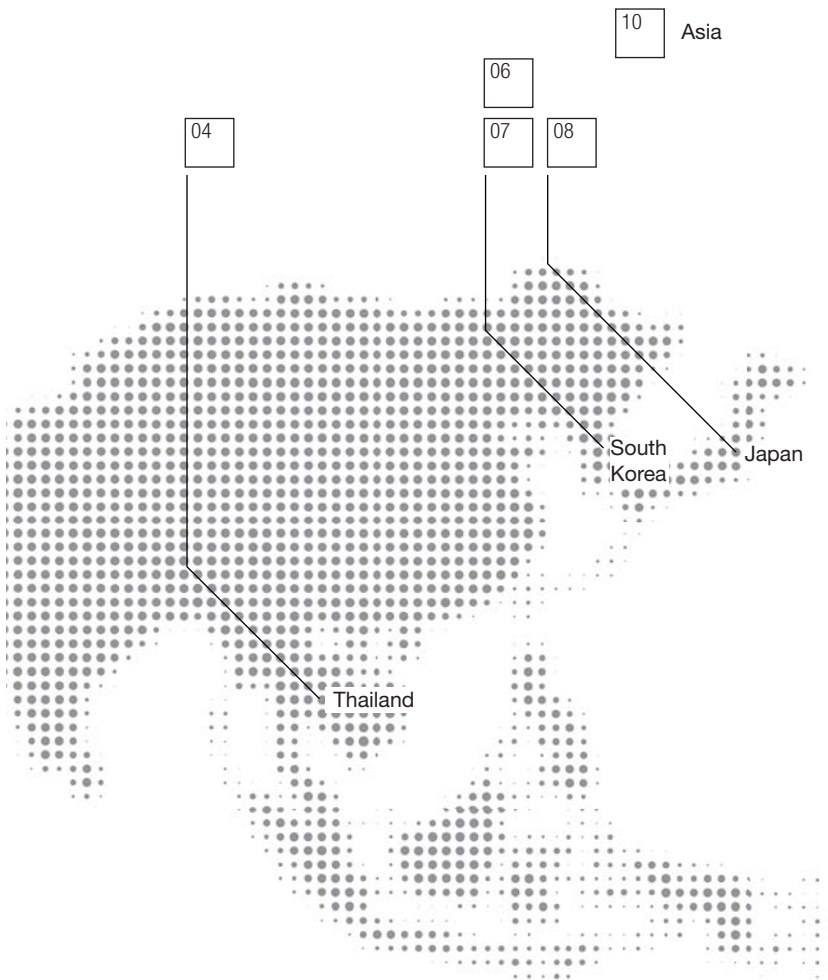
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Earth Institute Fellow
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Editor: Robert Alex Woodend

MARSEA, 2013

Graduate School of Arts & Sciences



• STAFF •

Editor-in-Chief

Anthony Abel Sunga
Master of Architecture, 2013
Graduate School of
Architecture, Planning & Preservation
Hometown: McAllen, Texas
Undergrad: University of Texas at Arlington
BS Architecture, 2008

APAC Chair

Anna Keegan
School of International & Public Affairs
Master of International Affairs, 2013
Hometown: Littleton, Colorado
Undergrad: Colgate University
BA Sociology & Anthropology,
2008

Particulate Matter Matters

Q&A with Ying Li
Earth Institute fellow

Edited by Anthony Abel Sunga
Master of Architecture, 2013

04

Q&A: Thailand

Tell us about the Earth Institute (EI), its mission, and your role as an EI Fellow?

The Earth Institute at Columbia University is an interdisciplinary research institute, and its stated mission is “to address complex issues facing the planet and its inhabitants, with particular focus on sustainable development and the needs of the world’s poor.” As an EI Fellow, I am currently working with Dr. Patrick Kinney, Professor of Environmental Health Sciences, on two research projects: (1) Assessing the public health impacts of fine particulate matter in the continental United States focusing on premature mortality. The goal of this project is to inform the development of the most cost-effective control strategies to reduce total particulate matter-related mortality in the US (2) Assessing the health co-benefits of greenhouse gas (GHG) reduction strategies in the transportation sector in Beijing, China. The main goal of this project is to help to understand the short-term ancillary benefits of climate change mitigation in a rapidly developing metropolitan area.

