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Hioki's Smart Community and Japan's Structural Reform

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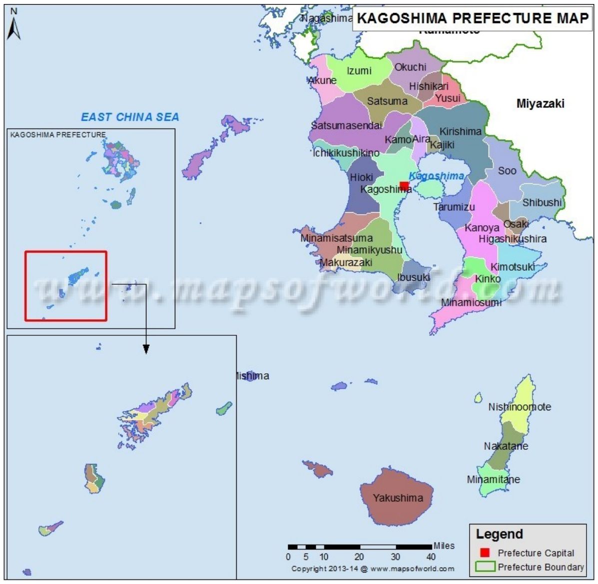
Energy is the master resource, the sine qua non for all resource extraction, material production, mobility, and every other sphere of economic activity. Mounting empirical evidence and expert interdisciplinary analyses show that the present energy economy poses unparalleled positive and negative externalities.[1] In response to these crises and opportunities, the global system is undergoing multiple energy revolutions. The general trend is towards convergence on disaster-resilient, low-carbon infrastructure, including distributed heat and power systems and other new networks.[2] And post 3-11 Japan is emerging as a leader in this movement.

As with most countries, Japan has numerous energy policies and visions. And again the same as elsewhere, many of Japan's energy scenarios are inherently contradictory, empirically fanciful, and risk fostering yet more stranded assets. But a close survey shows that Japan's energy regime is increasingly shaped by a pragmatic technocratic paradigm. This approach seeks to maximize the diffusion of renewable energy and efficiency so as to enhance disaster resilience, economic revitalization, national security, socioeconomic equity, and other macro-level objectives. Compared to competing transformative visions, centred on market signals or the mobilization of civil society, this technocratic narrative best apprehends the enormity of the global and domestic energy and climate externalities and is most capable of acting on them. It is thus gaining the most traction in effective policymaking. It explicitly recognizes the necessity for a "whole of government" approach, so as institutionalize rapid and responsive action in the face of multiple and fluid externalities and unprecedented uncertainties.

To illustrate how Japan's technocratic paradigm is unfolding, this short paper will examine one recent case, that of Hioki City's proposed smart community. Reviewing Hioki's project inevitably requires some attention to its context. And even our cursory inspection of that context sheds light on important, and generally overlooked, structural reforms underway in Japan. In short, Hioki's project shows how Japan's disaster prevention, spatial planning, and related policy regimes are being focused on incentivizing the diffusion of diverse forms of renewable energy, waste-heat recovery, efficiency, storage, and the smart network infrastructure that facilitates it.

Hioki City, A Typical Case of Decline

Hioki City (population: 49,056)[3] is the 7th largest city in Kagoshima Prefecture (population: 1.64 million), the southernmost prefecture on Japan's southern island of Kyushu. As seen in the attached map of Kagoshima Prefecture, Hioki City borders the west side of the prefectural capital, Kagoshima City (population: 598,936), with Satsuma Sendai City (population: 95,513) to its north, and lies midway along the west coast of Satsuma Peninsula. Hioki City is especially instructive precisely because it is not a special case. Save for the fact that it is close to Japan's two operating nuclear reactors at the Sendai plant in Satsuma Sendai, Hioki is generally representative of Japan's mid-sized peripheral regions.



Source

Kagoshima Prefecture

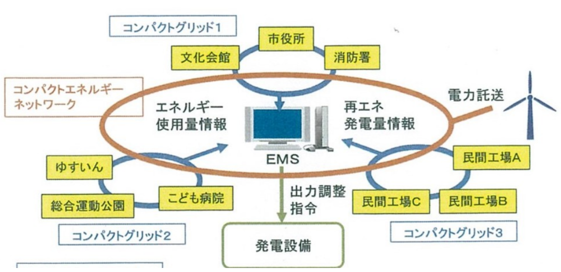
Like most of Japan's regional urban centres, Hioki's economic base and population have declined over the past several years and – barring smart policy intervention - the bad news is expected to continue.[4] Hioki's circumstances are aggravated by the 2011 reduction in operations at the local Panasonic semiconductor factory and other setbacks. The demographics are also daunting. In 2005, Hioki's population was 52,411, a number that had declined to 49,056 by 2016. The drop is projected to continue, leading to 47,261 residents in 2020, 37,866 in 2040, and about 29,000 in 2060. This population decline would represent a plunge of 43% between 2010 and 2060. In tandem with population decline, the percentage of elderly is increasing. Hioki's over-65 population was 27.9% in 2005, and this had risen to 31.1% in 2015, versus a national average of 26.7%.[5] The share of elderly in Hioki's demographic profile is expected to increase to 33.7% in 2020, and perhaps 39.7% in 2060. Moreover, the single-household rate among the elderly population is also relatively high, at 28.7%.[6] Left unchecked by smart policy, this shrinking and ageing population means further constriction of local business and the local tax base. Moreover, increased numbers of single-person, elderly households leads to greater energy consumption and reduced resilience in the face of natural disasters, with elderly women being the most vulnerable.[7]

Like many other Japanese communities, one of Hioki city's strategies to confront this decline centres on local energy projects. The March 11, 2011 (3-11) natural and nuclear disasters were a spur, later amplified by the nationwide debate on revitalizing depleting regions as well as the evidence that distributed energy offers multiple payoffs for local resilience. Surveys of Hioki's local renewable energy resource endowment indicated that the city and its immediate area possess significant potential in solar, wind, small hydro, and other resources. In December of 2013, Hioki City itself, along with area businesses, collaborated by investing in the "Hioki Wind Power Corporation." This wind power project is worth JPY 2.4 billion and, as of September 2015, operates an installed capacity of 6.9 MW of wind generation, via three 2.3 MW turbines.[8] In addition, in 2014 the Ministry of Agriculture, Forestry, Fisheries provided a grant to support the promotion of renewable energy businesses. This funding has been used for promoting small-hydro projects. Via the Hioki Hydro Power Promotion Association, the city mayor leads local business firms and financial institutions in surveying and exploiting local small hydro assets.[9]

Hioki's Smart Community Plan

These public-private collaborations gave rise to increasingly ambitious aims, particularly in light of the opportunities offered by the ongoing deregulation of Japan's power markets in tandem with expanding central-government support for heat and power grids as well as other ancillary infrastructure. Hence, in 2015, Hioki City and its business partners formalized their collaboration in an association. Their aim was to investigate how to promote the development of a smart community. To this end, they deliberated on the available options while assessing the energy demand profiles of public and private facilities to be included in the project.

