

Local Economies and the Future of Environmental Sustainability in Japan and Asia: Osaka and Kitakyushu 日本とアジアにおける局地経済と環境持続可能性の将来—大阪と北九州

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Japan is committed in principle to addressing global climate change and to bringing Japanese lifestyles, economy, and policies in line with the requirements of environmental sustainability. With the signing of the Kyoto Protocol in 1997, the country became a global exemplar of efforts to control CO2 emissions. Subsequently, successive national governments have attempted, with varying degrees of success, to mobilize government, business and the citizenry in the interests of environmental protection. With a growing sense of crisis, tied to the reality of rapid climate change, the debate over global energy supplies and the conflicting imperatives of economic growth and environmental sustainability, the question of how to align national policy with ecological stewardship has become ever more essential. Japan's effort commenced with the now-standard approaches to reducing consumption, reusing materials and recycling products, producing some results but falling far behind goals and aspirations. This was followed by efforts to capitalize on the promise of science and technology-driven change. While national policy in Japan as elsewhere lagged behind political rhetoric, community level initiatives have been more effective in advancing the cause of environmental sustainability. Policies adopted and implemented in Osaka and Kitakyushu, two cities formerly synonymous with the environmental disasters of Japan's early industrial economy, illustrate the constructive potential of local solutions in addressing a global challenge, but also the structural obstacles to success.

This paper examines the performance of Osaka and Kitakyushu, two cities whose leaders view environmental technologies as pivotal to regional well-being and as valuable sources of job and wealth creation. While they are not the only Japanese cities and certainly not the only global cities seeking to link environmental protection with economic development, they are emblematic of a growing effort by cities and regions to combine innovation, social priorities and wealth creation. Both Osaka and Kitakyushu were once major industrial polluters and their citizens lived with the resulting poor air and polluted water. Both cities have committed to becoming low carbon, sustainable cities, and are working with national and prefectural governments, the private sector and the general population to do so.

The Commercialization of Environmental Science and Technologies: Osaka and Kitakyushu have positioned themselves in the fast-moving world of national and regional innovation, wherein efforts are made to commercialize scientific and technological developments. The conflation of science and economic development is not new. In the post-World War II era, for example, the United States invested heavily in academic and applied research at universities and institutes, adding to the corpus of scientific knowledge, supporting the creation of new jobs and companies and, perhaps most important to American policy-makers, fuelling the arms race. The S&T-based innovation environment, developed beyond the military to sustain the

nuclear industry, to improve the oil and natural gas economy, and to support the large American automobile sector, tying academic and applied research to national economic and strategic priorities. In the late 20th century, with the wide-ranging impact of the information and communication technologies, governments around the world have looked at science and technology as the foundation for “new economy” prosperity. The marked success of selected science-based clusters, most notably Silicon Valley (California), Boston (Massachusetts), Waterloo (Canada), Singapore, and Taipei (Taiwan), convinced local and regional governments to invest heavily in the creation and expansion of innovation-based economies.

National and regional innovation systems serve purposes beyond basic economic development. In some communities, such as Tromsø, Norway, the goal has been to use scientific and technological innovations to respond to specific local (in this case sub-Arctic) circumstances. Likewise, in Canada, national commitments to medical research have sought to create new companies while also improving medical services and reducing costs. Japan has actively invested in scientific and technological discoveries that respond to national social priorities and create jobs and new businesses.¹

Locally based and regionally supported initiatives are growing in environmental and economic importance and impact. This, importantly, has been the pattern in the United States and other countries as diverse as the United Kingdom and Denmark, with local governments developing effective environmental strategies that capitalized on the mobilization of the citizenry and that presented locale-specific initiatives.

Osaka and Kitakyushu are among the Japanese cities that have tied their economic futures to the development of environmentally friendly technologies. Yokohama, too, is actively

developing next generation energy infrastructure, recycling and environmental technologies and was nominated by the World Bank as one of six Eco2 cities. Nonetheless, an overview of Osaka and Kitakyushu’s efforts illustrates the unique combination of environmental concerns, scientific and technological innovation and government plans for economic competitiveness that is driving two key cities and helping to set a Japanese national agenda.

Osaka: The Evolution of an Eco-City

Beginning in the 1950s and lasting well into the 1970s, Osaka suffered from severe environmental problems.



Industrial Osaka, 1955

With economic growth as the nation’s top priority, environmental protection took a distant back seat. From the Meiji era on, particularly during the postwar reconstruction period, Osaka prospered as the commercial and industrial centre of western Japan. As a result, it became one of the most polluted cities in the country if not the world. In 1960, Osaka “recorded smog on 156 days and the rivers resembled sewers.”² Around Japan, citizen movements sprang up to protest the mercury

and cadmium poisoning of the waterways and the asthma-inducing air pollution. In the face of massive pollution, many “local governments played a pioneering role in environmental regulation. They were the first to enact pollution prevention ordinances.”³ Osaka passed its first anti-pollution legislation in 1950.⁴ Efforts to reduce pollution, however, began in earnest in the 1970s with a Special Task Force for Anti-Pollution Emergency Measures (1970) and the purchase and operation of a pollution measurement van.

Since that time, Osaka has been at the forefront of Japanese environmental protection. The region has launched a series of initiatives for combatting pollution, improving waste management and recycling and, recently, reducing global warming. Led by its environmental bureau, Osaka launched its first Basic Environmental Plan in 1996, the second in February 2003 and its current plan in 2011. The 2003-2009 plan had four main policies:

- comfort (pollution prevention, the improvement of green spaces and the development of a healthy urban environment)
- recycling (waste reduction and recycling)
- collaboration (among residents, businesses and the city government)
- global environment (promote international cooperation).



