Building Resilience in the Anthropocene: Japan's Smart Communities

Andrew DeWit

Introduction

Scientific evidence strongly indicates the global climate system has transitioned from the relatively placid Holocene era to an increasingly uncertain Anthropocene[1]. This change poses worsening hazards for human communities, their critical infrastructure[2], agriculture, and other crucial elements of the built and natural environments. It also poses increasing threats to national security, and hence transcends partisan politics[3]. One particularly severe threat is the "end of stationarity" in the hydrologic cycle[4], which means past patterns of precipitation are no longer a reliable indicator of the future. Many of the challenges posed by the Anthropocene are recognized in the 2030 Agenda for Sustainable Development and Sendai Framework for

---

1) The science of the Anthropocene is described in detail in Waters C. N., et al. "The Anthropocene is functionally and stratigraphically distinct from the Holocene," *Science*, Vol. 351, January 2016. See also Waters, C. N. J. A. Zalasiewicz, M. Williams, M. A. Ellis and A. M. Snelling (eds) *A Stratigraphical Basis for the Anthropocene*, Geological Society Special Publications, Special Publication 395, June 4, 2014. A more general treatment of the Anthropocene and its implications for other academic disciplines and general intellectual debate is found in Hamilton C. *Defiant Earth: The Fate of Humans in the Anthropocene*, Polity Press, 2017.

2) Critical infrastructure includes power, communications, water, transport and other systems essential to human communities.

3) On the multiplicity of threats to national security, see Werrell, C. E. and Femia F. (eds) *Epicenters of Climate and Security: The New Geostrategic Landscape of the Anthropocene*, The Center for Climate and Security, June 2017: https://climateandsecurity.files.wordpress.com/2017/06/epicenters-of-climate-and-security_the-new-geostrategic-landscape-of-the-anthropocene_2017_06_091.pdf

4) Milly P. C. D. et al. "Stationarity Is Dead: Whither Water Management?" *Science*, Vol. 319, February 2008.

Disaster Risk Reduction 2015-2030[5].

Building resilience and sustainability in the Anthropocene entails policy integration to cope with multiple externalities. The existence of significant externalities places a premium of collaborative public-sector leadership[6]. Yet there is scant comparative literature on policy integration and fiscal flows linking the often siloed domains of disaster-resilience, energy policy, environmental policy, urban planning, and other areas relevant to mitigating and adapting to the Anthropocene.

Indeed, most case studies of mitigation and/or adaptation are micro-level, examining civil society's "soft resilience" or single cities. Or they merely compare national targets on emissions reductions and the deployment of renewable energy. Many of these studies are at best minimally engaged with the larger governance challenges and the interaction between contemporary energy and material flows as well as accelerating climate hazards. But the challenges are global, dynamic and interrelated. These facts were underscored on November 13, 2017 by the Union of Concerned Scientists and 1,700 other independent scientists. Together, these experts published a dire, evidence-based warning concerning the increasingly dynamic variables on hazards[7]. In this context, some social scientists are refining a "complexity framework," which specifically addresses the Anthropocene, to use in work on sustainability[8].

The present paper is a modest effort to address the gap in the literature by examining the political economy of Japanese resilience. It is part of a larger comparative research initiative centred on the Asia-Pacific, a research programme that seeks to understand why individual cases in the region are adopting varying strategies.

The project also addresses the relative prospects for success in decarbonizing via mitigation-led and adaptation-led approaches. The Japanese clearly emphasize adaptation, a s opposed to the German focus on mitigation. Until recently, mitigation (re-

5) On the 2030 Agenda and Sendai Framework, see: https://www. unece.org/environmental-policy/conventions/industrial-accidents/activities/sdgs-and-sendai. html

6) See eg, Helbling T. "Externalities: Prices Do Not Capture All Costs," International Monetary Fund, July 2017: http://www.imf.org/external/pubs/ft/fandd/basics/external.htm

7) On this, see Ripple W. J. et al. "World Scientists' Warning to Humanity: A Second Notice," *BioScience*, bix125, November 13, 2017: https://academic. oup. com/bioscience/advance-article/doi/10. 1093/biosci/bix125/4605229

8) Note, for example, Smith-Nononi, S. "Making Complexity Your Friend: Reframing Social Theory for the Anthropocene," *American Meteorological Society*, August 23, 2017: http://journals. ametsoc.org/doi/10. 1175/WCAS-D-16-0124.1

duced greenhouse gas emissions) and adaptation (resilience in the face of extreme weather, health risks, and other hazards) were often treated independently, or even seen as mutually exclusive[9]. Many observers were concerned that the necessity for aggressive decarbonization, particularly via adopting renewable energy, deep efficiency and clean electrification of transport, would be undermined by an "ecomodernist" confidence in geoengineering[10].

Moreover, state interventions to promote mitigation were largely seen as best confined to carbon pricing, setting renewable energy and emissions targets, and other comparatively indirect interventions in the economy. And adaptation strategies often emphasized responding to disasters by aiding victims rather than reducing human and material costs via the long-term and planned "build back better" investments emphasized in the Sendai Framework.

Following the work of Nicholas Stern[11] and other international experts[12], this current research assumes that indirect market-conforming interventions are inadequate considering the magnitude and urgency of climate threats. The present research programme is predicated on the fact that "industrial policy is back," and for good reasons[13].

In some countries, notably Japan, escalating damage from extreme weather and other disaster events have already led to a recognition that an inclusive, "whole of government" planning and investment in resilience and adaptation is imperative[14]. This approach may be especially important for the Asia-Pacific region because by 2018, over half of the Asia-Pacific population will live in cities, and require over USD

9) On this point, see the critical comments of IPCC Working Group II on the "presumed tradeoff between mitigation and adaptation" : http://www.ipcc.ch/ipccreports/tar/wg2/ index.php?idp=62

10) See Hamilton C. *Defiant Earth: The Fate of Humans in the Anthropocene*, Polity Press, 2017, especially pp. 1-26, 66-71.