One action the city and its partners took was to launch the "Hioki Local Energy Corporation" in November of 2015, as a vehicle for undertaking power-supply operations. Japan's staggered deregulation of its retail power markets took a major step on April 1 of 2016, via deregulation of the retail power sector. Taking advantage of the opportunity, Hioki Local Energy Corporation announced that it will commence operations as a new power company from August of 2016. It plans to offer electricity at a 3% discounted rate, compared to the power prices of Kyushu Electric, the regional utility. Hioki Local Energy Corporation also commits itself to devote 1% of the proceeds of power sales to local revitalization. It plans to deposit the monies into a "Hioki Future Fund," and then donate to local agricultural and other projects.[10]



Hioki City's "Compact Energy Network"

Moreover, the city and local business collaboration also developed an energy-centred smart city plan, evidently working in tandem with Hitachi Power Solutions Corporation. This project was first explicitly declared an aim by Hioki City Mayor Miyaji Takamitsu in the wake of winning the May 19, 2013 municipal election.[11] As illustrated in the attached figure (which is only available in Japanese), "Compact Energy Network," the city and its collaborators' current design envisions an energy system that links various city and business facilities as well as heat and power sources via three "compact grids" (in blue) and a common power grid, or "compact energy network" (in orange). Among the local buildings included in the project are the city offices, the fire department, sports facilities, health-care facilities, local factories, and other sources of heat and power demand. The network infrastructure includes a common grid network to link three compact grids, each deployed where there are clusters of public buildings and factories. Cogeneration, solar and other energy inputs will be used, and the system's inputs and efficiencies will be managed via the cloud (the energy management system, of "EMS," at its core). Efficiencies gained via energy management and other means are expected to reduce power prices by at least 10%, while securing energy supplies in the event of disaster, and at the same time significantly reducing emissions of greenhouse gases.

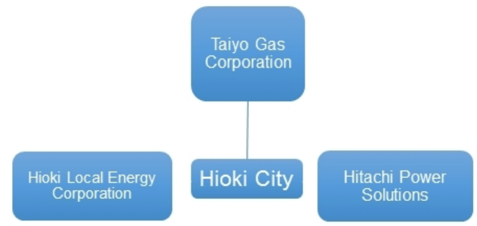
Compact grid number one, which is at the top of the "Compact Energy Network" figure, would link five of the city's facilities (the city hall, fire department, main community centre, cultural centre, and gymnasium). About 120 kW of solar power generation and 400 kWh of power storage capacity would be worked into this compact grid. One primary goal is to use the solar and storage capacity to reduce the peak-power demand of the cultural centre during events. Moreover, during natural or other disasters, this power could be used to supply the city hall and the main community centre, with the latter acting as an evacuation shelter.

Compact grid number two, on the figure's lefthand side, would link the city's hot springs facilities (*Yusuin*) with a children's hospital, a health centre, and a comprehensive sports park centre. The hot springs would become the site for 140 kW (4 units of 35 kW) of cogeneration capacity. This cogeneration capacity would be linked to the cluster's other facilities by power and heat network infrastructure. The grid would provide heat and power under normal circumstances, and act as a power source in emergencies.

Compact grid number three, on the figure's right-hand side, would see 1000 kW of cogeneration capacity installed in the city's "Kaida Factory Cluster" and heat and power links established among three site factories.

The Energy System Grant and its Objectives

On June 20 of 2016, this project was awarded a grant to study its feasibility. The grant will support the costs to survey a range of relevant factors during 2016. The following year, 2017, is slated for completion of a master plan, after which the power and heat generation and power storage capacity are to be installed (2018-19). The energy system is scheduled to begin operating in 2020 and continue for 20 years. The grant application is titled "A Survey on the Feasibility of Constructing a Compact Energy Network in Hioki City." As outlined in the attached figure "Hioki City Compact Energy Network Collaboration," the grant was formally awarded to Taiyo Gas as the lead applicant, with the energy business being "Hioki Local Energy Corporation" (in which Taiyo Gas is one of 16 partners, including Hioki City, Kagoshima Bank, and several area SMEs). A further collaborative applicant is Hitachi Power Solutions Corporation. The grant itself was awarded by the Ministry of Economy Trade and Industry's (METI) New Energy and Industrial Development Organization (NEDO) "Subsidy for the Promotion of Local Production-Local Consumption Style Renewable Energy Areal Use Projects." The Hioki project was one of 28 separate projects that the NEDO selected for funding in the first round for 2016.[12]



Hioki City Compact Energy Network Collaboration

This particular subsidy programme is a new one for METI, and began in Fiscal Year 2016 with a total value of JPY 4.5 billion. METI's outline of the programme's purposes describes it as aimed at fostering the diffusion of distributed energy. As to why, METI portrays the 3-11 nuclear and natural catastrophes as having led to an increased understanding of the risks of reliance on centralized generation systems. It states that in consequence there is a need to promote the diffusion of decentralized energy, particularly systems centred on renewable energy. METI adds that the use of energy management and other technologies, in tandem with the spatial deployment of energy systems, can help maximize the effective use of local energy resources. Moreover, the local-production/local-consumption model affords significant cuts in energy use and costs in normal circumstances. The system's disaster-role is that provides the community with a source of energy in emergencies.

The METI cautions that these systems are often challenged by relatively high costs. Hence the subsidy programme aims at facilitating the diffusion of these advanced energy systems, commensurate with local conditions. The goals include reducing the unit costs of these energy systems through greater economies of scale, the creation of new business services linked to demand response and other energy-related services, and the development of energy systems that can be deployed nationwide.

The METI subsidy programme period is five years, from 2016 to 2020, and the primary criterion for assessing the performance of supported projects will be whether overall system efficiencies of 20% or over are achieved. The METI also points out that the renewable generating capacity eligible for inclusion is not to be covered by the feed-in tariff (FIT). The end of the FIT is in sight, and hence another aim of the subsidy is to foster the non-subsidized diffusion of renewable-energy.[13]

The METI subsidy project is not the only one of its kind. In fact, the Ministry of Internal Affairs and Communications (MIC) has a similar fund, the "Distributed Energy Infrastructure Project," for encouraging the deployment of heat and power grids. Similar to the METI subsidy, MIC's programme seeks to foster renewables, particularly biomass, geothermal, and other 24/7 "baseload" energy, with the local community as the lead agent in the project. The MIC programme also explicitly looks to community use of FIT-subsidized heat and power generation as a mechanism of interregional redistribution and local revitalization.[14] The MIC subsidy's inclusion of FIT-incentivized renewables is a sharp contrast to the METI programme, showing that central agencies are clearly aimed at expanding a different area of the smart community paradigm.[15]

Additional finance for related smart-energy systems includes cogeneration-related subsidies managed by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) as well as the Ministry of the Environment (MOE). In the FY 2015 supplementary budget and the FY 2016 initial budget, these subsidies total JPY 167.94.[16] Moreover, the governing Liberal Democratic Party (through its Study Commission on Resources and Energy Strategies) helpfully maintains a comprehensive list of 46 national-level distributed-energy subsidies, categorizing them by their respective central-agency funder.[17] It is not possible to calculate the total monetary value of these individual subsidies, as many of them are part of much larger programmes that are not focused on energy.

To take one example of the above, the MLIT offers fiscal support for local governments that want to harness waste-heat energy resources in their sewage networks. Japan's potential for waste-heat capture in the best areas of its 460,000 kilometers of sewerage has been assessed at 15 million households' worth of heat-energy use, so this programme is potentially quite significant.[18] But the MLIT's support is part of the JPY 898.3 billion comprehensive disbursement for social infrastructure (*shakai shihon seibi sougou koufukin*), and there is no indication of how much of the total disbursement will go to waste-heat recovery.[19] Moreover, the MLIT supplements this particular initiative on waste-heat recovery from sewers with the offer of sending expert staff to advise local governments and other actors (such as private firms and public-private collaborations), to assist the latter in working up project proposals and other pertinent items.[20] This deployment of expert assistance has a monetary value that also cannot be quantified. What can be said with confidence is that many of the Japanese government's central agencies are quite interested in promoting distributed energy, especially renewable systems, and for a variety of reasons.