How did you become interested in this topic in this particular city? Are there unique conditions in Bangkok that makes it an attractive place to conduct research?

Since the late 1990s and early 2000s, the Bangkok area has been suffering from severe adverse health effects attributable to ambient air pollution, resulting in considerable economic loss. The worst problem is fine particulate matter emissions from motor vehicles in the city. Based on this, I selected examining the health benefits of traffic-related particulate matter control policies in Bangkok as the focus of my dissertation research.

What are the health risks of particulate matter, both in short- and long-term?

Fine particulate matter is considered the air pollutant with the greatest health impacts due to the factor that it induces a series of adverse health effects, in particular premature mortality. Because these tiny particles are inhalable and easily reach the deepest recesses of the respiratory systems of human beings, scientific studies have linked breathing particulate matter with a variety of significant health problems. Short-term exposure to particulate matter may cause premature death, respiratory- or cardiovascular-related hospital admissions and emergency room visits, acute asthma attacks, acute respiratory symptoms, or work and school absences. Long-term exposure to particulate matter may cause premature death, chronic diseases such as chronic bronchitis, and decreased pulmonary function.

Explain the relationship of particulate matter pollution with climate change?

An important chemical component of particulate matter, namely black carbon, has been discovered to be strongly light-

absorbing and thus plays an important role in global warming. The particles emitted by mobile diesel engines contain about 75% black carbon. Therefore, controlling PM emissions from diesel combustion will help to slow the near-term rate of climate change. Strategies to control greenhouse gas emissions, however, are most likely to reduce particulate matter emissions simultaneously. Since both particulate matter and GHG control strategies cause significant costs to the society, I believe countries, particularly developing countries that face severe air pollution problems, should consider integrating both air quality and climate policies whenever possible in order to generate double dividend.

Can you talk a bit about the Copenhagen Accord and why there is a perception that reducing greenhouse gases is antithetical to economic growth, especially for developing nations like Thailand?

Briefly, the Copenhagen Accord is a document that delegates at the 15th session of the Conference of Parties to the United Nations Framework Convention on Climate Change agreed to “take note of” at the final plenary in December 2009. The Accord includes emissions reduction commitments from all major emitters (countries) and provides for international review of both developed and developing countries’ targets and actions. Under the Accord, Thailand is not required at present to establish or achieve targets for reduction of greenhouse gas emissions, in part as a concession to the needs of developing nations for economic growth to alleviate poverty. On the other hand, reduction of GHG emissions in Thailand will bring about reductions in health-damaging air pollutants, such as particulate matter. As a result, it will improve public health and thus produce considerable economic benefits for the nation.

How has your research in Thailand helped your current research studying particulate matter in the US?

Currently, I am using a similar framework that was used for my Bangkok study to assess the health impact of PM in the US. The key factors that influence the health effects of ambient air pollution, such as the activity patterns of the pollution and the population's susceptibility to these effects, as well as the levels of uncertainty associated with these factors, might be different from country to country, particularly between developed and developing nations. It has been very interesting to compare various aspects of the work I have done in Thailand and my current project that focuses on the US.

How do emissions standards in Thailand differ from that of the US?

Thailand uses the European emission standards that define the acceptable limits for exhaust emissions of new vehicles sold in EU member states. In the US, new vehicle emissions standards are managed by the Environmental Protection Agency (EPA), with the exception that the state of California uses more stringent standards. Other states may choose to follow either the national or California standards.

What kind of changes do you think Thailand and the US must make to curb PM pollution? Do you believe that urban policy strategies like investing in public transportation and more stringent car emission standards will help the issues, or are there other strategies that can be employed?

To control emissions from motor vehicles, generally there are two distinct types of policy instruments: direct

regulations and economic incentive instruments. Both types of policy tools have advantages and disadvantages. Major regulatory instruments include vehicle emission standards, fuel quality regulations (e.g. unleaded gasoline and limits on diesel sulfur), and mandatory vehicle inspection and maintenance. Major economic incentive instruments include environmental road pricing, taxes on fuels or car emissions, and marketable permit systems for vehicle manufacturers. In Thailand, given the considerable uncertainty associated with instituting EI instruments and current lack of international experience and best practices, direct regulatory measures are considered more practical. On the other hand, in the US, the most common policies targeting road transportation emissions are still regulatory, a switch of policy focus to economic incentive has been proposed.