Under each of the four main policies are a series of action items. Comfort, for example, includes air quality measurement and improvement, water and land treatment standards and assessment, traffic pollution control and the improvement of the urban heat island effect (the phenomenon that makes urban centres hotter than surrounding areas due to the heat stored by roads and buildings) by using climbing plants and moss on the roofs and walls of buildings to cool them, creating wind paths, and collaborative *uchimizu* projects whereby residents sprinkle water (recycled from baths) onto sidewalks to create a cooling effect.⁵ The 2011 plan builds on the earlier one with an emphasis on making Osaka an environmentally advanced city with a goal of transitioning to a future-oriented industrial structure that draws on the city’s strengths in environmental technologies. Osaka set goals of a 25% reduction in greenhouse gas emissions by 2020 (from 1990 levels), an 80% reduction by 2050 and a reduction in the garbage the city produces from 110 million tons to 100 tons.⁶ The city has already been quite successful at reducing waste; while its population has remained constant, the amount of waste it incinerates dropped from 2.17 million tons a year in 1991 to 1.18 million tons in 2009.⁷

In March 2011, the City completed its “Osaka Environment Vision,” outlining its goals and the initiatives it plans to undertake to reach them.

With the slogan “Environment is the key to the future,” “Osaka, Environmentally Advanced City” proposes steps it will take to become an advanced environmentally-friendly urban and industrial milieu whose citizens live an environmentally conscious life.⁸ Initiatives (the key ones are described below) include using unused energy from urban infrastructure (e.g. waste incineration or sewage treatment plants), wider use of solar power, promotion of low carbon transportation including electric vehicles, the adoption of LED lights at museums and other public facilities, roads and parks, promotion of environmentally friendly buildings and eco homes, developing a special economic zone to promote the development of environmental and energy industries, establishing and testing a “smart” community, and various initiatives to emphasize environmental education and citizen awareness of environmental issues.

Since December 2011, Osaka City and Osaka prefecture have been amalgamating and reorganizing. Osaka City will be divided into eight or nine wards or individual municipalities, similar to Tokyo. The new Osaka Metropolitan Government will then deal with environmental issues while those policies related to residential living will be dealt with by individual ward governments. This means that much of what was done by Osaka City’s Environment Bureau will be taken over by the Osaka Metropolitan Government. Within this structure, Osaka is likely to pursue a wide-ranging strategy of applying scientific and technological innovations, combined with regulatory and other government strategies, designed to make the city and region a global leader in marrying technology and environmental protection and remediation. Mayor Hashimoto Toru’s outspoken opposition to the restarting of Japan’s nuclear power plants suggests

continued support for the promotion and development of renewable sources of energy and sustainable low energy public infrastructure. Hashimoto, while building his new party to challenge the ruling Democratic Party of Japan has, however, been notably less supportive of the city’s environmental agenda than his predecessors.



Three wheel electric car unveiled in Osaka, 2010

Electric Vehicles Infrastructure: Japanese automakers are at the forefront of the development of both hybrid and electric vehicles. The Japanese government has been supporting the development of a variety of electric vehicles (battery powered, fuel cell and hybrid) since the 1970s. Through research and development projects, long-term strategies, infrastructure support and market/purchasing support programs, the Ministry of Economy, Trade and Industry (METI) has taken a keen interest in the development of environmentally friendly vehicles.⁹

Nissan released the Leaf, the first affordable zero emission vehicle, in December 2010 and is aiming to be the world’s premier producer of electric vehicles. The Toyota Prius is the world’s top selling hybrid (3 million sold to March 2011) and Toyota launched its first

range of electric vehicles based on the iQ compact at the December 2011 Tokyo Motor Show. The Prius C (called the Aqua in Japan) went on sale in 2012 in Japan, the US and Europe. In 2011, Honda displayed its EV Fit and its EV-ster (an electric two seat roadster), both of which are scheduled to go into production in the near future. Mitsubishi's i-MiEV (Mitsubishi Innovative Electric Vehicle) hatchback was offered to commercial customers in Japan beginning July 2009 (Japan Post was an important first customer) and then to the wider public in Japan and gradually around the world from April 2010. (Non-Japanese manufacturers are also entering the electric vehicle market. GM launched the Chevrolet Volt; Tesla Motors has formed a business alliance with Toyota and Volkswagen to sell the E-Up in 2013; Daimler plans to mass produce an EV based on smart model in 2012. Ten Chinese automakers have invested 70 billion yuan in new energy cars with a focus on EVs.)¹⁰

The "Osaka EV Action Program" was launched in June 2009. An Osaka EV Action Council, consisting of industry experts, academics and government representatives was put in place to promote industries related to electric vehicles and their components, such as lightweight parts and high capacity motors.¹¹ Osaka's plan is divided into three stages. The first, 2010 - 2011, focussed on the development of EV infrastructure and the general promotion of electric vehicles. From 2012 to 2016, the government plans to promote Osaka's development as the centre of production of electric vehicles through policies that encourage their mass use. Specifically the target is for half of all taxis and newly registered private cars in Osaka to be electric vehicles by 2017, with Osaka emerging as the center of a significant global manufacturing cluster of electric vehicles and their parts.¹²

Fig. 1: Osaka Prefectural Government's planning of EV introduction

EV City Configuration	2010-2011 Stage 1	2012-2016 Stage 2	2017 and after Stage 3
	EV prevalence (creation of the initial market) Construction of power charging facilities Application for new energy industry zone	Full swing of EV car sharing Introduction of new energy industry zone Introduction of new social transportation system	Mass use of EVs in public transportation (e.g. 50% of taxis will be EVs by 2017). Prevalence and expansion of EVs in the private car sector Convergence of new energy associated industries Prevalence of new transportation system
	Empirical experiment, granting of subsidies (through the Ministry of Economy, Trade and Industry; Ministry of Land, Infrastructure, Transport and Tourism; Ministry of Internal Affairs and Communications; and Ministry of the Environment), EV introduction and promotion and PR execution Smart Energy R&D	Application of smart energy technology to transportation infrastructure facilities and residences	
	Verification of storage cells/solar cells (applied in public facilities, buildings and residences)	Introduction of storage cells/solar cells (applied in public facilities, buildings, residences and business facilities)	

Source: Data source: Roadmap (plan) Osaka edition (Nov. 2010)

The Osaka EV Action Program has three main components - infrastructure, the development of an EV cluster, and the training of EV professionals. But will consumers purchase electric cars in numbers needed to make them competitive? The development of infrastructure, particularly the availability of rapid recharging stations, is the key to encouraging people to buy electric vehicles. It is obvious that easy access to recharging stations is a key prerequisite. Osaka began by putting in place 20 rapid recharging stations in optimal locations while developing a more complete "Osaka recharging infrastructure network". The development of the network is essential to assure consumers that their vehicles will not run out of power.