The Hioki Project and its Context

The Hioki City smart community project is only one of many underway in Japan. The best known are Kitakyushu, Keihana, Yokohama, and Toyota City projects, along with Panasonic's project at Fujisawa, Mitsui's initiative at Kashiwanoha,[21] and Sekisui House's various ventures such as Higashimatsushima "smart disaster-resilient eco-town."[22] In addition to these generally well-publicized projects, there are numerous others that receive little or no coverage, even in Japan's domestic vernacular press as well as in detailed Japanese-language studies of smart communities.[23] These smart-community initiatives are distinct from the flurry of private-sector single-firm or consortium power projects (largely solar) that followed the July 2012 implementation of the FIT. They are also quite different from the citizen-solar projects that remain the focus of the 15 organizations that came together in the "People's Power Network" on February 21 of 2014.[24]

Comparative Cost and FIT Support for Solar

※2016	Capital Cost ($/kW)	Operating Cost ($/kW/Yr)	Utilization Rate (%)	Generation Cost ($/MWh)	FIT Support (¢/kWh) ※2015
Germany	1,000	32	11%	103	8.9 (Auction Price)
France	1,050	32	14%	93	10.6 (Auction Price)
UK	1,160	32	10%	130	16.5
Spain	1,390	36	16%	148	(FIT abolished)
Turkey	1,240	32	16%	122	13.3
US	1,427	21	19%	87	(RPS system)
Brazil	1,381	24	19%	111	7.8 (Auction Price)
Australia	1,445	18	20%	85	(RPS system)
India	898	17	19%	90	7.7-9.2
China	1,181	12	16%	102	14.3-15.8
Japan	2,205	68	14%	192	22.5

(Source: METI, Agency for Natural Resources and Energy, June 2016

One key difference between the emergent smart communities and the private-sector and civil-society projects is that the latter focus on the supply side of energy, and particularly on generation by FIT-subsidized solar power. In fact, as of June 11, 2016, solar power accounts for just under 97% (27.4 GW) of the 28.4 GW of renewable capacity installed in Japan since the adoption of the FIT. And solar is 91.5% (79.9 GW) of the 87.3 GW of renewable capacity that has been approved for installation.[25] Yet as the attached figure on "Comparative Cost and FIT Support for Solar"[26] shows, Japan's solar is expensive. In Japan, solar's capital costs as well as operating and maintenance costs are quite high, at USD 2,205 per kilowatt (kW) over double those of Germany and by far the highest of all the countries surveyed. There are myriad reasons for these high costs, but they mainly reflect Japan's higher costs for hardware, installation and other aspects of solar systems.[27] Japan's capacity utilization rate for solar (which measures average actual output as a fraction of installed capacity) is only mid-range, at 14%. That figure is better than Germany (11%) and the UK (10%), but considerably less than the US (19%), India (19%), China (16%) and Australia (20%). The result of Japan's high costs and only average capacity utilization is very high generation costs: Japan's USD 192 per MWh cost for solar-power generation greatly exceeds any of its peer countries. Moreover, Japan's FIT subsidy remains high, and in consequence the FIT-supported renewable surcharge on power bills has risen from roughly JPY 2250 billion (JPY 0.22/kWh) in 2012 to JPY 1.84 trillion (JPY 1.58/kWh) in 2015.[28] Since 3-11, increased fossil-fuel imports, the FIT and other expenses have caused Japan's power costs to rise by 25% for households and just under 40% for industry.[29] Solar's rising burden on power bills is one major reason the authorities want to encourage investment in such other renewable power sources as biomass, wind, geothermal, and small hydro.

Smart-community projects such as Hioki's are one of the several emergent strategies for promoting renewable power and heat generation without adding to the pressure on power bills. They are aimed at evolving full-fledged energy systems, which incorporate a far more diverse portfolio of energy inputs than just solar. These inputs include the waste-heat, geothermal, and other options that the Japanese central agencies have been aggressively subsidizing since 3-11 but getting little traction on. Hioki's project would also consume its own power production locally rather than sell it, subsidized by the FIT, into the regional grid. That "self-consumption" of power helps alleviate the problem of intermittent solar and wind power input into the extant power grid, which has led to extensive output curtailment by 7 of Japan's 10 regional power firms.[30] (This emphasis on the self-consumption of solar power is also seen in Japan's "Net Zero Energy Home" and "Net Zero Energy Building" strategies, which in Fiscal Year 2016 are subsidized at JPY 10.1 billion.[31])

Another factor that sets Japan's smart-community projects apart from private-sector and civil-society projects is that they generally include advanced transmission grids (increasingly both heat and power) and a wide variety of efficiency-oriented measures (LEDs, energy-management systems, and others). Their spatial extent is not the entire city, but rather neighbourhood-sized clusters of concentrated power and thermal demand. And Hioki's plan is an indication that these separate clusters of microgrids are to be linked together, in an approach that fosters the local resilience, local development, reduced emissions, and lower energy costs that are core objectives for the Japanese state.

This development is potentially very important. Japan is generally not seen as a significant player in the microgrid market, which is dominated by North America. Indeed, the US power microgrid and district heating/cooling (DHC) lobbies joined forces on May 18 of 2016, when the International District Energy Association (IDEA) and the Microgrid Resources Coalition (MRC) merged to push for a more rapid diffusion of their resilient, efficient and distributed infrastructure. As IDEA President and CEO Rob Thornton argued on the day of the merger, "we are witnessing a paradigm shift from remote central station power plants toward more localized, distributed generation for enhanced reliability, resiliency and energy efficiency, especially in cities, communities and campuses."[32]

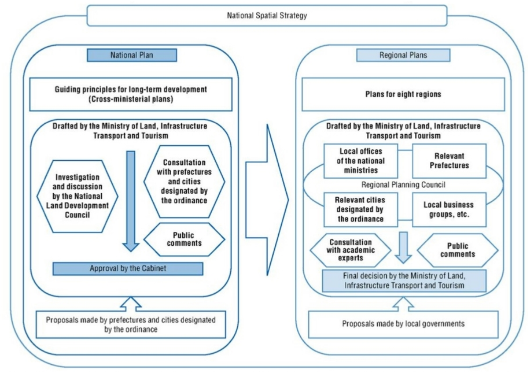
Yet Hitachi, Toshiba and other Japanese firms are among the industry's leaders, powerfully incentivized by the impact of 3-11. Japanese firms dominate their domestic market and have an increasing presence in the US and other markets. In fact, Hitachi's smart community project at Kashiwanoha (in Chiba Prefecture) came to include the firm's first microgrid because 3-11 impelled a "rethink on the design of the country's energy infrastructure."[33] As we have seen earlier, Hitachi's microgrid technology and expertise on system architecture is key to the Hioki smart community.

Another point that distinguishes Japan's smart community projects is that most also include advanced recycling, mobility and associated projects to further reduce emissions, energy consumption, and resource demand. Not a few also venture into robotics and new materials, such as carbon-laminated timber, carbon and/or cellulose nanofiber, and other substances, drawing on Japan's increasing emphasis on these industries.

An additional major difference is governance. Some of Japan's smart community initiative are led by corporate actors, including Panasonic, Sekisui House, and others. But Hioki City's "compact energy network system" collaboration is clearly in the mold of the "local government led" smart communities and energy systems championed by the most visionary of Japan's energy technocrats. Representative of this stream of technocrats is cabinet advisor Kashiwagi Takao and his colleagues at the Tokyo Institute of Technology's Advanced Energy Systems Center, or "AES Center." The AES Center was official inaugurated in 2010, and collaborates with such partners as Hitachi, Toshiba, Mitsubishi, and other blue-chip firms.[34] Since 3-11, the Center has increasingly focused on using the crisis as an opportunity to accelerate the deployment of smart communities that maximize renewable energy, local leadership, resilience, and other priorities.[35] Moreover, Kashiwagi's consistent emphasis on the importance of local-government leadership, in order to maximize trust, equity and other crucial factors, appears to have diffused among policymakers.[36]

Japan's National Spatial Strategy and Smart Communities

Indeed, Kashiwagi described smart-community-related innovation as "structural reform" before 3-11 and the subsequent emergence of Abenomics.[37] He has also long emphasized FIT-supported renewable energy in regional smart communities as a means of local revitalization, outlining this vision at a November 1, 2010 METI symposium.[38] The AES Center he leads is well-represented on Japan's key planning initiatives, such as "National Resilience," the "National Spatial Strategy," and others. These plans are overlooked (when not ignored, or simply derided)[39] in the business press, which displays at best only a limited understanding of the growing intersection between distributed energy and mitigation/adaptation to climate change.[40] But an expanding body of specialist literature has begun to examine how the spatial and resilience plans shape the flow of fiscal and other resources and compose an important part of the structural reform aspect of Abenomics.[41]



Source: Ministry of Land, Infrastructure, Transport and Tourism (2014a), "Grand Design of National Spatial Development Towards 2050, Japan", Ministry of Land, Infrastructure, Transport and Tourism, Tokyo, July, available at: *www.mlit.go.jp/common/001088248.pdf*.