The aim for your current research is to develop the most cost-effective control strategies to reduce total PM-related premature mortality. What strategies have you seen are you most excited about?

The project being conducted by my team at the Earth Institute is now underway. Since emissions are not necessarily proportional to mortality—e.g. a small amount of emissions may affect a population-dense area and thus causes significant health outcomes—we are investigating emissions from which areas contribute the most to PM-related premature mortality in the US. Preliminary results show that states whose emissions contribute most to mortality are California, New York, and Texas. Therefore, controlling emissions in these states are expected to reduce avoidable deaths in a cost-effective way. We are further going to investigate PM emissions from smaller geographic units

such as counties, towns, and so on.

What advice do you have to everyday people to help reduce PM pollution?

Anthropogenic PMs are mainly generated as a result of combustion processes including the burning of fossil fuels for power generation, heating and household cooking, agricultural field burning, engine combustion, and various industrial processes. Therefore, our everyday activities will affect PM emissions directly or indirectly and we all can contribute to the reduction of PM emissions through some actions in our daily life, such as reducing electricity consumption, limiting driving, switching to public transportation or cleaner vehicles, and recycling.

Smart Cities: South Korea's Jeju Island as a Smart Grid Testbed

Hyunjin Kim
Master of Public Administration, 2014

Edited by Ryan Hakim
Master of Public Administration, 2013

06

ARTICLE: South Korea

Jeju, an island located past the southernmost tip of the Korean Peninsula, is well known for its sweeping volcanic rock landscape, ocean cliff views, and scenic walking trails that follow miles of coastline. The abundance of sunshine and open coastline also make Jeju an ideal location for renewable energy development projects. Hundreds of wind turbines line the shore and solar-powered boilers and rooftop panels provide local farmers energy for everyday use. Based on this potential for renewable energy, the South Korean government chose Jeju as the testbed for the country's smart grid pilot program in 2009.

A smart grid is an intelligent power transmission and distribution system that combines information technology with the existing power grid to facilitate information exchange between suppliers and consumers in real time. Using new meters and devices installed in buildings and homes, residents can check prices and control energy consumption to avoid peak times when prices are higher. Smart appliances can also save energy by automatically turning on or off according to electricity costs. In turn, energy companies can monitor consumption and accordingly adjust

credit: Energy Smart Community Initiative, APEC Smart Grid Test Bed Network



energy production, enhancing energy efficiency and stability.

The Jeju pilot program, in particular, also provides certain residents with electric cars and installed charging stations. Households that have solar panels and storage batteries can even sell any surplus generated power back to energy companies, such as the Korea Electric and Power Company. Since the project began, typical participants reported a decrease in their electricity bill from about \$40 (KRW44,000) to \$1 (KRW1,100).

The South Korean government launched the smart grid pilot program in Jeju to study and foster strategies for sustainable growth. The project represents the world's first and largest all-inclusive smart grid. Once the test-bed system performs successfully and proves ready for large-scale application, the South Korean government plans to implement the model in major South Korean cities and export it to other cities around the world. The South Korean government has already committed 2% of its GDP for investments in green technology and infrastructure to make this ambitious goal into a reality by 2030.

While the essential concepts for a smart grid are the same worldwide, the system has different implications for developing and developed countries. For cities in emerging market countries, smart grid deployment can improve overall electric utility reliability, reduce electricity theft rates, manage surging demand, and incorporate new sources of renewable energy.

For regions that do not yet have a fully built power grid, smart grids represent an opportunity to steer the development of their power sector towards more manageable, reliable, and efficient designs. For developed cities, the smart grid system can instead aid with brownfield redevelopment, upgrade outdated power grid infrastructure, and enhance energy efficiency in older buildings.

Another key factor in global smart grid deployment will be private-public sector collaboration, which has played a crucial role in the Jeju test-bed. The \$220 million project involved the cooperation of more than 160 private companies, which also contributed around \$160 million. According to a 2012 report by Pike Research, smart grid technology markets are expected to grow

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Bike City

Ella Kim

Master of Arts in Quantitative Methods
in the Social Sciences,
Master of International Affairs, 2013

Edited by Robert Alex Woodend
MARSEA, 2013

07

ARTICLE: South Korea



Changwon, located in South Korea's southern Gyeongsang province, has rarely been considered in the same breath as its bigger, flashier counterparts Seoul and Busan in terms of economic or cultural development. However, with its innovative climate change policies, Changwon is rapidly establishing itself as the leader among Korean cities in cultivating urban sustainability.