11) Stern, N. *Why Are We Waiting? The Logic, Urgency, and Promise of Tackling Climate Change*, MIT Press, 2015.

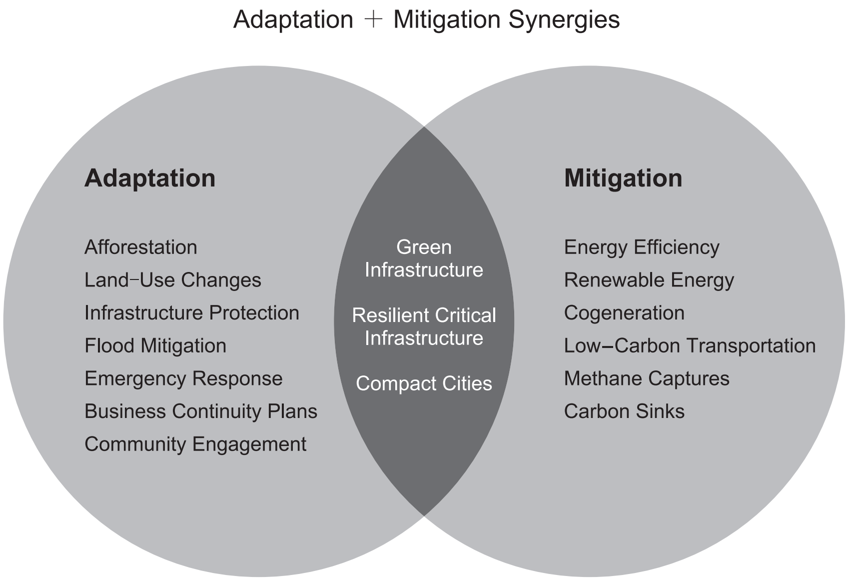
12) For example, Skelton A. and Julian Allwood, "The carbon price: a toothless tool for material efficiency?" *Philos Trans A Math Phys Eng Sci.*, June 2017.

13) See eg, Dietsche, E. "New industrial policy and the extractive industries," WIDER Working Paper 2017/161, United Nations University World Institute for Development Economics Research, August 2017.

14) DeWit, A. "Japan: Response of policy entrepreneurs to an energy crisis," in (Patrice Geoffron, Lorna Greening, Raphael Heffron eds) *Meeting the Paris mandate: A cross-national comparison of energy policy-making*. Springer-Verlag (forthcoming, 2018).

1.7 trillion in annual climate-resilient infrastructure investments in the face of mounting disasters[15].

Abundant evidence indicates the potentially decarbonizing impact of state-fostered resilient adaptation, coordinated at the national level. For example, compact cities and green infrastructure are inherently mitigating as well as robust in the face of mounting risks of flood, fire and other disasters[16]. So too are smart distributed energy networks that are growing from within vulnerable, carbon-intensive conventional power and heating systems[17]. Hence, this research will include in-depth analysis of integrated planning to promote resilient, compact and decarbonizing communities and critical infrastructure[18].



Source: adapted from Winkelman[19]

Figure 1 The Intersection of Adaptation and Mitigation Strategies

15) The number is taken from *Meeting Asia's Infrastructure Needs*, Asian Development Bank, 2017: http://www.preventionweb.net/files/53939_specialreportinfrastructure.pdf

16) See eg Bay J. and S. Lehmann (eds) *Growing Compact: Urban Form, Density and Sustainability*, Routledge, 2017.

17) This development is outlined in *The Utility of the Future*, MIT Energy Initiative, 2016: https://energy. mit.edu/wp-content/uploads/2016/12/Utility-of-the-Future-Full-Report.pdf

18) Similar work includes Kwok, S. and Watanabe, C. *From Compact City to Smart City: A Sustainability Science & Synergy Perspective*, Journal of Environmental Science and Engineering A 6, 2017: http://www.davidpublisher.org/Public/uploads/Contribute/5962f22d0f424.pdf

19) Winkelman, S. "Green Resilience: Adaptation + Mitigation Synergies," Center for Clean

This paper asserts that it is possible to achieve synergies by smart adaptation and mitigation. This claim is not original, as there have been efforts to enhance such synergies by breaking down siloes[20). **Figure 1** illustrates several of these synergistic outcomes. The figure indicates that the nexus between conventional adaptation (eg, afforestation, flood counter-measures, emergency response) and mitigation (eg, energy efficiency, renewable energy deployments, and modal shifts in transportation) strategies can be synergistic. These synergistic outcomes include — but are not limited to — the green infrastructure, resilient critical infrastructure, and compact city initiatives illustrated at the intersection of the Venn diagram.

All countries have multiple reasons for mitigating climate change as well as adapting to the accelerating hazards that appear unavoidable in the coming decades of the Anthropocene. These latter include risks of global food-supply shocks and military conflict. The "threat multiplier" effect of climate change is indeed already evident and hence recognized as such by the US military and the North Atlantic Treaty Organization (NATO)[21)].

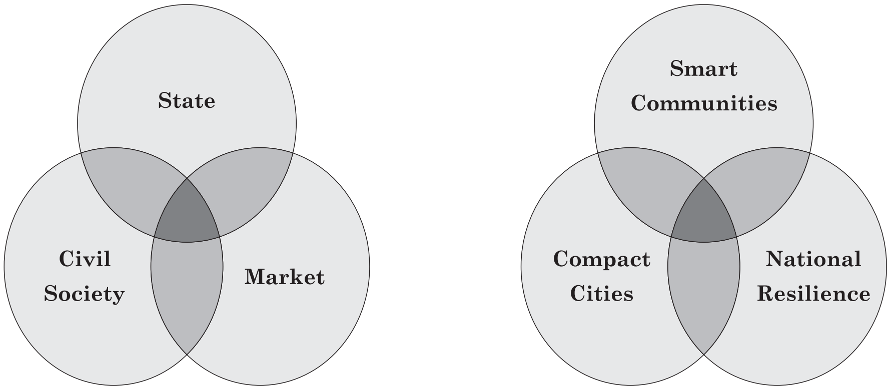
Japan is therefore not alone in possessing ample reasons to address climate change. But this paper argues that Japan has an especially potent set of incentives to do so, and that these incentives dovetail with the country's sobering demographic, fiscal, energy insecurity and other challenges. And driven by these incentives, coupled with period crises (such as the March 11, 2011 natural and nuclear disasters in