Source: OECD Territorial Review of Japan, 2016, p. 88

At the macro-level, Japanese policymakers aim to foster a very broad portfolio of new smart community business models and infrastructures appropriate to a resource- and carbon-constrained era.[42] Japan's shifting priorities are clearly evident in the new National Spatial Strategy (NSS), adopted in August 2015. As the OECD points out in its *Territorial Review of Japan, 2016*, the NSS "is the most important of a number of key planning documents." One reason is evident in the attached figure on the "Formulation of the National Spatial Strategy." Unlike prior spatial plans, the NSS is a "truly horizontal initiative," one that was built on the basis of "an intensive exercise in inter-ministerial co-ordination and consultations extending beyond the government itself under the aegis of the National Land Council, which brings together parliamentarians, academic experts, representatives of the private sector, elected officials from the cities and regions, and others." The NSS is thus distinctive from Japan's previous top-down planning strategies, being composed in a "whole of government" approach that includes the other central agencies as well as the subnational governments. In addition, the consultation with civil society was also unprecedented in its breath. This degree of consultation gives the NSS a legitimacy that transcends its predecessor documents. On top of that legitimacy is legal authority: at least 20 other national laws are obligated to refer to the NSS.[43]

Changing Priorities in Japan's "National Spatial Strategy"

2008 NSS	2015 NSS
• "network" 111x	• "network" 185x
• "disaster" 146x	• "disaster" 228x
• "climate change" 5x	• "climate change" 15x
• "energy" 54x	• "energy" 207x
• "compact" 2x	• "compact" 67x
• "renewable energy" 1x	• "renewable energy" 33x
• "smart community" 0x	• "smart community" 7x
• "distributed" 0x	• "distributed" 13x

Source: Compiled from keyword searches in NSS 2008 and NSS 2015.

Other important items are the 2015 NSS's careful attention to smart communities, renewable energy, climate change, resilience and other factors as the context for urban policy. This shift is displayed in the attached figure on "Changing Priorities in Japan's 'National Spatial Strategy,'" which measures the frequency of several keywords in the 2008 NSS and compares the numbers with the 2015 NSS. For example, the word "energy" appears only 54 times in the 2008 NSS, but the 2015 NSS has 207 mentions of "energy."[44] Similar results are seen for "compact" (as in spatial densification), "renewable energy," "smart community," and "distributed" (in reference to distributed energy).

The comparison, coupled with a thorough reading of the two texts, tells us that the 2008 NSS was concerned with disasters and the transport and other networks that are critical to economic activity and responding to crises. But the 2015 NSS displays a far greater concern for climate and other disaster threats, as one would expect in the wake of the 3-11 disaster. But the NSS 2015 also reflects the emergence of a very different, distributed network paradigm for coping with disaster threats as well as the ageing and other challenges discussed earlier.

One reason for the attention to smart and distributed energy in the 2015 NSS is that the planning initiative included its first-ever energy expert, Kashiwagi Takao. As noted earlier, Kashiwagi is a champion of smart communities. But perhaps even more interesting is the fact that he also emphasizes the need to shift the focus of public works away from bridges and roads and toward energy projects.[45] Kashiwagi's stress on the strategic importance of smart-energy networks is similar to Nicholas Stern's arguments in his 2015 book *Why Are We Waiting? The Logic, Urgency, and Promise of Tackling Climate Change*. Stern is the world's leading economist on climate change and energy, with a profound understanding of history and institutions. He presents the core network infrastructures of the smart energy economy as comparable to the roads that were core networks for the development of the Fordist economy and the railroads that were central to the steam-based economy.

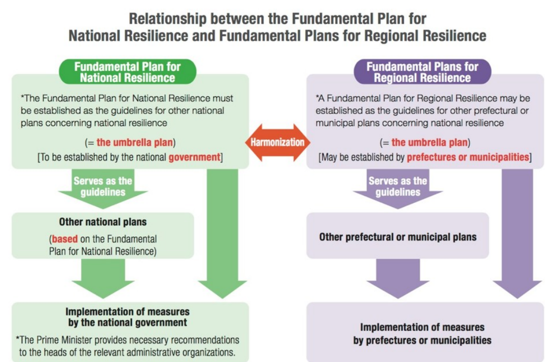
For example, Stern argues that "Economic history tells us that networks, be they power grids or railways, played a central role in past economic transformations: grids enabled great surges of creativity and innovation and led to opportunity and growth across the economy…More effective temporal and spatial management of the energy system, for instance with smart technologies or increased flexibility of the energy markets, could aid in the management of low-carbon generation, reduce the need for extra infrastructure, and unlock the potential for renewable energy to meet both base and peak demand for energy."[46] This understanding of strategic structural reform, through smart energy systems, is what Kashiwagi's participation has brought into the heart of Japan's post 3-11 spatial planning.

The Overarching Role of the "National Resilience Plan"

The OECD and other observers express concern that, no matter how laudable, the densification goals written into the NSS may not be realized. They point out that many of the aims of previous NSS documents were not realized. The reasons for limited implementation include the difficulty of shaping business and household locational choices, constraints on public finance, and other factors. While these points are all important, they neglect at least three very important facts that differentiate the current NSS from its predecessors. One is that energy production and consumption infrastructure has become a key, and explicit, factor in driving spatial reform. The second is that the 2015 NSS was framed in the context of the "National Resilience Plan." The third point is that locational choices are being shaped by the powerful combination of incentives that give rise to Hioki City's smart community strategy. We have already seen how energy is written into the 2015 NSS. We examine the latter two items in detail below.

Japan's National Resilience Plan and Resilient, Smart Communities

Japan's National Resilience Plan (NRP) is as ambitious and inclusive as the NSS, and may be more authoritative. The NRP is aimed at bolstering the country's resilience to natural and other disasters, as well as fostering the capacity to recover from such disasters when they occur. Based on the best national and international evidence, it expertly evaluates risks and vulnerabilities, selects and prioritizes countermeasures, and then evaluates progress on these measures.[47] Particularly impressive is the NRP's use of the most advanced climate science as well as its emphasis on critical infrastructure and smart communities/smart energy. National Resilience itself is under the authority of a State Minister, a new position announced during the December 26, 2012 inauguration of the first cabinet of PM Abe Shinzo. The position is combined with the Chairman of the National Public Safety Commission, the Minister for the Abduction Issue, and Minister of State for Disaster Management.



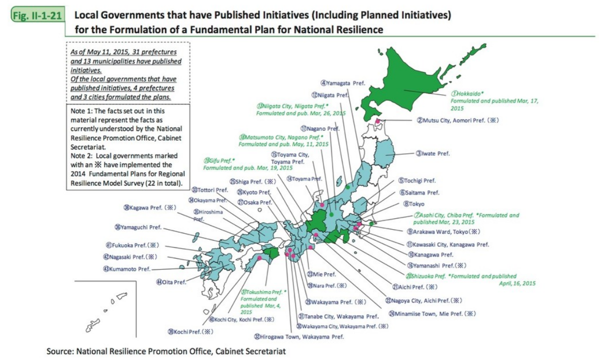
Source: Building National Resilience

As the above figure "Relationship between the Fundamental Plan for National Resilience and Fundamental Plans for Regional Resilience" indicates, the NRP is also a "whole of government" approach to planning. The NRP is based on the National Resilience Law passed by the Diet on December 4 of 2013 and then worked up into a plan by the governing Liberal Democratic Party (LDP) politicians and disaster-resilience technocrats in the Cabinet Secretariat's National Resilience Council (NRC)[48] and the "National Resilience (Disaster Prevention and Reduction) Deliberation Committee"(NRDC).[49] The NRDC first met on March 5, 2013 and continues its deliberations as of this writing. Its membership is drawn primarily from the top ranks of Japan's academic community, including Kashiwagi Takao, who advises on energy. Other specialists advise on ageing, primary industries, local communities, local administration, risk communication, industrial structure, the environment, disaster prevention, finance, national lands, and information services. In a laudable exercise in transparency, the minutes from NRDC meetings and the materials it deliberates are uploaded to its dedicated web site, generally within a week of its 7-9 meetings per year.