The locations of the charging stations have to be carefully chosen with population density and traffic flows in mind. Charging stations are set up on the Meishin (Nagoya-Kobe) highway in cooperation with NEXCO West Japan. Experiments with exact positioning of charging stations (e.g. in parking lots, in front of convenience stores etc.) are also ongoing. Recharging is initially being subsidized so consumers pay less than 300 yen/hour. Quick charging stations have been developed enabling a full ten hour charge to be delivered in 30 minutes. Chargers made by different manufacturers will be networked through the communications infrastructure. From March

2011, reservations for charging could be made via mobile phone.¹³ By April 2012, the Osaka Prefectural Government had completed 239 regular power-charging stations, some of which provide free charging. The charge is about 200 - 210 yen per hour at other regular power charging stations. Thirty-six quick charging stations are also now in operation. Nevertheless, the number of electric vehicles was small as of August 31, 2012, with approximately 1,261 electric vehicles (and 365 plug-in hybrid vehicles) on Osaka’s roads.¹⁴ There are nearly 1,000 other electric vehicles in the Kansai area. See Table 1 below for comparisons with other major cities. Osaka is among the world leaders in electric vehicles, yet the numbers everywhere remain modest.

Table One:

Electric Vehicles and Electric Vehicle Supply Equipment

City EV Today EVSE Today

Barcelona	280 Public 200 Private	248 Slow Charging 1 Fast Charging
Berlin	350 +/-	220 +/-
Helsinki	120	some
Kanagawa	2,183	109 Quick Charging 341 100/200V Outlets
Los Angeles	2,000	106
New York	238	75 +/-
Osaka*	1,261	239 and 36 quick charging

Source: *EV City Casebook: A Local at the Global Electric Vehicle Movement, 2012* (Source <http://www.iea.org/evi/EVCityCasebook.pdf>). *Osaka information supplied by Mr. Maeno Yuichi, Osaka Prefectural Government, Interview on April 20, 2012. Updated information supplied in email correspondence on October 10, 2012.

Along with the development of the necessary electric vehicle-recharging infrastructure, the Osaka government undertook other initiatives to encourage consumers to buy these new cars. To help create that market and develop consumer awareness and comfort with electric vehicles, Osaka hosted EV promotion events. Taxi firms were encouraged, with subsidies of

up to a million yen (\$12,000 US) per vehicle, to introduce electric vehicles into their fleets. Fifty EV taxis went on the roads in February 2011; for the first three weeks passengers could ride free. The Osaka prefectural government estimates that more than one million people will be exposed to electric vehicles through these fifty taxis. Osaka has also converted its government fleet to electric vehicles. Electric cars are also being used as public pollution patrol cars and Community Safety Patrol cars.¹⁵ Electric motor bikes are being promoted to banks and delivery services. The Subsidies are being offered to purchasers of electric vehicles to offset their higher price. City of Osaka is also promoting electric carpooling projects. Programs have been launched to train people to repair electric vehicles. The prefecture is also subsidizing projects on how to convert an average car into an electric vehicle.¹⁶ Electric car-sharing projects are being promoted.

Osaka is among the most advanced cities in the world in terms of the adoption of electric vehicles. With some 40,000 Electric Vehicles/Plug-in Hybrid Electric Vehicles units sold worldwide in 2011, these vehicles represent a tiny fraction of global car and truck production. Of the cities surveyed for the 2012 EV City Casebook, only the Japanese city of Kanagawa (near Tokyo) had a charging network and adoption of EVs that compared to that installed in Osaka. In no other major centres have Electric Vehicles made major strides and no other Japanese cities are following Osaka-like approaches that focused on start-up investments.

These initiatives, in Osaka and elsewhere, are thus far of more symbolic than practical importance. There were over 3.2 million cars registered in Osaka in 2012, making the city’s commitment to electric vehicles pale in comparison. The significance of the Osaka initiative rests primarily in the early-adopter element, providing substantial purchases to

support local industry and promoting a “demonstration effect” so that other Japanese and international cities can see, for example, how an all-electric local government car fleet operates.¹⁷ Any significant environmental impact will come several years, if not decades, down the line, if, and only if, consumers and commercial users follow the prefectural lead. In the short-term, important promotional and urban profile benefits are attached to such environmental investments.

Of equal importance to the immediate returns and impact is the fact that Osaka’s prefectural government clearly believes that the electric vehicle industry will help the region address significant environmental challenges. The government is equally convinced that the EV developments supported at the local level will help create an internationally competitive domestic and export industry based in Osaka. The combination of objectives - the societal challenge of creating a cleaner energy region and the economic need to foster globally competitive export companies - has accelerated government investment and commitment in the electric vehicle sector.

Osaka New Energy Cluster Support: In April 2010, Osaka prefectural governor Hashimoto Toru (now Mayor of Osaka City) began promoting Osaka to new energy companies, particularly to automobile and solar panel manufacturers. His aim is to make Osaka a leading new energy cluster and he has a good base from which to build. Along with auto factories, Osaka and the surrounding area is home to many component part makers and a variety of research and development facilities. Osaka has five large solar companies (Sharp, Sanyo, Kyocera, Mitsubishi Electric and Kaneka); it holds 11% of world market share and 70% of Japan’s domestic market. The national and local governments together subsidize about 20% of the cost for residential and industrial installation. The national subsidy program subsidizes 30,000 yen per kw for

installation costs under 550,000 yen and 35,000 yen per kw for installation costs below 475,000 yen. These subsidies have been declining in an effort to encourage solar panel makers to bring down installation costs as quickly as possible. Osaka City began a subsidy program for solar power system installation in 2009. It provided subsidies of 100,000 yen for every kw in FY2009 and 70,000 per kw in FY2010 and FY2011. Over the three years of the program more than 10,000 kw worth of solar power systems was installed in Osaka.¹⁸ A push to install solar panels on government and school buildings is also underway.