---

Air Policy, December 21, 2016: https://www.ctc-n.org/sites/www.ctc-n.org/files/ctcn_ccap_webinar_green_resilience_adaptation_mitigation_synergies.pdf

20) For example, Laurikka, H. Synergies Between Mitigation and Adaptation Exist in Several Sectors, SDG Knowledge Hub, March 12, 2013: http://sdg.iisd.org/commentary/guest-articles/synergies-between-mitigation-and-adaptation-exist-in-several-sectors/, Rizvi, A. R., Baig, S., Barrow, E., Kumar, C. (2015). *Synergies between Climate Mitigation and Adaptation in Forest Landscape Restoration.* Gland, Switzerland: IUCN, 2015: https://portals.iucn.org/library/sites/library/files/documents/2015-013.pdf, Locatelli, B., Fedele, G., Fayolle, V., Baglee, A., "Synergies between adaptation and mitigation in climate change finance," *International Journal of Climate Change Strategies and Management*, Vol. 8 Issue: 1 2016: https://doi.org/10.1108/IJCCSM-07-2014-0088

21) On these agencies' assessments, see Nuccitelli D. "NATO joins the Pentagon in deeming climate change a threat multiplier," *Bulletin of the Atomic Scientists*, May 25, 2017: https://thebulletin.org/nato-joins-pentagon-deeming-climate-change-threat-multiplier10790. See also Causevic, A. "Climate Change and NATO: A New Study," The Center for Climate & Security, October 4, 2017: https://climateandsecurity.org/2017/10/24/climate-change-and-nato-a-new-study/



Source: Author.

Figure 2 Agency and Policy Regimes in Building Japanese Resilience

Tohoku; hereafter 3-11), Japan is indeed taking action.

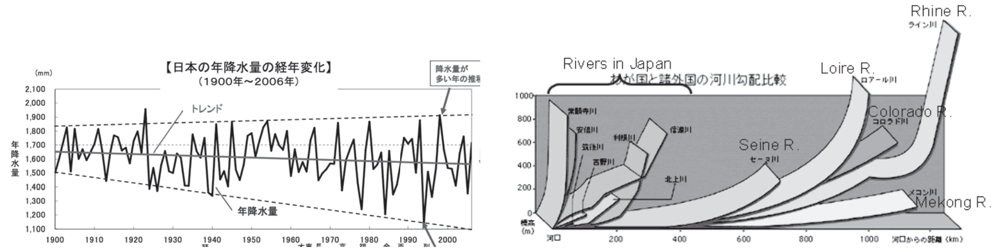
Figure 2 is one means to visualize what Japan is doing. This paper will demonstrate that Japan has built a comparatively well-integrated coordination among state agencies, market players, and civil society. Further, it will argue that this coordination is especially pronounced in policies relating to smart communities, compact cities and national resilience. It will, in addition, show that the most crucial area of overlap among these policies regimes is critical infrastructure, especially energy-related infrastructure.

As noted, Japan has ample incentives to implement policy coordination. **Figure 3** illustrates a potent and worsening threat that Japanese policymakers simply cannot ignore. This figure is one indicator of what the end of the Holocene and onset of the Anthropocene means for Japan's built and natural environments. It also shows why integrated, robust industrial policy is required to confront climate change. The figure highlights the increasing variation in Japan's annual rainfall from 1900 to 2006, which has continued to accelerate in recent years. And note Japan's short and steep rivers, compared to the Seine, Rhine, Mekong and other major global rivers in the right-hand section of the figure. Japanese rivers' short length and steep pitch derive from the fact that the country is quite narrow (no point in Japan is more than 150 kilometers from the sea) and quite mountainous. Moreover, Japan receives roughly twice the global annual average of rainfall, all of which makes Japanese rivers are more like waterfalls during the country's seasonal bouts of concentrated rainfall.

In addition, the flood risk, always present in Japan, is also rapidly worsening.

Japan Confronts the Anthropocene

Japan's Increasing Variation in Rainfall, 1900-2006 | **Japan's Short and Steep Rivers are "Waterfalls"**



Source: adapted from MHLW, nd[22] and MLIT, nd[23].

Figure 3 The End of Stationarity in Japan

It is useful to recall that the Meiji-era state-building elite brought over Dutch hydrologist Johannes de Rijke, in 1873. Upon seeing the Joganji River in Toyama Prefecture, de Rijke reportedly exclaimed that "rivers in Japan are like waterfalls[24]." That remark was made back in the Holocene era, and the dramatically increasing variation in annual rainfall displayed in **figure 3** indicates that the Japan's hydrologic challenges have worsened greatly with the onset of the Anthropocene.

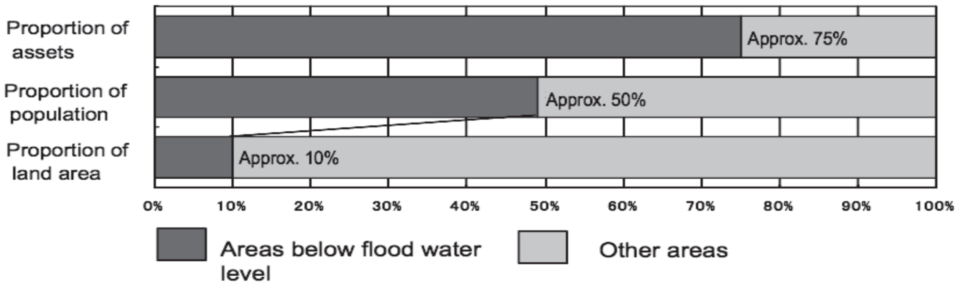
Figure 4 places these hydrological facts in perspective. As is well known, roughly 70 percent of Japan is mountainous, with half the population and three-quarters of the assets concentrated into the 10 percent of land that is coastal flood plains. The topography of Tokyo is particularly fraught. The figure shows that the levels of the Sumida, Ara (in the figure, "Arakawa"), Edo and other rivers that run through Tokyo are already considerably higher than their surrounding districts. As sea levels continue to rise and bouts of intense rain become more common, the threat of catastrophic flooding correspondingly increases.