Other advisory bodies for formulating the NRP include the "Liaison Committee Among Central Agencies Concerned with Promoting National Resilience." This committee first met on March 19 of 2013, and evidently performs a communication role that helps break down silos.[50] Its meetings are short, at roughly 30 minutes, and infrequent, having become semi-annual since 2014 after 6 meetings in 2013. Also, the committee deliberates materials already considered by the above National Resilience (Disaster Prevention and Reduction) Deliberation Committee.

A further forum for promoting the NRP is a "Japan-US National Resilience Workshop." This workshop was undertaken on July 7 of 2014. It does not appear to be institutionalized as a recurrent event, but is featured as one of the National Resilience-related committees by the Japanese Cabinet Office's National Resilience Promotion Office.[51] The workshop centred on lessons learned from the US-Japan cooperation after 3-11, in the "Operation Friendship" (*tomodachi sakusen*). Presentations at the workshop included the US Department of Homeland Security, which provided an overview on "national protection." Other presentations included talks by Japan's local government leaders, including the Mayor of Ofunato City and the Governor of Koichi Prefecture.[52]

The NRP that these and other committees produced was given cabinet assent on June 3 of 2014, in tandem with an "National Resilience Action Plan." The Action Plan is updated annually, resulting in very good monitoring and flexibility.



Source: p. 84 White Paper on Disaster Management in Japan, 2015.

National Resilience Plan and Regional Plans

The subnational governments are also adopting versions of the NRP. The attached figure on the "National Resilience Plan and Regional Plans" indicates that as of May 11, 2015 there were 31 prefectural and 13 municipal plans. This number of subnational plans, less than a year after formal passage of the NRP, is suggestive of its legitimacy among subnational policymakers. More recent data, from June 9, 2016, and show that all 47 prefectures have completed plans or have them under development, with 32 completed and 15 under development.[53]

The Impact of the NRP

The above has shown that the NRP is an authoritative plan and that it is being adopted and implemented at all levels of government. But the next issues to address are whether the NRP is in fact useful and whether it is shaping the political economy. The first of these two issues has an inescapably political dimension. Because of the intensely partisan environment of Japanese politics, it is difficult to find objective assessments of the NRP. But one useful check of the NRP's content is to compare it with what was recommended by the OECD's 2009 "Review of Risk Management Policies, Japan: Large-Scale Floods and Earthquakes."[54] The OECD Review is important for three major reasons. First, it was produced by internationally recognized and unbiased experts. Second, it predates the trauma of the 3-11 natural and nuclear disasters as well as the December 2012 return to power of the LDP under PM Abe Shinzo. Third, the OECD Review covers the two major threats addressed by the NRP, and is as deeply concerned by the acceleration of climate change as the Japanese. In short, the OECD Review is a well-informed, impartial study that remains relevant.

Among other things, the OECD Review recommended that the Japanese government undertake greater investment in resilient infrastructure, adopt a more powerful coordinating role for the central government, and institute a more systematic evaluation of options. The NRP spending on resilience and its emphasis on the agency of the central government are very unwelcome to its critics. These critics, such as Igarashi Takayoshi (former cabinet advisor to the Democratic Party of Japan), warn that the spending heralds the return of the "construction state" and that a stronger coordinating role of the central government threatens local autonomy. But neither Igarashi nor any other critics reference the OECD Review.[55] The assertion that local governments are best left to develop and deploy their own disaster counter-measures seems most unwise, in light of the scale and scope of the externalities posed by climate change, energy risks, and the other threats the NRP addresses. It is indeed striking that Igarashi and others do not consider the accelerating threat of climate change. Igarashi even downplayed the threat of earthquakes, a complacency that surely must have been shaken by the unanticipated string of earthquakes that struck Kumamoto Prefecture and nearby regions in March of 2016.

Yet at least Igarashi paid attention to the NRP. By contrast, it would appear (after careful checking) that all the post-3-11 literature on Japan's disaster threats and resilience is unaware of, or simply chooses to ignore, both the OECD Review and the NRP.

It is clearly unwise to ignore or simply deride the NRP. One reason, as explained above, is that the NRP was drawn up and is being revised by some of Japan's most competent authorities in a broad range of areas relevant to mitigating and adapting to very real and worsening threats. Another reason is that the NRP requires other national laws – including the NSS – to reference it. The NRP's annual Action Plans also keep track of how other plans are referencing it, along with national resilience spending by various government agencies, and other pertinent factors.[56]

In addition, the NRP's initiatives are given additional momentum by the work of the very active and very professional Association for National Resilience (ANR), which was inaugurated on July 1 of 2014.[57] The Association regularly holds events on such important matters as smart communities, green resilience, advanced energy systems, new materials, risk communication, and related items. The Association's 14 working groups cover these diverse market segments, and include impartial, internationally networked actors. They are formulating new approaches in areas that include green resilience, use of new materials (particularly cross-laminated timber), local revitalization, resilient housing, resilient business management, resilience against tsunami, mudslides, floods, and other hazards.[58]

Added to the above, the NRC and ANR do impressive work on calculating the economic scale of Japan's resilience market, which it estimated to be over JPY 24 trillion (USD 220 billion) in 2013, when public and private-sector spending are amalgamated.[59]

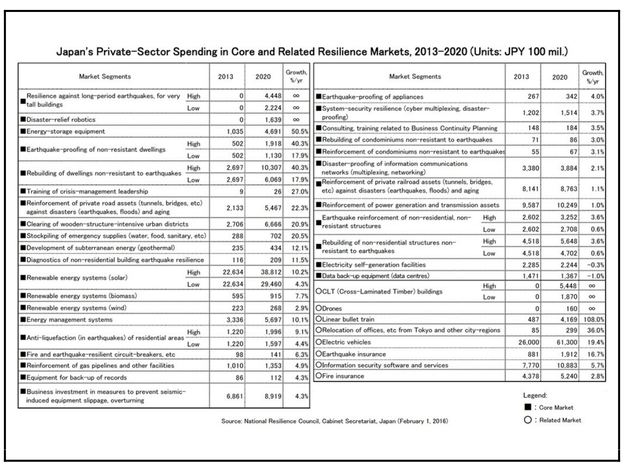
Specifically, as part of the overall resilience project, the NRC undertook a survey of private-sector firms' current and projected spending in late 2015. The survey determined that private-sector spending on resilience totaled about JPY 11.9 trillion in 2013. That total can be broken down into "core" markets segments (goods and services) that are directly focused on resilience, and "related" market segments (again, goods and services) that address aspects of resilience. The survey found that the aggregate value of core markets was roughly JPY 8 trillion and that related markets were worth JPY 4 trillion.

The NRC's analysis also estimated that these core and related markets would likely double in size by 2020.[60] As can be seen in the figure "Japan's Private-Sector Spending in Core and Related Resilience Markets, 2013-2020," the three largest (core and related) sectors are:

1) electric vehicles, at JPY 2.6 trillion in 2013 and projected to amount to JPY 6.13 trillion in 2020

2) renewable energy (solar), at JPY 2.26 trillion in 2013 and JPY 3.88 trillion in 2020 (high estimate)

3) power generation and transmission infrastructure reinforcement, valued at JPY 958 billion in 2013 and JPY 1.02 trillion in 2020



Japan's Private–Sector Spending in Core and Related Resilience Markets, 2013–2020 (Units: JPY 100 mil.)