The Osaka/Kansai region also boasts a significant concentration of companies and corporate research institutions, government research labs and universities that specialize in battery research and production. In the lithium ion battery sector, Kansai companies hold over 80% of domestic market share and 23% of global market share. And for solar batteries, Kansai companies hold almost 74% of market share domestically and 8% globally.¹⁹ Osaka University and Kansai University are working on a NEDO and METI funded project, “Next generation High Performance Battery System Research and Development (Li-EAD)”. Kyoto University’s Sunrise Project, also NEDO funded, focuses on next generation batteries which are lighter (one-tenth the weight of present batteries) for electric vehicles.

Beneath the large world famous companies are a sizeable number of small and mid-sized new energy related companies. From 2007 through 2010, 80 Osaka companies received a METI Energetic and Innovative SME 300 company ranking, which put Osaka prefecture in first place in Japan. Many of these are world-class companies manufacturing everything from high pressure valves for hydrogen fuel cells to high precision printing devices for solar panel electric parts to gaskets (sealing material) for lithium ion batteries (the only company in the world producing these).

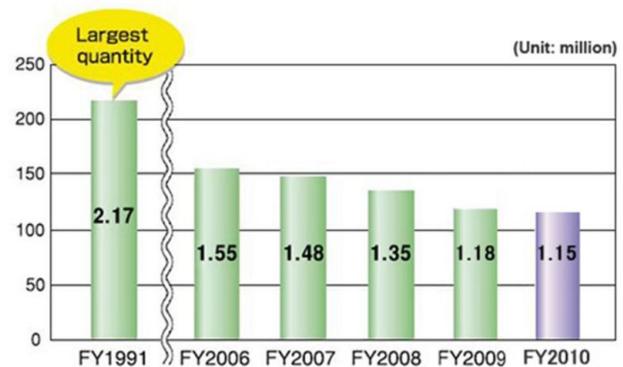
In the Yumeshima and Sakishima Islands District of Osaka, reclaimed lands on the city's coast, Osaka is building a cluster of environmental technology and new energy production facilities. Sumitomo Corporation and Sumitomo Mitsui Finance and Leasing Co., Ltd are organizing a consortium of companies to fund and create a megasolar power generation facility in Yumeshima. Preparations for the Yumeshima Mega Solar Project are underway. Once pricing for the feed-in-tariff system has been determined, a formal contract arrangement can be made. Yumeshima Megasolar should produce power for about 3000 homes. Osaka City provided the land for the project (previously a waste disposal site built on reclaimed land) and has been actively promoting it.²⁰

Eco-Town and Industrial Waste Recycling:

Osaka Eco Town was launched in July 2005, after two and a half years of planning, as Japan's 24th Eco Town. The Eco Town initiative, created by Japan's Ministry of International Trade and Industry (currently METI) and the former Ministry of Health and Welfare (later transferred to the Ministry of Environment), was designed to prolong the life of landfill sites (Japan was seriously short of sites and those it had were estimated to be full shortly) and to reinvigorate local economies through promoting the development and growth of environmental industries.²¹ The other key element of Japan's Eco Towns is the concept of zero emissions or taking waste from one industry or from households and using it as much as possible as raw materials for another industry.

The Osaka prefectural government's Eco-Town plan called for the construction of a variety of recycling and industrial waste treatment facilities in a then unused, former landfill site, a waterfront area of the city. At the time, Osaka had a large amount of industrial waste and difficulty in establishing appropriate waste treatment. Osaka began constructing

“appropriate treatment and recycling facilities for difficult-to-treat wastes, including hazardous substances, recycling facilities targeting wastes both large in volume and disposal percentage, such as those derived from construction and recycling facilities targeting wastes considered to be useful resources that can be more effectively used, such as containers, packaging and/or food waste.”²²



Waste reduction in Osaka

There are now seven recycling facilities within the Eco-Town spread among three areas (Osaka City Bay Area, the waterfront in Sakai City and in Neyagawa City).²³ These facilities include Rematec, which uses reclaimed fuel technology to convert industrial waste (which comes in by tanker from 2000 domestic companies) to recycled fuel without producing any gas emissions or waste water. The resulting product is sold to cement companies as fuel. Biomass Ethanol Japan Kansai Company produces bioethanol from construction wood wastes, Recycle and Equal Co. Ltd makes transportation pallets from waste plastic containers and packages and Taisei Industry recycles food waste from restaurants and supermarkets and makes it into feed and fertilizer. In conjunction with Osaka city government, the prefecture is working to bring more companies into the Eco Town.²⁴

Osaka City has been building and upgrading its waste disposal plants over the past few decades. The Maishima Incinerator Plant, built by Hitachi Zosen and run by the city, is famous due to its theme park style building with its variety of shapes and colours. The Maishima Incinerator handles regular and bulky waste disposal and iron and aluminum recycling for the city of Osaka. Incineration is done at very high heat so fewer harmful substances are produced. Through the use of gas exhaust treatment equipment, the incinerator only produces clean smoke. Maishima recycles or incinerates 900 tons of garbage a day in its two plants. All energy for the building is produced in-house. Staff at the Maishima plant run public and school tours for domestic and international visitors to teach about recycling.

Osaka prefecture began supporting the expansion of Osaka's environment-related industries into Asia in 2007 - 2009. At the end of the two years it produced a report called the Environment Business Asian Development Project (<http://www.pref.osaka.jp/keizaikoryu/kaigai/kankyo.html>) that highlighted opportunities for Osaka companies, particularly in wastewater treatment.