Mayor Park Wan-Su has been particularly aggressive in addressing Changwon's sustainability challenges. During Mayor Park's tenure, Changwon has become the second city after Seoul to join the International Council for Local Environmental Initiatives and C40, both international networks of local governments designing and implementing sustainability initiatives. Furthermore, Mayor Park also started three major sustainability projects in 2008: restoring streams, promoting solar energy production, and expanding the bicycle infrastructure. These projects, in addition to reducing carbon emissions, are helping to ensure that Changwon residents benefit from reduced traffic and improved air quality.

Of Changwon's sustainability programs, which aim to reduce carbon emissions by 30 percent by 2020, its bicycle share program, "Nearby Useful Bike, Interesting Joyful Attraction (NUBIJA)," has been cited as its most successful. Designing and establishing bicycle infrastructure and cycling programs are relatively low-cost ways to relieve traffic congestion and provide an emissions-free alternative to motorized transportation. When it comes to reducing carbon emissions from urban transportation, few options are as attractive as increasing bicycle usage.

Changwon set out to introduce a user-friendly bicycle rental system that would become part of the city's urban landscape. The city extensively researched other cities' bicycle programs, and also analyzed Changwon's physical geography to optimize its system. Based on this research, the government made extensive improvements to Changwon's bicycle and road infrastructure. Over fifteen 96km-long, bike-only roads have been developed. To create a bicycle-friendly environment, the city repaired existing bicycle paths, optimized intersections with vehicular traffic, and created new

bicycle-only thoroughfares. The city also lowered the automobile speed limit and narrowed automobile lanes to create more room for bicycles.

Developers introduced a satellite-based navigation system (GPS) to track the location of rental bicycles, alleviating the potential for theft. Bicycle storage terminals were installed; residents can access the bicycles by locking and unlocking the Radio Frequency Identification device used on every bicycle. Kiosks were set up to provide information on rentals and security at terminals. Furthermore, a central control center was also established to guarantee the smoothness of the NUBIJA program's operations.

In addition to technological and operational investments, the city held bicycle riding lessons and bicycle safety training to increase public awareness and encourage uptake of the bicycle rental program. In terms of other incentives, Changwon also became the first city in the country to offer bicycle insurance, which compensates Changwon residents involved in a bicycle-related accident. The city also gives a 30,000 won (about

GSAPP to Japan: Understanding Deployable Technology

Anthony Abel Sunga
Master of Architecture, 2013

During spring break 2013, a team of seven students, including myself, and professors Mark Collins and Toru Hasegawa from Columbia University, Graduate School of Architecture, Planning, and Preservation traveled to Tokyo and Kyoto for the final semester Kinne-sponsored research trip. We visited important architectural and historical sites, battled against

Japanese architecture students on Processing at Code Dojo: Tokyo, and most importantly visited the Advanced Telecommunications Research Institute International (ATR) and the YRP Ubiquitous Networking Laboratory (YRP-UNL) to learn about emerging technologies pertinent to architecture.

08

Photo Essay: Japan



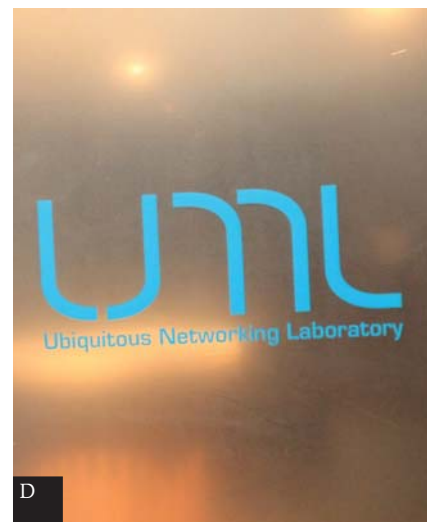
A



B



C



D

A Our visit to the ATR lab began with a presentation by Dr. Yukiyasu Kamitani, PhD, head of the Department of Neuroinformatics on brain-computer interface. The goal of the project was to understand how the brain “reads” images and theoretically be able to reconstruct our dreams.

B Motoaki Kawanabe, PhD, senior researcher of the Brain Information Communication Research Laboratory Group (BICR), ATR presenting the “Smart House” facility.