Market Segments		2013	2020	Growth, %/yr
■Resilience against long-period earthquakes, for very tall buildings	High	0	4,448	∞
	Low	0	2,224	∞
■Disaster-relief robotics		0	1,639	∞
■Energy-storage equipment		1,035	4,691	50.5%
■Earthquake-proofing of non-resistant dwellings	High	502	1,918	40.3%
	Low	502	1,130	17.9%
■Rebuilding of dwellings non-resistant to earthquakes	High	2,697	10,307	40.3%
	Low	2,697	6,069	17.9%
■Training of crisis-management leadership		9	26	27.0%
■Reinforcement of private road assets (tunnels, bridges, etc) against disasters (earthquakes, floods) and aging		2,133	5,467	22.3%
■Clearing of wooden-structure-intensive urban districts		2,706	6,666	20.9%
■Stockpiling of emergency supplies (water, food, sanitary, etc)		288	702	20.5%
■Development of subterranean energy (geothermal)		235	434	12.1%
■Diagnostics of non-residential building earthquake resilience		116	209	11.5%
■Renewable energy systems (solar)	High	22,634	38,812	10.2%
	Low	22,634	29,460	4.3%
■Renewable energy systems (biomass)		595	915	7.7%
■Renewable energy systems (wind)		223	268	2.9%
■Energy management systems		3,336	5,697	10.1%
■Anti-liquefaction (in earthquakes) of residential areas	High	1,220	1,996	9.1%
	Low	1,220	1,597	4.4%
■Fire and earthquake-resilient circuit-breakers, etc		98	141	6.3%
■Reinforcement of gas pipelines and other facilities		1,010	1,353	4.9%
■Equipment for back-up of records		86	112	4.3%
■Business investment in measures to prevent seismic-induced equipment slippage, overturning		6,861	8,919	4.3%

Market Segments		2013	2020	Growth, %/yr
■Earthquake-proofing of appliances		267	342	4.0%
■System-security resilience (cyber multiplexing, disaster-proofing)		1,202	1,514	3.7%
■Consulting, training related to Business Continuity Planning		148	184	3.5%
■Rebuilding of condominiums non-resistant to earthquakes		71	86	3.0%
■Reinforcement of condominiums non-resistant to earthquakes		55	67	3.1%
■Disaster-proofing of information communications networks (multiplexing, networking)		3,380	3,884	2.1%
■Reinforcement of private railroad assets (tunnels, bridges, etc) against disasters (earthquakes, floods) and aging		8,141	8,763	1.1%
■Reinforcement of power generation and transmission assets		9,587	10,249	1.0%
■Earthquake reinforcement of non-residential, non-resistant structures	High	2,602	3,252	3.6%
	Low	2,602	2,708	0.6%
■Rebuilding of non-residential structures non-resistant to earthquakes	High	4,518	5,648	3.6%
	Low	4,518	4,702	0.6%
■Electricity self-generation facilities		2,285	2,244	-0.3%
■Data back-up equipment (data centres)		1,471	1,367	-1.0%
○CLT (Cross-Laminated Timber) buildings	High	0	5,448	∞
	Low	0	1,870	∞
○Drones		0	160	∞
○Linear bullet train		487	4,169	108.0%
○Relocation of offices, etc from Tokyo and other city-regions		85	299	36.0%
○Electric vehicles		26,000	61,300	19.4%
○Earthquake insurance		881	1,912	16.7%
○Information security software and services		7,770	10,883	5.7%
○Fire insurance		4,378	5,240	2.8%

Legend:
■ : Core Market
○ : Related Market

Source: National Resilience Council, Cabinet Secretariat, Japan (February 1, 2016)

The figure shows that if one excludes electric vehicles and other "related" market segments, then renewable energy is the largest market in Japan's private-sector spending on resilience. We saw earlier that Japanese renewable projects are unduly biased towards solar, which is highly subsidized and comparatively quick and easy for business and cooperative to deploy. But the JPY 2.26 trillion spent on solar systems in 2013 was accompanied by JPY 59.5 billion on biomass, JPY 23.5 billion on geothermal, and JPY 22.3 billion on wind power, for a total of JPY 2.37 billion on renewable energy generation systems. In addition, batteries and other energy storage equipment totaled just over JPY 103 billion, while efficiency-enhancing energy management systems amounted to just under JPY 334 billion. The more Japan's resilience paradigm incentivizes spending on a broad portfolio of renewable inputs and energy systems (ie, transmission, storage and management), the greater the non-solar renewable and associated network spending will increase.

Indeed, using the NRC's high estimate of JPY 3.88 trillion for the solar market in 2020, Japan's total resilience-centred renewable market is projected to increase to JPY 4.04 trillion by 2020. In addition, the markets for batteries and other storage equipment are slated to expand to JPY 469 billion. And spending on energy management systems is expected to grow to just under JPY 570 billion.

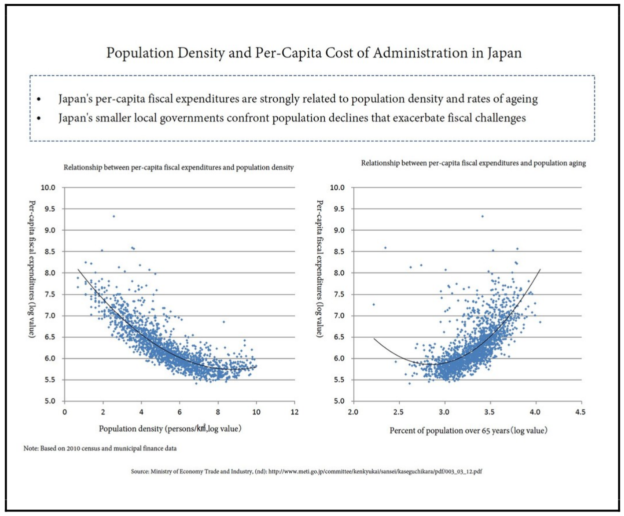
In other words, Japan's total private-sector investment in disaster-resilient renewable energy, storage and energy management is estimated to become a JPY 4.92 trillion market by 2020. That figure is likely to be an underestimate, in light of global trends and the policies reviewed earlier; but even so it is an impressive increase from the JPY 2.81 trillion in 2013. Note also that the NRC also projects that the core market in National Resilience will total between JPY 11.8 and 13.5 trillion in 2020. Thus, renewable energy generation, storage and management are estimated to be between 36% and 42% of core markets in Japan's private-sector expenditures on National Resilience.

The NRC's documents also reveal that public-sector spending on National Resilience totaled JPY 12.4 trillion in 2013. Much of that investment was also devoted to renewable-energy generation, transmission and storage, in Japan's profusion of smart communities, disaster-relief shelters, and other applications.[61] As we have seen, in post 3-11 Japan building resilience has become explicitly and powerfully linked to renewable energy systems and their enabling storage and transmission technologies. Indeed, Furuya Keiji, the LDP's first state minister of National Resilience and Disaster Reduction (2012-2014) devoted an entire section of his June 2014 book on National Resilience to distributed, renewable energy.[62]

Returning to the figure on private-sector National Resilience spending, we can see that other core markets include earthquake-proofing of building and equipment, reinforcement of transport systems (roads and railroads), disaster-relief robotics, communications resilience, and training of specialist leadership. In addition to electric vehicles, the related markets include insurance, information security, and the linear bullet train (in development). It is debatable that the latter will bolster resilience. But the LDP's rationale for including it is that it encourages the distribution of people and facilities away from undeniably excessive over-concentration on Tokyo, perhaps the most disaster-threatened megacity on the planet.[63] In any event, most of the rest of the investment does appear likely to increase resilience in the face of disasters and other patent threats (such as cyber-attack or supply shocks of energy and other materials).