Another reason Japan has to act in the Anthropocene is that it is dangerously

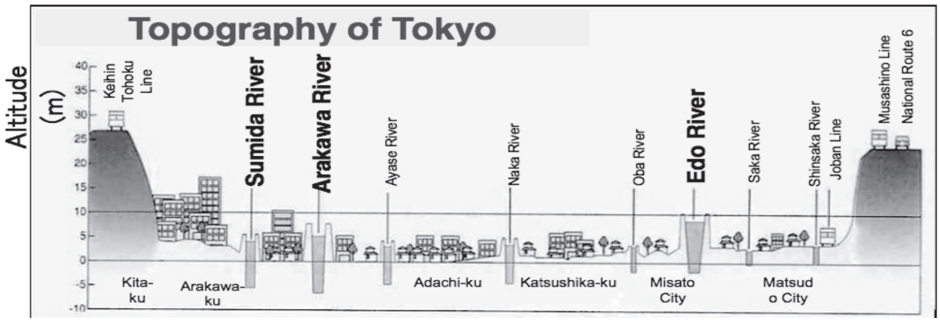
22) See Ministry of Health, Labour and Welfare (Japan), "Overview of water supply services," Diagram 1 "Rivers around the world," (no date): http://www.mhlw.go.jp/english/policy/health/water_supply/1.html#

23) See figure in Ministry of Land, Infrastructure, Transport and Tourism, Japan, (in Japanese), "Nature energy is greatly increasing," (no date): https://www.cgr.mlit.go.jp/cginfo/syokai/busyo/kasen/damunosikumi/pdf/p01-02.pdf

24) On Johannes de Rijke's comment, see Asian Disaster Risk Reduction Center (ADRC), "Rivers in Japan 1998" : http://www.adrc.asia/management/JPN/RIVERS%20IN%20JAPAN%201998.html



Source: Japan Rivers, Learning to Live with River CIA The World Fact book



Source: adapted from Atsumi, 2009[25].

Figure 4 Tokyo's Flood Risk

dependent on fossil fuels. The consumption of these energy resources is not only the primary driver for the end of the Holocene era[26], but also poses multiple other risks for resource-poor Japan.

Figure 5 shows the change in Japan's energy self sufficiency in comparative perspective for the years 2000 and 2016. These data measure primary energy as opposed to merely electricity, which is generally only 30 percent of all energy inputs. Most transport, industrial processes and the like rely on liquid or solid fuels rather than electricity, which is thus a secondary energy source (or "energy carrier") because it

25) See Atsumi, M. "River management in Japan," River Bureau, Ministry of Land, Infrastructure, Transport and Tourism, Japan, January 2009: https://www.mlit.go.jp/river/basic_info/english/pdf/conf_05.pdf

26) On the role of fossil fuels, see Zalasiewics, J. et al. "The New World of the Anthropocene," in *Environ. Sci. Technol.* 2010, 44: http://pubs.acs.org/doi/pdfplus/10.1021/es903118j. A recent book-length treatment of fossil-fuels' role is available in Austin, G. (ed) *Economic Development and Environmental History in the Anthropocene: Perspectives on Asia and Africa*. New York, Bloomsbury Academic, 2017.

Japan's Energy Vulnerability

	Self Sufficiency (2000)	Self Sufficiency (2016) China/India=2015	Primary Nationally Produced Resources
U.S.	73%	88%	Natural Gas Coal, Petroleum
U.K.	74%	67%	Petroleum
Germany	40%	37%	Coal
France	52%	54%	Nuclear Power
China	98%	84%	Coal
India	80%	65%	Coal
Japan	20%	**8%**	None

Source: IEA Energy Balances 2017 ＊Japan's self sufficiency ratios estimated by Agency for Natural Resources and Energy

Source: ANRE, 2017[27].

Figure 5 Japan's Energy Self Sufficiency in Comparative Perspective, 2000–2010

is a means of moving energy in a useable form one point (eg, the generation facility) to another (eg, the site of consumption)[28]. In Japanese usage, energy self sufficiency measures the share of domestically produced energy, including hydro and other renewable energy along with nuclear power[29]. As is evident from the figure, in 2000 Japan's self sufficiency was lowest among its peer countries in the industrialized world as well as its increasingly large neighbours China and India. Moreover, in 2016, Japan's self sufficiency had declined to a striking low level of only 8 percent. This number was far less than the next lowest level of 37 percent self sufficiency in Germany.

The right-hand column of **figure 5** also indicates that Japan lacks the relatively abundant domestic energy resources that underlie its peers' comparatively high levels

27) ANRE, "Resources, Geopolitics, and National Strategies," Agency for Natural Resources and Energy Ministry of Economy, Trade and Industry, September 29th, 2017: http://www.enecho.meti.go.jp/committee/studygroup/ene_situation/002/pdf/002_008_01.pdf

28) On this crucial difference between primary and secondary energy, see US EIA, "What are secondary energy sources?," US Energy Information Administration (no date): https://www.eia.gov/energyexplained/?page=secondary_home

29) Whether Japan's nuclear power is in fact a domestic source is open to question. The uranium fuel (and its by-products) used in Japan's nuclear reactors is ultimately an imported commodity. But the Japanese energy authorities deem nuclear energy production a domestic energy source. This paper draws on their data without necessarily agreeing that nuclear power is a completely domestic resource.

of self sufficiency. The implications of this are clear: Japan is extremely vulnerable to supply, price and other shocks in energy. And though conventional economics generally treats energy as just another commodity, it is in fact the "master resource[30]." Energy is essential for every other sphere of economic activity, including mobility, resource extraction, material production, and virtually all household consumption. Japan's low self sufficiency in energy renders it uniquely exposed to disruptive events.