In 1992, Osaka City established the Global Environment Centre Foundation in conjunction with the United Nations Environment Program's (UNEP) International Environmental Technology Centre (IETC). Osaka hosted the International Garden and Greenery Expo in 1990 with the theme of "harmonious coexistence between nature and mankind." Osaka plans to leverage its knowledge and experience in pollution prevention and energy conservation to help developing nations deal with their environmental problems, and in turn support UNEP's activities promoting environmental conservation in developing countries, which face many of the same environmental problems Osaka faced in the 1960s.²⁵

The Global Environment Centre Foundation focuses on conservation and urban environmental management in developing countries. The Centre is funded by Osaka City and Osaka Prefecture with some corporate support. It hosts workshops, seminars and training programs for participants from developing countries sometimes in cooperation with the Japan International Cooperation Agency (JICA). Some of the workshops have applied the Japanese eco-town concept to various cities in the Asia Pacific. As part of a JICA Grass Roots Technical Cooperation Project, the Centre is working in Vietnam's Ha Long Bay on a project to develop a community-based recycling system. Garbage both from residents and from sightseeing boats has caused a significant deterioration in the Ha Long Bay area, sufficiently serious that UNESCO has considered delisting it from the World Heritage list.

The Global Environment Centre Foundation also hosts a database of Japanese companies and their environmental technologies. Interestingly, its biggest user is the US. Main areas of overseas interest are industrial waste and air pollution technologies. The Centre also provides opportunities for Osaka citizens to learn about environmental issues.

The Kansai-Asia Environmental and Energy-Saving Business Promotion Forum (and its portal Team E-Kansai) works to facilitate the development of environmental business connections between businesses in the Kansai and in other parts of Asia. The Forum is a network of government, industry groups and individual companies. Its activities include sending and receiving environmental business missions, supporting an overseas training program in Japan, sending Japanese specialists abroad and introducing Kansai's environmental and energy conservation technologies to Asia.²⁶

Kitakyushu: Environmental Reclamation

Osaka is not the only region that has

endeavoured to connect its economic future with environmental reclamation and environmental technologies. Kitakyushu, a city with a population just under 1 million people located at the northern end of the island of Kyushu, has made a fundamental commitment to this sector of the new economy.²⁷ From the beginning of the 20th century, when the first national steel works (now the Nippon Steel Company) factory was constructed on Dokai Bay, over one thousand industrial plants were built along the coastline. The Kitakyushu area was a key part of the modernization of Japan. Industrialization was aided by easy access to energy due to the nearby Chikuho coalfields and iron ore from China. By the 1960s, Kitakyushu was one of Japan's four largest industrial zones²⁸ and the city's companies accounted for five percent of Japan's production.²⁹ Machinery, shipbuilding, ceramics, cement, chemical and electronic factories all became important parts of Kitakyushu's industrial structure. However, steel was its backbone, dominating the local economy: "In its heyday in the 1970s, Yawata works alone employed 46,000 people."³⁰

The downside of this industrial activity was rampant air and water pollution problems. Smokestacks belched fumes that came to be known as "the seven colored smoke" due to the black smoke from burning coal, the red from iron oxide and other colors from various fumes. Dokai Bay was so heavily polluted by industrial and domestic waste water that it was nicknamed the "Sea of Death" In fact when, in response to citizen demands, the city conducted the first water quality survey of the bay in 1966, "results of the examination revealed that Dokai Bay could no longer be called 'a sea' because the watercolor was reddish black or yellowish black."³¹



Industrial pollution in Dokai Bay, 1960s

Women's groups actively agitated against pollution. As the husbands of most of these women worked for the steel company, the woman did not protest against the company directly but instead appealed to city council. In the mid- 1960s, the Tobata Women's Association produced a documentary called *Aozora ga Hoshii - We Want our Blue Sky Back* which showed the damage pollution was causing. The movie was shown throughout Japan and had a considerable impact. Kitakyushu began to take steps to deal with its pollution problems. The city signed a pollution prevention agreement in 1967. Pollution monitoring began in 1970 and Environmental Quality Standards for Dokai Bay and other waterways were established in 1971. In 1971, the city also founded the Environmental Pollution Control Bureau (now the Environmental Bureau). Kitakyushu also began enacting a variety of environmental regulations, tougher than those passed by the national government, and effectively pressing major companies to curb their pollution.³² Between 1972 and 1991, Kitakyushu spent a total of 804 billion yen to prevent or clean up environmental pollution.³³ The decline of iron and steel manufacturing and other heavy industry prompted local officials to start promoting and supporting a shift from heavy industry to environmental industries. Recognition of the importance of appropriate waste management was increasing nationwide

and Kitakyushu began to carve out a niche for itself in this area.

Recycling Eco-Town: Kitakyushu was selected as one of Japan's first four Eco-Towns in July 1997. Its focus is the facilitation of resource circulation and eco-industries. Resource circulation is connected to the zero emissions concept of taking household and industrial waste and utilizing it as raw materials for other industries. Kitakyushu's Eco Town was designed to create this resource-recycling society and to stimulate the local economy through the growth of these environmental industries.³⁴ The Kitakyushu Eco-Town project is located in the eastern part of the Hibiki landfill area, which borders the sea. It is made up of the Comprehensive Environmental Industrial Complex (an area for the handling and distribution of recyclables), the Hibiki Recycling Area (business sites for lease to small and medium sized environmental enterprises) and the Practical Research Area (a centre for research and development on environmental technologies).³⁵



Kitakyushu's eco-town under construction

The Comprehensive Environmental Industrial Complex has become a recycling hub for western Japan and accepts waste (household electric appliances, office machinery, cars, medical waste, fluorescent lights, PET bottles

and mixed construction waste) from a wide geographic area. In 2012, Kitakyushu is Japan's largest Eco-Town with 28 business facilities, 16 research facilities, 1400 employees and an investment of 66 billion yen.³⁶ One of the strengths of the Kitakyushu Eco-Town Project is the financial support and cooperation of large Japanese companies:

For example, the major funders of the Nishi-Nippon PET-Bottle Recycle Co. include Nippon Steel Corporation and Mitsui & Co., and the major funders of a company known as Recycle Tech include Shinryo and Ricoh Corporation. Indeed, it is not only funds that the parent companies are providing. In many cases the recycling factories are using production plants, technologies and know-how obtained from the parent. For example, the PET bottle plant is using know-how from Nippon Steel Corporation in its plant operating technology.³⁷

Strong connections between the large companies and the Kitakyushu Eco-Town recycling businesses have been important to the Eco Town's success. The PET and car recycling, for example, builds on the knowledge of Nippon Steel Corporation while the medical supplies recycling uses information and technology from the cement manufacturing industry. Along with financial help, the larger companies sometimes loan staff or offer technical assistance.