Putting Money into Compact, Smart Communities

Let us turn to return to the OECD and other observers' concerns that the goals in the NSS may be unattainable. A second reason that the broad aims of the NSS (and the NRP) seem likely to be realized is that they overlap a great deal and are backed up by Japan's potent inter-regionally redistributive regime of public finance. These factors allow the technocrats to strongly incentivize core projects, especially in public facilities that serve as anchors for locational choices by business and households.

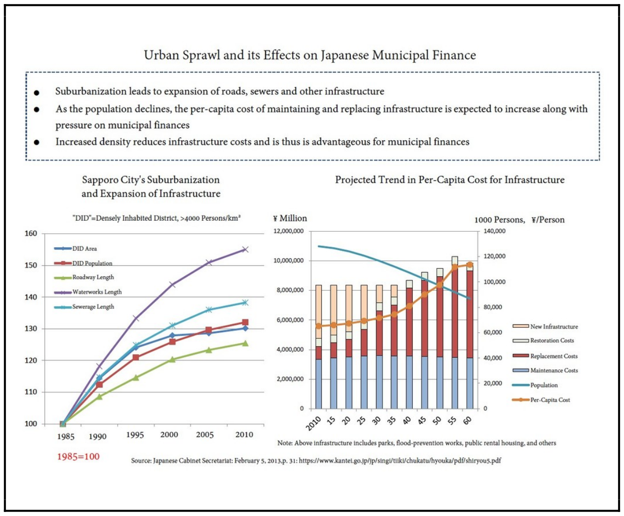


The spatial energy concerns of Kashiwagi's smart community stream dovetail very nicely with Japanese urban planners' desire to foster compact and networked cities, as we saw earlier in the NSS. Encouraging densification has become common-sense among the technocratic elite and is rapidly diffusing throughout the municipalities. Energy projects for local revitalization are only one of multiple incentives. Another set of incentives is seen in the figure "Population Density and Per-Capita Cost of Administration in Japan," which quantifies how costly a low-density and ageing population is. This kind of empirical analysis of the interaction between public finance and spatial and demographic factors is quite advanced and widespread in Japan.

Detailed empirical studies of the relationship between spatial forms, demographic change, and finance are also increasingly common. An example of the work is seen in the study of

Sapporo City's fiscal future, in the figure "Urban Sprawl and its Effects on Japanese Municipal Finance. It shows that low population densities and high rates of ageing are strongly associated with comparatively high per-capita spending by local governments. These analyses deftly outline the consequences of past urbanization, whose sprawl resulted in a large investment in roads, waterworks and other infrastructure. The "projected trends in the per-capita cost for infrastructure," meaning expenses on maintenance, replacement and recovery from disaster, suggest significant rates of increase are already underway. These cost increases are expected to accelerate before reaching a rough plateau in mid-century. And it should be noted that these projected cost trajectories may be underestimated, in light of the increasing toll from climate change as well as possible increases in energy and material costs.

The local tax base also plays an increasingly strong role in encouraging attention to the merits of "compact-city" densification. The figure on "Land Values and Tax Revenues in a Japanese Municipality, FY 2013," displays the fiscal attractiveness of compact-city approaches for Toyama Prefecture's Toyama City (population: 418,489).[64] This city has been studied in detail by the OECD as a model of "compact city" policies, alongside Melbourne, Paris, Portland and Vancouver.[65] The international attention has helped give Toyama a benchmark status in Japanese specialist debate on urban policy options. As is evident from the attached figure on "Land Values and Tax Revenues," the planning technocrats' discussion of Toyama City stresses the benefits that densification has for the city's fiscal health. They emphasize that densification raises property values in the crucial urban core, which is only 0.4% of the city's land area but is the source of 22.2% (in FY 2013) of the city's revenues from the fixed asset tax (the property tax) and the city planning tax. In Fiscal Year 2014, the revenues from these two taxes totaled just under JPY 9.8 trillion, and composed 47.6% of the average tax base of Japan's cities, towns and villages.[66]

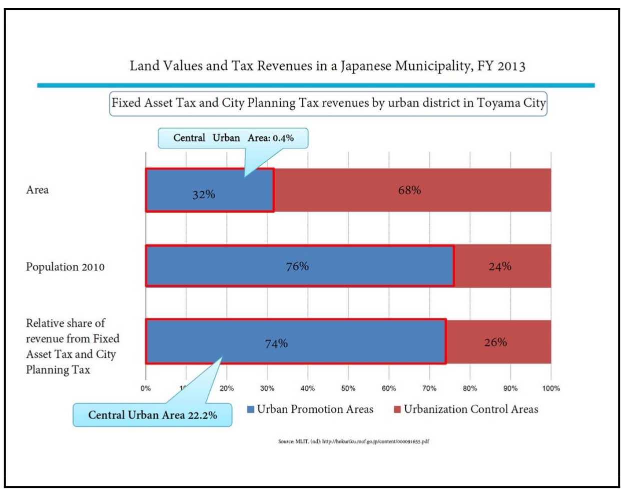


Japanese policymakers use the fixed asset tax and other tax incentives to incentivize the spatial planning and other policies undertaken by local communities. MLIT surveys indicate that over 50% of municipalities – especially the larger ones - have some degree of "compact city" policy in their master plans. Several municipal governments explicitly aim at densification to raise property values and thus increase their fixed asset tax and other tax revenues while cutting expenditures for maintenance and other costs. In tandem, policymakers in MIC and MLIT are focusing tax reform on increasing urban density (to raise land values), fostering the diffusion of smart energy systems, and rolling out light rail, FVC buses, and other smart mobility. The fixed asset tax is one mechanism in this initiative.

Another important fiscal mechanism is back-up financing by the local allocation tax (or LAT, a JPY 16 trillion fund for interregional redistribution). The LAT's role in encouraging densification is seen in the fact that it finances 90% of the interest costs for local debt floated to refurbish local facilities. These refurbishments can be relocation of public facilities into more dense clusters as well as the combination of functions. The latter is seen, for example, when local communities combine previously dispersed medical facilities into a central location.[67]

The use of "special tax measures" (*sozei tokubetsu sochi*) is also notable, as special depreciation tax measures centred on energy and the environment mushroomed from JPY 800 million in FY 2011 to JPY 552.5 billion in 2013, reaching well over half of FY 2013's JPY 949.3 billion in total special depreciation allowances (versus a total of JPY 313.1 billion in FY 2011).[68] From FY 2011, these special measures include LEDs, biomass, small-hydro, waste-heat recovery (from sewerages), batteries, cogeneration and other energy-producing, transmission, conservation and storage systems.[69]

Most of this investment is clustered in compact and smart cities, such as Toyota, Sendai, and Yokohama. Hioki is just one more example on a quickly lengthening list. Japan therefore affords strong evidence of a nationwide paradigm shift, one that incorporates a raft of incentives in an increasingly robust and coherent package of smart community policies.



So examining Hioki's case shows how Japan's structural reform is in fact accelerating, especially in disaster resilience. Given the impressive institutional, fiscal and other resources Japan is deploying, it seems reasonable to suggest it could become a global leader in disaster-resilient critical infrastructure, which includes transport, energy, water, waste and telecoms. This critical infrastructure is the core of the built environment and will be the focus of massive investment over the coming decades. Research by the Cities Climate Finance Leadership Alliance and the Global Commission on the Economy and Climate suggests that over $90 trillion worth of low-carbon, climate-resilient infrastructure needs to be built by 2030. The required volume of resilient infrastructure greatly exceeds the present $50 trillion value of all global infrastructure. Getting there a tall order, given that current infrastructure spend of $2.5 to $3 trillion per year is only half the required volume.[70] The more renewable, compact, and efficient the energy systems and other elements of the built environment, the lower the community's energy costs and environmental impacts.[71] Yet in order to avoid lock-in effects that render climate goals unreachable, ramped-up investment in resilient, low-carbon infrastructure has to start in the present and rapidly become a global paradigm. Against this backdrop, Japan's resilient and smart projects in Hioki and nationwide are clearly very important. Surely they deserve a lot more study, so as to further maximize their resilience and local revitalization while minimizing their emissions, energy consumption, and costs.