Figure 6 further details Japan's vulnerability. This is because Japan's import reliance on the two most critical fossil fuels, petroleum and gas, is generally much higher than its peer countries. Japan imports 99 percent of its oil and 98 percent of its gas (meaning natural gas in the form of liquefied natural gas, or LNG). In addition, Japan is very dependent on the increasingly unstable Middle East region for supplies of these fuels. Japan's high reliance on Saudi Arabia in particular is a matter of concern, since in the latter part of 2017 the Saudi state has become increasingly unstable[31]. Making matters even worse, the figure's right-hand columns show that Japan's imports are via tanker transport. The Japanese archipelago lacks any pipeline connections to neighbouring countries (it also lacks any external power grid connections). Such infrastructure networks are not a guarantee of security, as they can be attacked by enemies as well as used to apply diplomatic pressure[32]. Yet external energy networks can also help alleviate isolation and foster supply-sharing as well as reduce the sobering geopolitical risk of shipping crucial energy commodities through dangerous "choke points" such as the straits of Hormuz and Malacca[33].

Table 1 offers greater detail on Japan's primary energy supply and its component shares for the period 2010 to 2016, including estimates for 2017 and 2018. As can be seen from the table, the primary energy supply (measured in millions of tons of

---

30) On the critical role of energy, see Day, J.W. and C. Hall "Energy: The Master Resource," in Day, J.W. and C. Hall, *America's Most Sustainable Cities and Regions Surviving the 21st Century Megatrends,* Springer, 2016, pp. 167-216.

31) On Saudi Arabia's increasing turmoil, see Lippman, T.W. "The End of Saudi-Style Stability," Middle East Institute, November 9, 2017: http://www.mei.edu/content/end-saudi-style-stability

32) On these matters, see Vladimirov M.and De Jong S. Deciphering Gazprom's Pipeline Agenda in Europe, The Atlantic Council, March 14, 2017: http://www.atlanticcouncil.org/blogs/new-atlanticist/deciphering-gazprom-s-pipeline-agenda-in-europe

33) A detailed discussion of choke points and their risks can be found in US EIA, "World Oil Transit Chokepoints," US Energy Information Administration, July 25, 2017: https://www.eia.gov/beta/international/regions-topics.cfm?RegionTopicID=WOTC

	Petroleum				Gas			
	Import Reliance	% Middle East	Largest Importer		Import Reliance	% Middle East	Largest Importer	
U.S.	41%	8%	15% Canada	Connected via Pipeline	2%	0%	3% Canada	Connected via Pipeline
U.K.	22%	1%	12% Norway	Connected via Pipeline	46%	10%	32% Norway	Connected via Pipeline
Germany	96%	4%	37% Russia	Connected via Pipeline	90%	0%	44% Russia	Connected via Pipeline
France	97%	25%	15% Saudi Arabia	Tanker Transport *Connected via European Pipeline	99%	2%	40% Norway	Connected via Pipeline
China	61%	31%	9% Saudi Arabia	Tanker Transport *Connected via pipeline to Russia etc.	29%	4%	15% Turkmenistan	Connected via Pipeline
India	83%	46%	15% Saudi Arabia	Tanker Transport *No pipeline	40%	25%	22% Qatar	Tanker Transport *No pipeline
Japan	**99%**	**85%**	37% Saudi Arabia	Tanker Transport *No pipeline	**98%**	**23%**	28% Australia	Tanker Transport *No pipeline

Source: Produced by Agency for Natural Resources and Energy from IEA/Energy balances etc. ＊Data for China and India is from 2015
Source: ANRE, 2017[34].

Figure 6 Japan's Import Reliance in Comparative Perspective, 2016

oil equivalent, or Mtoe) has fallen from 514.7 Mtoe in FY 2010 (meaning April 1 to March 31 of 2010-2011) to 465.6 in FY 2016. This decline is expected to continue through to FY 2018, primarily because of increasing efficiency. The greatest share of primary energy is shown to be the fossil fuels of oil, gas and coal. In FY 2014, these three fuels composed fully 94.7 percent of Japan's primary energy, much higher than the 87.5 percent level in China and 82.9 percent in the US for the same year[35].

Table 1 makes a number of assumptions about Japan's energy future. One is that the number of nuclear reactors in operation will roughly double, from 5 (in November 2017) to 10 in FY 2018. The IEEJ assume that this increase in the role of nuclear energy will play a large role in raising the country's rate of self sufficiency to just over 10 percent.

Table 2 provides an overview of Japan's power mix and production for the period from 1970 through to 2014. The data show the massive expansion in Japan's gen-

34) ANRE, "Resources, Geopolitics, and National Strategies," Agency for Natural Resources and Energy Ministry of Economy, Trade and Industry, September 29, 2017: http://www.enecho.meti.go.jp/committee/studygroup/ene_situation/002/pdf/002_008_01.pdf

35) For these data, see the relevant figure on comparative reliance on fossil fuels in ANRE, (in Japanese) "The Energy Problems Confronting Japan," Agency for Natural Resources and Energy Ministry of Economy, Trade and Industry, July 21, 2017: http://www.enecho.meti.go.jp/about/special/johoteikyo/energyissue.html