The Hibiki Recycling Area is a cluster of small and medium sized companies that work in the area of waste treatment and recycling and support the development of creative ideas. This area is reserved for small and medium sized enterprises and is focussed on treating waste from the nearby community. One section of this

area is home to automobile dismantling companies that have set up End of Life Vehicle recycling. The Practical Research Area houses a number of research institutes, company testing and demonstration facilities. It is hoped that this applied research will lead to the development of new businesses.

In 2004, Phase 2 of the Eco Town Project was launched. This phase included strategies to expand recycling and various environmental projects and had the goal of expanding the Eco Town project to include the whole city. Some examples of the initiatives undertaken include the establishment of the Kitakyushu Eco-Premium Award to reward eco-friendly industrial activities in Kitakyushu and the Eco Action 21 Certification and Registration Support Project for small and medium sized businesses and the Japan-China Eco Town Cooperation Project.³⁸ The Japan-China Eco Town Cooperation Project is designed to create resource-recycling cities in China using Kitakyushu's Eco-Town Project as a reference. Projects have begun in Qingdao, Tianjin and Dalian. The Kitakyushu Science and Research Park opened in April 2011 promoting local industries and academic institutions. Four universities (Waseda University, Fukuoka University, the Kyushu Institute of Technology and the University of Kitakyushu) have research facilities and graduate programs based there.

Source

(<http://www.hkip.org.hk/plcc/download/Japan.pdf>).

Kyushu Recycle and Environmental Industry Plaza (K-RIP) was created by the Kyushu office of the Ministry of Economy, Trade and Industry in 1999 to support companies in the recycling and environmental technology sectors.³⁹ K-RIP's financing comes from METI but also from member companies. At the end of 2010, K-RIP had 492 members, including 285 companies, 82 individual academics, 75 individual members, 9

NPO corporate members and 41 local government representatives.

K-RIP has six regular staff members, all seconded from companies for two year terms—one each from Aso Corporation, Asahi Kasei Corporation, Kankyo Technos Co. Ltd, Kyushu Electric Power Co. Inc., Saibu Gas Company Ltd and Nippon Steel Corp. There are also two METI advisors/coordinators. The staff has helped Kyushu mid-sized companies build contacts with China and Korea, by offering advice and introducing them to potential partners. As one of the K-RIP managers said, "The future for environmental products is in China and it is right on Kyushu's door step."⁴⁰

Japan's trade and investment relations with China remain in flux, for political and diplomatic reasons as much as because of commercial constraints. Japan, and Osaka specifically, secured valuable business in China, building off an impressive surge in the early 21st century, one that has been largely tied to the transference of Japanese manufacturing capacity to China and sales of high technology equipment.⁴¹ The Kitakyushu - China trade promotional efforts hold great promise for this Japanese city.

In 2008, Kitakyushu was also selected from among 82 applications to be one of the first six (now 13) Japanese Eco-Model Cities (EMC) based on its pioneering approaches to achieve a low-carbon society.⁴² Kitakyushu is calling itself the Carbon Free City in Asia and proclaiming its desire to be the World Capital of Sustainable Development. To this end, the city is focussing on next generation urban development with an emphasis on energy conservation, resource recycling and sharing its knowledge with the Asian development region.⁴³ The Kitakyushu Eco-Model City Action Plan (also called the Kitakyushu Green Frontier Plan) calls for a 30% CO2 reduction target by 2030 and 50% by 2050. Kitakyushu is hoping that its technology transfer and assistance to

Asian countries will result in another 23.4 million tons (or 150%) reduction in greenhouse gas emissions.

For Kitakyushu as for Japan and the world, the publication of impressive targets may ultimately mean little. Many countries failed to meet the Kyoto targets; China and India remain dismissive of the overall effort. The failure of the 2009 Copenhagen meetings to come up with binding agreements on emission targets underscored the elasticity of international emissions plans and commitments. But Kitakyushu completed a comprehensive and largely successful environmental clean-up, and recognizes both the costs and benefits of extensive reclamation projects. Japanese officials have argued that they were, before the Fukushima disaster, on a path to meeting their emission targets. The switch from nuclear to other energy sources represented a major set back in emissions, but also created a deep national commitment to environmental responsibility. Underlying the Eco-Model plan is the belief that practical applications of emerging environmental technologies can make a dramatic difference in global climate change. Time, as always, will tell.

Wise Energy Use: The Kitakyushu Green Frontier Plan promotes the belief that environmental efforts will create an advanced society, develop the economy, educate people and help them lead fulfilling lives. Specific actions include trying to make Kitakyushu as compact a city as possible with a low carbon transportation system, energy saving buildings, solar paneled roofs over shopping areas and other public spaces. Kitakyushu is also building on its lead in introducing green IT and using the factory by-product heat for public use. (This will be discussed below.) The Plan also promotes the a low carbon society. Kitakyushu is home to the Environment Museum, the Kitakyushu Eco-House exhibit, the Jono District Low-Carbon Advanced Model Area, the Kitakyushu Next Generation Park and the

Kitakyushu Smart Community Development Project.⁴⁴

In 2012, Kitakyushu is expanding the area beside Eco-Town where the Kitakyushu Next Generation Energy Park is being built to educate people about the variety of energy sources. There will be a coking plant, an oil storage facility and a natural gas production facility as well as wind turbines, solar panels, hydroelectric power and a biomass manufacturing facility.⁴⁵ Waste sites in the area are being cleaned up and a large plot of land is being set aside as a green belt where, it is hoped, birds, plants, insects and other wildlife will return. Students, seniors, citizen groups and companies are carrying out a range of forest restoration activities.