Related articles

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Notes

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[30] On this, see Andy Colthorpe, "NEC-supplied storage system targets Japan's solar curtailment rules," PV Tech, April 22, 2016: http://www.pv-tech.org/news/nec-supplied-storage-system-targets-japans-solar-curtailment-rules

[31] An up-to-date (as of March 4, 2016) listing of Japan's "Net Zero Energy Home" and "Net Zero Energy Building" subsidy programmes is available here (in Japanese): http://www.ace.or.jp/web/law/pdf/law_aux/Auxiliary_hosei20160308.pdf

[32] See "International District Energy Association and Microgrid Resources Coalition announce merger to promote wider adoption of microgrids," May 18, 2015: http://www.districtenergy.org/blog/2016/05/18/international-district-energy-association-and-microgrid-resources-coalition-announce-merger-to-promote-wider-adoption-of-microgrids/

[33] On this, see Elisa Wood, "Hitachi Moves into the North America Microgrid Market with 100-Year Plan," Microgrid Knowledge, December 17, 2015: https://microgridknowledge.com/hitachi-north-america-microgrid/

[34] The AES Center's list of partners is here: https://aes.ssr.titech.ac.jp/partner

[35] These ambitions are succinctly described by Kashiwagi Takao in the AES Center Annual Digest, "AES News," Spring 2015-Winter 2016: http://aes.ssr.titech.ac.jp/wp-content/uploads/download/pdf/AES_Annual_Eng_2015-2016.pdf

[36] For a review of Kashiwagi's arguments on the crucial role of local governments, see Andrew DeWit Andrew DeWit, "Japan's Radical Energy Technocrats: Structural Reform Through Smart Communities, the Feed-in Tariff and Japanese-Style 'Stadtwerke'", *The Asia-Pacific Journal*, Vol. 12, Issue 48, No. 2, December 1, 2014: http://apjjf.org/2014/12/48/Andrew-DeWit/4229.html

[37] See, for example, (in Japanese) Kashiwagi Takao "Towards Achieving Both Economic Development and Environmental Countermeasures: The Smart City Perspective," *New Era* Vol 71, Ministry of Land, Infrastructure, Transport and Tourism, Japan, September 2010: http://www.mlit.go.jp/kokudokeikaku/iten/service/newsletter/i_02_71_1.html

[38] See (in Japanese) "Okayama Symposium on Building Future Environmental Cities," Shun Rupo, Chugoku METI, December 2010:

http://www.chugoku.meti.go.jp/info/densikoho/22fy/h2212/miraitoshi.pdf
[39] Some press coverage focused on the use of the phrase "balanced national development" (*kokudo no kintou aru hatten*) as a signal of the recrudescence of massive and wasteful public works, while ignoring the role of energy and smart communities. For example, see (in Japanese) Azumi Akiko "That Phrase Resurfaces in the National Spatial Plan," *Toyo Keizai Online*, July 22, 2015: http://toyokeizai.net/articles/-/77842
[40] One telling example of this phenomenon is that the Nikkei business daily newspaper has carried only 9 articles on microgrids over the year up to July 27, 2016.
[41] There is an abundant specialist literature on these plans in Japanese, especially among the research institutions that work in spatial planning, infrastructure, and related areas. In English, the most recent work is Sugahara, Masaru and Leslie Bermont (2016), "Energy and Resilient Cities", OECD Regional Development Working Papers, 2016/05, OECD Publishing, Paris: http://dx.doi.org/10.1787/5jlwj0rl3745-en
[42] On these policymakers and their initiatives, see Andrew DeWit "Japan's Bid to Become a World Leader in Renewable Energy," The Asia-Pacific Journal, Vol. 13, Issue 39, No. 2, October 5, 2015: http://www.japanfocus.org/-Andrew-DeWit/4385/article.html
[43] See pp. 79-80 of *OECD Territorial Reviews: Japan 2016*, 2016/04, OECD Publishing, Paris
[44] The National Spatial Strategies and related documents are available (in Japanese), at the MLIT website: http://www.mlit.go.jp/kokudoseisaku/kokudokeikaku_fr3_000003.html
[45] See (in Japanese) pp. 10-15 in Kashiwagi Takao, *Smart Communities: A Smart Network Design for Local Government Infrastructure*, October 15, 2014,Jihyo: http://www.jihyo.co.jp/smart_community5.html
[46] See pp. 48-9, in Nicholas Stern, *Why Are We Waiting? The Logic, Urgency, and Promise of Tackling Climate Change, MIT Press*: 2015
[47] A brief English-language outline of the process is available at "Building National Resilience: Creating a Strong and Flexible Country," National Resilience Promotion Office, Cabinet Secretariat, Japan, nd: http://www.cas.go.jp/jp/seisaku/kokudo_kyoujinka/en/e01_panf.pdf
[48] See the Cabinet Secretariat's National Resilience Council's website: http://www.cas.go.jp/jp/seisaku/resilience/
[49] See (in Japanese) Nakazato Kousei, "National Resilience Begins, with the Passage of the Basic Law," Daiwa Institute of Research, December 13, 2013: http://www.dir.co.jp/research/report/capital-mkt/20131213_008009.pdf
[50] The particulars concerning this committee's membership and its deliberations are available (in Japanese) at: http://www.cas.go.jp/jp/seisaku/kyoujinka/index.html
[51] The list is available here: http://www.cas.go.jp/jp/seisaku/kokudo_kyoujinka/kondankai.html
[52] The workshop overview and presentation materials (some in English) is available here: http://www.cas.go.jp/jp/seisaku/kokudo_kyoujinka/workshop/h260707.html
[53] On this, see (in Japanese) "Prefectures publishing their regional plans for National Resilience," National Resilience Promotion Office, Cabinet Secretariat, Japan, June 9, 2016: http://www.cas.go.jp/jp/seisaku/kokudo_kyoujinka/pdf/map2.pdf
[54] The web site for the OECD study is here: http://www.oecd.org/japan/oecdreviewsofriskmanagementpoliciesjapan.htm
[55] See (in Japanese) Igarashi Takayoshi, "Criticism of National Resilience: The "Future Model" that Public Works Ought to be Aimed at," Iwanami Booklet No. 833, October 4, 2013.

[56] A list of the plans referencing the NRP can be found on pp. 145-6 of (in Japanese) National Resilience Action Plan, 2016, National Resilience Promotion Office, Cabinet Secretariat, Japan, 2016: http://www.cas.go.jp/jp/seisaku/kokudo_kyoujinka/pdf/ap2016.pdf
[57] The website of the Association for National Resilience is here: http://www.resilience-jp.org
[58] The website of the Association for National Resilience working groups is here: http://www.resilience-jp.org/wg/
[59] See Andrew DeWit, "Japan's 'National Resilience' and the Legacy of 3-11," The Asia-Pacific Journal, Vol. 14, Issue 6, No. 1, March 15, 2016: http://apjjf.org/2016/06/DeWit.html
[60] See (in Japanese), "Concerning the size and estimates for the private-sector market in national resilience," February 1, 2016, Cabinet Secretariat's National Resilience Council, p. 5: http://www.cas.go.jp/jp/seisaku/resilience/dai24/siryo2-3.pdf
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[62] See (in Japanese), Furuya Keiji, "National Resilience: the Challenges of Transitioning to a Resilient Society," June 2014, PHP Books, pp. 157-70.
[63] For a comparison the scale of the threats confronting Tokyo, see the last section of Andrew DeWit, "Japan's Resilient, Decarbonizing and Democratic Smart Communities", The Asia-Pacific Journal, Vol. 12, Issue 50, No. 3, December 15, 2014: http://apjjf.org/2014/12/50/Andrew-DeWit/4236.html
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