Table 1　Japan's Energy Consumption, 2010-2018

		Historical				Projections		Year-to-year changes		
		FY2010	FY2014	FY2015	FY2016	FY2017	FY2018	FY2016	FY2017	FY2018
Energy	**Primary energy supply (Mtoe)[1]**	**514.7**	**473.9**	**467.0**	**465.6**	**465.4**	**462.4**	**−0.3%**	**−0.1%**	**−0.6%**
	Oil[2] (GL)	**232.3**	**217.1**	**211.7**	**205.4**	**198.3**	**193.0**	**−2.9%**	**−3.5%**	**−2.7%**
	Natural gas[2] (Mt of LNG equiv.)	**73.3**	**90.5**	**86.0**	**88.1**	**85.3**	**83.4**	**2.5%**	**−3.2%**	**−2.2%**
	LNG imports (Mt)	70.6	89.1	83.6	84.7	82.1	80.3	1.4%	−3.1%	−2.3%
	Coal[2] (Mt)	**184.7**	**190.0**	**190.2**	**188.0**	**188.2**	**188.8**	**−1.1%**	**0.1%**	**0.3%**
	Nuclear (TWh)	**288.2**	**0.0**	**9.4**	**18.1**	**55.6**	**65.6**	**91%**	**208%**	**17.9%**
	Hydro (TWh)	**84.3**	**83.8**	**87.4**	**80.1**	**80.1**	**80.1**	**−8.4%**	**0.0%**	**0.0%**
	Other renewables[3] (TWh)	**63.9**	**87.6**	**99.7**	**109.7**	**118.9**	**127.3**	**10.1%**	**8.3%**	**7.1%**
	Final energy consumption[4] (Mtoe)	**342.1**	**315.9**	**311.4**	**311.4**	**309.9**	**307.6**	**0.0%**	**−0.5%**	**−0.8%**
	Industry[5]	**159.3**	**149.2**	**147.2**	**146.6**	**146.7**	**145.9**	**−0.4%**	**0.1%**	**−0.5%**
	Buildings	**100.2**	**89.9**	**87.2**	**88.7**	**88.0**	**87.3**	**1.7%**	**−0.7%**	**−0.8%**
	Transport	**82.5**	**76.8**	**76.9**	**76.1**	**75.2**	**74.3**	**−1.1%**	**−1.1%**	**−1.2%**
	Petroleum products	**177.6**	**159.4**	**158.9**	**156.5**	**154.1**	**151.3**	**−1.5%**	**−1.6%**	**−1.8%**
	Natural gas and city gas	**34.5**	**34.6**	**34.1**	**35.1**	**35.5**	**35.7**	**3.1%**	**1.1%**	**0.6%**
	Coal and coal products	**36.7**	**36.0**	**33.7**	**33.6**	**33.9**	**34.1**	**−0.3%**	**0.9%**	**0.6%**
	Electricity	**89.8**	**82.7**	**81.6**	**83.1**	**83.4**	**83.4**	**1.8%**	**0.4%**	**0.0%**
	Electricity sales[6] (TWh)	**(926.6)**	**(851.4)**	**(837.5)**	**853.9**	**857.7**	**857.7**	**n.a.**	**0.4%**	**0.0%**
	City gas sales[7] (Billion m^3)	**39.28**	**40.16**	**39.91**	**41.53**	**41.93**	**42.19**	**4.1%**	**1.0%**	**0.6%**
	Fuel oil sales (GL)	**196.0**	**182.7**	**180.5**	**176.8**	**173.9**	**171.0**	**−2.1%**	**−1.6%**	**−1.7%**
	Energy-related CO_2 emissions[4] (Mt)	**1,139**	**1,189**	**1,149**	**1,136**	**1,113**	**1,096**	**−1.1%**	**−2.0%**	**−1.6%**
	(FY2013=100)	92.2	96.3	93.0	92.0	90.1	88.7	—	—	—
Prices	**Crude oil, import, CIF ($/bbl)**	**84**	**89**	**49**	**48**	**51**	**52**	**−2.5%**	**7.2%**	**0.8%**
	LNG, import, CIF ($/t)	**584**	**797**	**452**	**363**	**399**	**395**	**−19.8%**	**10.0%**	**−1.0%**
	($/MBtu)	11.3	15.3	8.7	7.0	7.7	7.6	—	—	—
	Steam coal, import, CIF ($/t)	**114**	**93**	**76**	**81**	**93**	**87**	**6.8%**	**14.7%**	**−6.5%**
	Coking coal, import, CIF ($/t)	**175**	**109**	**88**	**110**	**121**	**101**	**25.8%**	**9.7%**	**−16.9%**
Economy	**Nominal GDP (JPY trillion)**	**499.2**	**517.7**	**531.8**	**537.5**	**545.1**	**553.4**	**1.1%**	**1.4%**	**1.5%**
	Real GDP (JPY trillion)	**492.8**	**510.3**	**516.6**	**523.0**	**530.5**	**536.6**	**1.2%**	**1.4%**	**1.1%**
	Industrial production (CY2010=100)	**99.4**	**98.4**	**97.5**	**98.6**	**101.1**	**102.5**	**1.2%**	**2.6%**	**1.3%**
	Exchange rate (JPY/$)	**86.1**	**109.2**	**120.4**	**108.4**	**114.8**	**115.0**	**−9.9%**	**5.8%**	**0.2%**

Notes：
1．Mtoe＝10^{13}kcal
2．Conversion factors for Oil: 9,126kcal/L; Natural gas: 13,043kcal/kg; Steam coal: 6,139kcal/kg; Coking coal: 6,928kcal/kg until FY2012.
Conversion factors for Oil: 9,145kcal/L; Natural gas: 13,141kcal/kg; Steam coal: 6,203kcal/kg; Coking coal: 6,877kcal/kg since FY2013.
3．Excluding large hydro 30MW or more
4．Estimated actual value for fiscal 2016
5．Industry includes non-energy use.
6．Figures in parentheses are old statistical figures.
7．Conversion factor: 1m^3＝10,000kcal
Source: IEEJ, 2017[36)].

eration capacity, from 57.5 gigawatt equivalent (GWe) in 1970 to 234.03 GWe in 2014. As is clear from the table, the role of nuclear increased most, going from 1.32 GWe

36) See IEEJ, "Economic and Energy Outlook of Japan through FY2018," The Institute of Energy Economics Japan, July 25, 2017, Table 1, p. 4: http://eneken.ieej.or.jp/en/press/press170725.pdf