In January 2011, METI and Nippon Steel launched the Hydrogen Town Project to experiment with the use of hydrogen as an energy source. Hydrogen is a by product of the production of steel (how to make hydrogen is one of the challenges of considering it as an energy source). The Hydrogen Town Project fuels a number of homes and monitors the electricity use.⁴⁶

In December 2011, Kitakyushu was selected as one of Japan's "Future Cities". These selected cities (six in areas affected by the Great East Japan Earthquake and five elsewhere) are to "create 'human-centered cities while creating new values to resolve the challenges of the environment and aging.'"⁴⁷ Kitakyushu Future City's vision includes energy conservation (decreasing greenhouse gas emissions from 15.6 million tons in 2005 to 11.8 million in 2025), increasing recycling rates to 40% and overcoming pollution to promote global environmental cooperation.

In 2012, the OECD named Kitakyushu as a "Green Growth" model city, the fourth in the world after Paris, Chicago and Stockholm, in recognition of its economic and environmental

achievements.⁴⁸ OECD will send an investigative team to analyze Kitakyushu's environmental protection procedures, and report their results to its 34 member countries.

In FY2009, the Kitakyushu Eco-Industrial Complex Promotion Council created a research group to study the "public utilization of factory by product heat. Studies were carried out and model areas were chosen. Nippon Steels excess or unused power is supplying energy to a Kitakyushu neighbourhood. The company is using this opportunity to experiment with dynamic pricing. Nippon Steel is experimenting with pricing levels and time of day to track impact on demand.⁴⁹

Environmental Outreach:

Kitakyushu started cooperating internationally beginning with the Kitakyushu International Techno-Cooperative Association (KITA) established in 1980 to transfer environmental technologies and policies to the developing world. KITA offers training courses in areas like industrial environmental protection, energy management, renovating facilities for cleaner production. Since its inception, over 6,200 trainees from 138 countries have been accepted and over 160 experts have been sent to countries around the world.⁵⁰ Kitakyushu Asian Center for Low Carbon Society, nicknamed Asian Green Camp, was created in June 2010 to promote low carbon societies and create environmental business in Asia. The goal is to take technologies from Kitakyushu in particular and Japan in general to help Asian countries create low-carbon societies through the development of environmental businesses. The Kitakyushu Asian Center for Low Carbon Society is operated jointly by the city of Kitakyushu, KITA and the Kitakyushu Urban Center of the Institute for Global Environmental Strategies and has also signed a cooperation agreement with the United Nations Industrial Development Organization (UNIDO). It acts "as a core facility dedicated to

vitalization of local economies through a commitment to carbon reduction projects in Asian societies."⁵¹ Significant technology transfer projects include water treatment projects with Dai Phong, Vietnam and Phnom Penh, Cambodia; recycling eco-town collaborations with Qingdao, Tianjin and Dalian China; and various power generation and environmental impact control projects.⁵²

The Kitakyushu Asian Center for Low Carbon Society also works closely with the Institute for Global Environmental Strategies (IGES), the Japanese Ministry of Environment's international outreach branch. One large and successful project launched by Kitakyushu and IGES has been the development of a sustainable waste management system in Surabaya, Indonesia, enabling Surabaya to reduce its waste by over 20% within the first four years of the project through increased public awareness of the need to reduce waste and separate it at the source, the start-up of a number of small recycling businesses, and two waste water treatment pilot projects.⁵³ The program was so successful that Kitakyushu has organized workshops and networking seminars to help cities implementing or planning to implement similar waste management programs.⁵⁴

The motivation of these outreach projects is twofold: to help with carbon reduction in neighbouring Asian countries (these efforts also count toward Japan's greenhouse gas reduction goals) and to open up opportunities for Kitakyushu's environmental technology companies to expand into new markets.

Kitakyushu has been actively spreading environmental knowledge and technologies throughout Asia. The Kitakyushu International Techno-cooperative Association (KITA) offers international training courses, cooperation projects and seminars on environmental issues and an international friendship program for trainees visiting Kitakyushu.⁵⁵ Between 1980

and 2008, it accepted 5,366 trainees from 133 countries and it sent 144 specialists to 25 countries.⁵⁶

Kitakyushu and Dalian have been sister cities since 1979, the year following the signing of a Peace and Friendship Treaty between China and Japan. While there were some environmental initiatives began in the 1980s, real environmental collaboration occurred in the early 1990s when various seminars and exchanges of experts and government officials began. The Kitakyushu municipal government designated Dalian as an environmental demonstration zone and the Chinese government embraced the idea. Japanese overseas development assistance funding was applied for and received. The resulting Dalian Environmental Demonstration Zone project was implemented between December 1996 and March 2000.⁵⁷ The two city projects included environmental research, technology transfer of clean production technologies, training programs and visits of engineers, plant managers and officials focussing on everything from air, water and noise pollution to solid waste and environmental monitoring. Dalian city officials “gained from the project specific, concrete, and very detailed know-how, technologies and policy options to tackle local environmental problems from a city in a neighbouring country with a similar experience.”⁵⁸ Dalian’s environmental quality also improved, additional training programs between the two cities resulted and it sparked additional regional environmental cooperation.⁵⁹

International or cross border trade of recyclable (end of life products and parts) and recycled products, particularly in the Asian region, grew dramatically in the 21st century until the economic slowdown of 2008.⁶⁰ The roots of this trade grew out of the changes Japan made to its waste management systems to encourage and legislate a recycling and resource-circulating society⁶¹ combined with

rapid growth in Asia, especially China, that created soaring demand for resources, including recycled materials. Gradually more and more of Japan’s recyclable resources were sold to developing countries in Asia. Two serious problems came from this development. The first was the negative impact this outflow of recycled materials had on Japan’s domestic recycling system. Japanese recycling companies were left without an adequate supply of resources and many companies went bankrupt. On the Asian side, improper treatment of materials during the recycling process caused land, air and water pollution and endangered the health of workers and nearby residents alike. METI’s Working Group on Enhancing International Recycling, Waste Prevention and Recycling Subcommittee of Industrial Structure Council concluded that a workable cross-border recycling system had to be developed in the Asian region with local governments playing a key role. METI launched a three-year pilot project (fiscal 2005 through 2007) to model a cross-border recycling system.