C The “Smart House” is a livable environment where test families can live for a short stay to help researchers understand the implications of living in this type of environment. It is equipped with various sensors to detect bodies, machines to aid disabled inhabitants, and health monitoring technology.

D At the YRP-UNL we had a private meeting with Jun Yamada, Strategic Planning Board member, to listen to his presentation on the TRON-concept Intelligent House and new advancements in radio-frequency identification (RFID).

E The house is a project by Dr. Ken Sakamura built upon the Real-Time Operating System Nucleus (TRON), which is the operating system found in billions of electronic devices, appliances, and vehicles. The objective of the house is to achieve full domestic automation. It is designed and outfitted to maintain ideal domestic conditions with many sustainable attributes. The environmental control systems not only employ typical HVAC systems, but also automatically manipulate the physical building to use natural processes for temperature, humidity, and light.



E



F

F The showroom at the YRP-UNL displays real-world applications of RFIDs developed at the lab. Jun Yamada demonstrates the application on food manufacturing and transportation. Packages of food can be tagged in real-time with vital information about the product. Information like expiration dates, temperature, quantities, inspections, etc. can be updated in real-time and transmitted to a remote central location through the internet. This has many implications in decreasing costs, increasing food safety, and reducing waste.

Communicating Climate Change in Asia

Interview with Tien Ming Lee
Earth Institute fellow

Robert Alex Woodend
MARSEA, 2013

10

Q&A: Asia



I sat down with Earth Institute (EI) Fellow Tien Ming Lee to talk about climate change in Asia. Lee is a conservation biologist from Singapore and holds a PhD in biology from the University of California in San Diego. He is an expert on the public's perception of climate change, with a regional focus on Asia. We talked about these perceptions and the challenges surrounding public support for environmental policy.

What is the Earth Institute?

The EI, which is directed by the economist Jeffery Sachs, is one of the top interdisciplinary institutes in the world that looks at sustainable development issues—very broadly defined. Right now our current foci include water, food security, biodiversity, and even urban planning. The EI has many different units, but all are highly interdisciplinary. This is one of the key features about the Institute.

How are you involved with the EI?

I'm affiliated with the Ecology, Evolution, and Environmental Biology Department and the Center for Research

on Environmental Decisions. The Center tries to understand the psychological aspects of how people make decisions, especially environmental ones like energy conservation behavior, hazard management, or evacuation.

What projects are you working on now?

My main project tries to predict climate change perceptions globally. It looks at how demographic variables such as age, gender, and other quantifiable indices such as beliefs and opinions predict public perceptions on climate change.

What have you discovered in your research concerning Asia?

It's not surprising that as a region, Asia has very different signals—different predictors—even between, say, China and India. The drivers for whether or not someone sees climate change as a threat are very different. It's impossible to say all the countries in Asia share the same set. So, one of the key messages of this project is that opinion is very difficult to predict. The question has never been studied this broadly. We're looking at over one hundred countries, so it's pretty exciting. Our work will allow

people to look at any country, examine its public opinion on climate change, and determine what factors contribute to that opinion. The objective is to have something that is useful for every country.

Is there a special way in which climate change is going to affect Asia? Are there different concerns there than, say, in Europe or America?

China is an interesting study because of its large population and strong central government. Renmin University recently did a national poll in collaboration with Yale Project on Climate Change Communication, of which I am an affiliate, and found that many people are really concerned about climate change. They see it as a human-cost phenomenon. This is in sharp contrast to the US where it is very polarized with a substantial portion of the population still in denial of climate change.

Do you think that means Asia is going to be more responsive or politically able to deal with climate change?

At least for China, the central

government is paying a lot of attention to it, and for good reasons. There has been an increasing number of devastating natural occurrences that have forced the government into examining the problem. Many experts believe that the latest five-year plan was the most comprehensive plan to address climate change in China.

There are ways to try to limit climate change and ways to try to respond to it. Do you think it's more important to curb emissions or prepare for climate change's effects?

This question of mitigation or adaptation depends on where you are. I don't think there's a one-size-fits-all policy. I think each city should plan accordingly. Indonesia, for example, has thousands of islands each with its own conditions, and different islands face different problems. On some islands, sea-levels rising is an issue, so you need different solutions. You have to go local to strike the right balance between the two. Focusing on only one would be disastrous.