Table 2 Japan's Power Generation Capacity and Production, 1970–2014

								Average annual growth rate (%)
	1970	1980	1990	2000	2005	2010	2014*	2000 to 2014*
Capacity of electrical plants (GWe)								
—Thermal	36.91	80.77	104.09	138.16	139.22	135.07	143.78	0.29
—Hydro	18.81	28.54	36.32	44.85	45.67	43.85	45.40	0.09
—Nuclear	1.32	15.51	31.48	45.08	49.58	48.96	44.26	0.13
—Wind	—	—	—	0.00	0.00	0.09	0.03	—
—Geothermal	0.01	0.13	0.24	0.50	0.50	0.50	0.47	−0.44
—Other renewable	—	—	—	—	0.00	0.01	0.08	—
—Total	57.05	124.95	172.12	228.60	234.96	228.48	234.03	0.17
Electricity production (TW.h)								
—Thermal	216.7	317.7	446.6	526.9	581.6	553.3	717.8	2.2
—Hydro	72.5	84.5	88.1	89.3	79.8	74.2	70.3	−1.7
—Nuclear	4.6	82.0	201.4	321.3	304.8	288.2	0.0	−100.0
—Wind	—	—	—	0.0	0.0	0.1	0.0	—
—Geothermal	0.1	0.9	1.5	3.1	3.0	2.5	2.4	−1.8
—Other renewable	—	—	—	—	0.0	0.0	0.1	—
—Total**	293.9	485.5	737.6	940.7	969.1	918.2	790.6	−1.2
Total electricity consumption (TW.h)***	355.0	575.1	862.0	1,080.0	1,117.4	1,134.8	1,047.9	−0.2

＊ Latest available data (fiscal year)
＊＊ Electricity transmission losses are not deducted.
＊＊＊ Total electricity consumption is based on the "General energy Statistics", which includes electricity own-use by autoproducers and electricity transmission losses.
Source: IAEA, 2016[37].

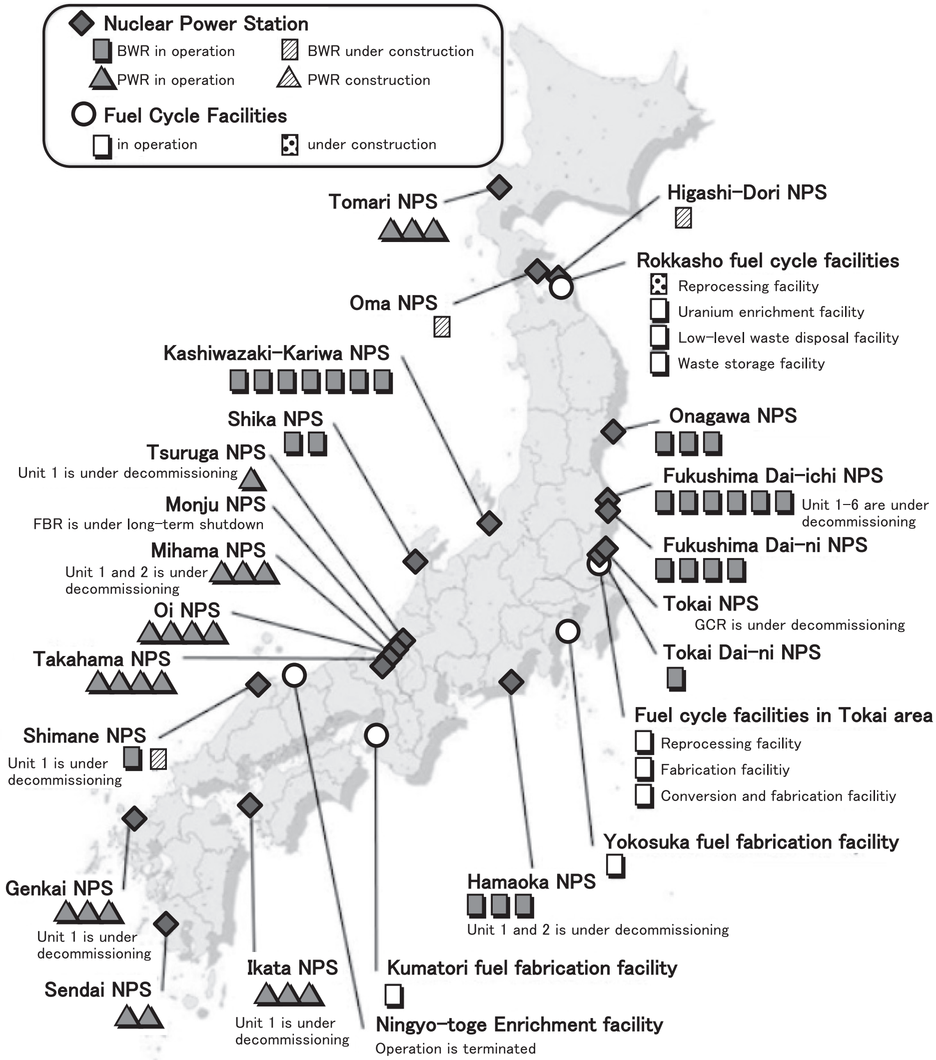
of capacity in 1970 to 44.26 GWe in 2014 (this latter number was a significant decline from 2010 due to the loss of the Fukushima reactors in 2011). The next largest expansion of capacity was recorded in thermal (coal, oil and LNG), followed by increased hydro capacity.

Table 2's numbers for power generation also show that Japan sought to displace the role of fossil fuels by nuclear. The loss of nuclear capacity after the March 11, 2011 disasters in Tohoku was followed by a dramatic increase in thermal power production. Thermal power production thus increased from 553.5 terrawatt hours (TWh)[38] in 2010 to 717.8 TWh in 2014.The increase was dramatic in spite of a drop in overall power consumption from 1,134.8 TWh in 2010 to 1,047.9 TWh in 2014.