Kitakyushu, which was chosen to lead the project, created a task force of people from all aspects of the recycling system and selected Tianjin, China as its partner city. The pilot program took place in 2006 using mixed plastics as the main item. Radio frequency identification tags were used to trace the trade and participants agreed to follow a strict code of practise. The project was deemed a success and the Kitakyushu task force next took steps to create an ongoing regime with a traceability system certified by a third party. This third party was established in 2009 in Kitakyushu and called the Resource Circulation Network. Japan’s Ministry of Land, Infrastructure, Transport and Tourism plans to replicate this model in promoting resource circulation domestically. Kitakyushu hopes to extend this model to other Asian countries.

The manner in which the environmental

strategies in these cities unfolded, in part in concert with national strategies, illustrates the challenges of moving from scientific and technological discoveries to market-relevant solutions, the opportunities created by combining societal and commercial objectives and the importance of local strategies and regional implementation in demonstrating the economic and social viability of Japan's environmental objectives.

According to Nakamura Hidenori of the Institute for Global Environmental Strategies, Kyushu (largely meaning Kitakyushu) and Greater Osaka are two of the "three regions in Japan that have potential to further extend local governments' support to low-carbon business promotion in Asia based on their efforts to develop regional industrial clusters."⁶² (Tokyo is the other region.) Nakamura promoted increased cooperation around low-carbon development through the establishment of an Asian intercity platform. Kitakyushu and Osaka would be two of the cities most likely to benefit from this kind of platform, which would facilitate technical cooperation around environmental regulations and opportunities to enhance business connections. Nakamura even suggests that the Kitakyushu Center for Low Carbon Society might be a good candidate to host the secretariat for an Asian intercity platform of this kind.

The efforts by Kitakyushu and Osaka represent a potentially potent combination of commercial self-interest and environmental commitment. Officials in both cities clearly believe that they have pioneered effective models for urban environmental sustainability, connected to regional efforts to commercialize environmental technologies. Both communities have significant histories of international outreach, an approach strongly supported by government, both through administrative support and substantial international aid spending on environmental projects.

Connecting economic development to more socially motivated concerns about environmental sustainability has had the effect of strengthening the cities' efforts. Extending the reach beyond Japan and positioning both Kitakyushu and Osaka as leaders in environmental sustainability helps regional companies to build themselves into globally important enterprises.

Conclusion: Since the signing of the Kyoto Protocol, scholars and commentators have written extensively about the efforts - and failures - of national governments to develop wide-ranging environmental policies designed to address a serious global issue. While these national and international efforts have, in large measure been disappointing, as Osaka and Kitakyushu demonstrate, some local and regional governments have been alert to the possibilities and responsibilities of modern environmental management. Their efforts suggest important ways of coping with the challenges and consequences of environmental problems, including water, land and air pollution associated industry and domestic energy and waste.

Environmental technologies are not the only area of local engagement with environmental issues. In a thorough study on the role of local authorities and vehicle emissions, Fujikura Ryo observed that in some cases,

The political leaders of local governments that administrate over large cities are motivated to solve environmental problems on their own as quickly as possible, rather than depending on the national government. They know that the image of having a proactive stance on environmental problems will lead to stronger voter support.⁶³

Clearly, as environmental concerns have mounted - the 2012 protests over the restarting of Japan's nuclear power plants being an excellent example⁶⁴ - local and regional politicians have discovered that ecological considerations weigh heavily on voters.⁶⁵

Equally, however, local and regional governments have become increasingly aware of the economic and job creation benefits of the "Green Economy." Governments in other countries - California in the United States, Ontario in Canada, to cite two high profile examples - concluded (if over optimistically) that environmental technologies represented a vital economic opportunity, promising new companies, expanded employment and ecologically sound sustained prosperity. Local administrators also realized that investments in local environmental industries, from Osaka's EV infrastructure to Kitakyushu's life-cycle recycling initiatives, could create enterprises of national and international outreach. While it will take several decades to determine conclusively the commercial viability of these investments, early developments suggest that both cities have selected wisely in terms of improving local environmental conditions and creating prosperity-sustaining jobs and business.

From the early days of the global environmental movement, some astute analysts argued that ultimately, only a major reduction in overall consumption - basically using fewer resources and consuming them more efficiently - could offset the widespread damage associated with rapid development and associated climate change. There has, however, been little evidence that the major industrial or industrializing nations are prepared to make the major lifestyle changes required to achieve truly meaningful environmental stewardship. Instead, and fuelled by a widespread belief in the ability of science and technology to address the most fundamental challenges in the world,

governments, business and the general population seem to have concluded that environmental technologies will both provide ecological solutions and sustain the quality of life associated with the post-World War II industrial age. The "Green Economy," then, has emerged as an ecological hope and a key 21st century economic development strategy.

Osaka and Kitakyushu demonstrate that sub-national governments, often acting with considerable national support, can play leadership roles in promoting environmental industries and implementing dramatic local responses to ecological conditions. These two Japanese cities, along with other urban areas around the world, have realized that local action in response to specific regional conditions and opportunities, can make a major difference both in terms of environmental realities and medium and long-term economic development. Osaka and Kitakyushu have invested heavily - some might describe it as gambling - on the future of environmental technologies, believing that their regions can become national and international leaders in the ecological economy. The initiatives, sufficiently advanced in terms of practical application to demonstrate the value and impact of environmental technologies, have elevated the political importance of environmental questions by linking quality of life, environmental stewardship and wealth production. This combination, reaching well beyond the ecological awareness that has long been the cornerstone of the modern environmental movement, may well provide a path to create effective, efficient and sustainable solutions to ecological problems.

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theasipacjo0b-20), co-author of *Japan and the Internet Revolution* (<http://www.amazon.com/dp/0333921534/?tag=theasipacjo0b-20>) (*Palgrave-Macmillan, 2003*), *Innovation Nation: Japanese Science and Technology in the 21st Century, Digital Media in East Asia: National Innovation and the Transformation of a Region* (<http://www.amazon.com/dp/1604978058/?tag=theasipacjo0b-20>), and co-editor of *Japan in the Age of Globalization* (<http://www.amazon.com/dp/0415665841/?tag=theasipacjo0b-20>).

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