As for balancing environmental costs and development. Is there a right way for China, for example, to do that, or a wrong way?

If you've been following some of the things that have been coming out about China, there are several things the Chinese are very concerned about. One is the air they breathe. You can't see far, and you have difficulty breathing. People have linked that to climate change, which is not truly accurate. People get this mixed up. For example, one of the questions scientists ask to gauge people's understanding of climate change is if climate change is caused by ozone depletion. People often incorrectly think that it does contribute to climate change. But what we can see from the

Chinese example is that when it comes to air pollution, they understand that it affects public health. They get really upset by this and want to take action.

What would you say to a Chinese government official who said, "We can't worry about this now; we have to grow the economy first?"

I think the good thing is that at least the central government is realizing that the economy and the environment are linked. You can't have one without the other. So, they know if they want good long-term growth, they have to think about the environment more. One of the interesting things about the Chinese government is that the top officials are often scientists, unlike the US where politicians are mostly lawyers. They will be more sensitive to scientific data.

What about solutions? What should Asian countries be doing?

Awareness is generally very low. First, people need to know there's an issue. You need a sufficient level of awareness. You need to recognize it as a threat, not just to your health, but to the economy as well. Once people recognize that, it's much easier to push solutions, whatever that entails. So, of course, education is crucial. I know the next generation will care about climate change and will want to deal with it, but it takes time for a generation to come around. We have seen this many times in history.

Do you think that once people have enough awareness and that the politics and economics will follow?

Yes, that's why there's a very strong push on climate change communication. How do you reach out to people who are interested. People who are not interested? It's akin to the voting situation: how do you get people to vote? Some people

will always vote a particular way, that is why targeting swing voters is the most effective tactic in elections. We need to get to the people on the fence. There are different levels of engagement, so we have to communicate the issue and reach out in different ways and get something done. If there is enough support for climate change issues, the government will have to pay attention.

Do you see NGOs having a strong role to play in communication, or can government do it?

I think they have to work hand-in-hand. Different types of organizations have different roles. You have to keep the channels open. You have to keep communicating. Successful petitions require someone to push and get enough support. Governments have to be kind of neutral, so it's difficult. There's a lot more room to maneuver if you're an NGO or grassroots organizations. A lot is about communication. It's about trying to get the people moving. Government policy can only do so much, so you need smaller groups. NGOs would probably be the most effective group to do the engagement.

continued from page 6: JEJU

to more than \$70 billion by 2020. Even though the technology already exists for the development of smart grids, the lack of regulations and global standards may delay the mainstream deployment and adoption of smart grids.

More importantly, in addition to secure and globally interoperable technology, the success of smart grids relies on the awareness by consumers and businesses of these technologies and their utility. The Jeju testbed faced a difficult and resource-intensive challenge in educating residents about the correct use of the different technologies.

Several all-inclusive pilot projects similar to the Jeju test-bed have since begun operation, such as the Maui Smart Grid Demonstration Project and Japan's four Smart City Projects. The Chinese government has also begun to explore several initiatives and, on a lesser scale, energy companies in Europe and the United States have adopted the use of smart meters.

With the steep rise in global demand for energy, smart grids, and other innovative energy solutions are becoming increasingly important in alleviating global energy concerns, and Jeju's smart grids provide useful lessons to future smart grid initiatives.

continued from page 7: BIKE

US \$25) grant to residents who commute by bicycle at least 15 days per month.

As a result, Changwon has come to be known as a city of bikes. NUBIJA currently consists of about 300 terminals and 5,000 bicycles. From October 2008 to April 2011, Changwon residents traveled a total of over 29 million kilometers with NUBIJA bikes, resulting in offsetting 5,900 tons of carbon emissions per year. This has not only increased residents' physical activity and contributed to job creation, but, more importantly, has established biking as a convenient, ecological alternative for Changwon residents.

In January of last year, World Mayor Awards honored Park for his work. The mayor was touted for his dedication in addressing Changwon's sustainability challenges: "The mayor's environmental initiatives have won attention outside the country and seemingly gone beyond concrete measures towards changing people's perceptions in this area. The city has been described as the environmental capital of South Korea."

If you are interested in writing for
the APAC Journal or would like to
join the editorial staff,
please contact:

Anthony Abel Sunga
apacjournal@gmail.com
columbia.edu/cu/weai/studentaffairs/