Figure 7 provides an overview of Japan's nuclear facilities. The International Atomic Energy Association (IAEA), which produced the figure, uses a rather confusing designation of power stations "in operation" to refer to Japan's viable nuclear reactors. The figure does note that the Fukushima Dai-ichi reactors and several others

37) See IAEA, "Country Nuclear Power Profiles 2016 Edition: Japan," The International Atomic Energy Association, Table 5: http://eneken.ieej.or.jp/en/press/press170725.pdf

38) Table 2 uses the abbreviation "TW.h," but this paper uses the more standard abbreviation "TWh."



Source: IAEA, 2016[39].

Figure 7 Japan's Nuclear Facilities, 2016

are "under decommissioning," but does not differentiate the 5 that are actually in operation from those that remain off-line. The reactors currently (November 2017) operating are one at Ikata, two at Sendai, and two units at Takahama.

It is true that twelve reactors (at six separate plants) have passed safety inspections, including two at the Kashiwazaki Kariwa plant (the world's largest). Yet

39) See IAEA, "Country Nuclear Power Profiles 2016 Edition: Japan," The International Atomic Energy Association, Figure 2: http://eneken.ieej.or.jp/en/press/press170725.pdf

putting them back on-line is fraught with political and legal hurdles. Moreover, even the Nuclear Regulation Authority's (NRA) new Chairman, Fuketa Toyoshi, is willing to go on record that the slow pace of inspections will not be accelerated. Fuketa concedes that the NRA has considerable accumulated experience in conducting safety checks, but points out that seismic and other risks require thorough inspections. He made it clear to the press that he simply could not forecast the number of reactors that would be approved over the coming five years[40]. Hence the IEEJ's estimate that 10 reactors will be in operation by 2018 is simply a guess.

Table 1 also shows that the IEEJ assumes that non-hydro renewable energy will only double in output between 2010 and 2018, increasing from 63.9 TWh to 127.3 TWh. The same table also assesses the share of hydro to decline over the same period, dropping for 84.3 TWh in 2010 to 80.1 TWh in 2018. Given the geopolitical and other risks of relying on fossil fuels, these numbers indicate either inertia in the energy economy and its governance or difficulty in assessing what Japan is doing.

It is certainly the case that Japanese deployments of alternative energy have been less than optimistic forecasts that followed the 3-11 disaster. The International Energy Agency's (IEA) October 2017 report *Renewables 2017: Analysis and Forecasts to 2022* is rather pessimistic about Japan's present and future role as a site non-hydro renewable energy as well as hydro.

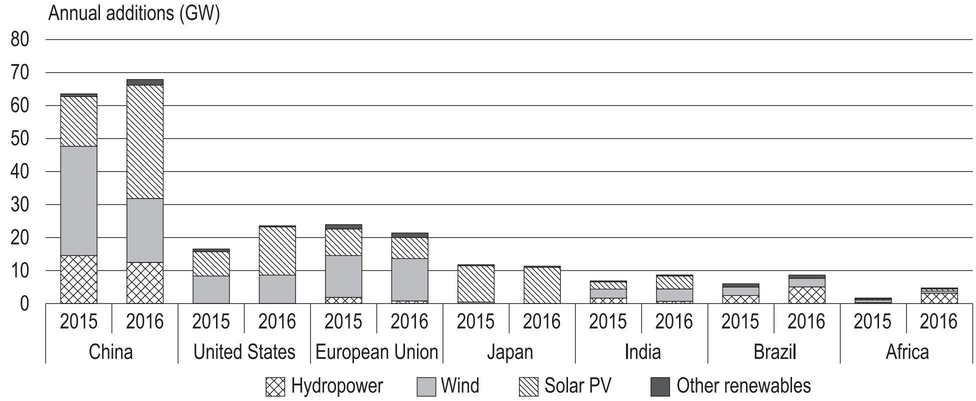
The IEA's data show that Japan's capacity additions have been slowing down. **Figure 8** shows that Japan's capacity additions for 2015 and 2016 are almost entirely solar power, and that they dropped from just over 10 GW in 2015 to roughly 8 GW in 2016.

Moreover, capacity additions do not equate with generation. The reason is that solar and wind power generation totals in Japan are at best, respectively, 12 percent and 20 percent of their rated capacity. As in all countries, solar panels do not generate power at night or inclement weather. And wind turbines often do not generate energy due to insufficient wind speeds.

The IEA undertakes comparative studies on average generation capacity factors (meaning the percentage of energy output versus rated capacity). Its survey of output between 2008-2012 indicates that Japan's aggregate figure for both solar and wind is 15 percent, far less than the 27 percent recorded for the United States, the 26 percent

---

40) On this, see Tsukimori O. and A. Sheldrick, "Japan nuclear regulator says restart approval pace unlikely to speed up," *Reuters News*, November 7, 2017.



Source: 2015 capacity data for OECD countries based on IEA (2017d), *Renewables Information 2017,* www.iea.org/statistics/.
Source: IEA, 2017[41].

Figure 8 Renewable Capacity Additions in 2015 and 2016

seen in Canada, and the 18 percent figure for China[42]. Japan's performance in this regard is not especially poor, but rather about average. Better technology, siting and other factors may raise Japan's average generation capacity factors in the future, but at present the difference between the gross figures on capacity additions and actual output is very great.

The IEA's projections for the future of Japanese renewables is also not very optimistic. The pessimism holds when compared against Japan's peer countries in addition to Japan's desperate need for alternatives to fossil fuels and nuclear.

Table 3 reveals that between 2017 and 2022, Japan is expected to rank low in the deployment of non-hydro renewable and hydro. In solar, Japan is slated to only fourth (20.5 GW) and in bioenergy (2.6 GW) only third. In no other technology is Japan forecast to rank among the global top 5.

Figure 9 displays Japan's poor prospects in a more comparative light. Japan's solar and wind provided about 5 percent of total power generation in 2016, higher than India and not far from the total recorded for China, the global leader in renewables. But by 2022, Japan share of solar and wind power generation (ie, not just capacity, but actual output) is assessed as remaining well below 10 percent of total

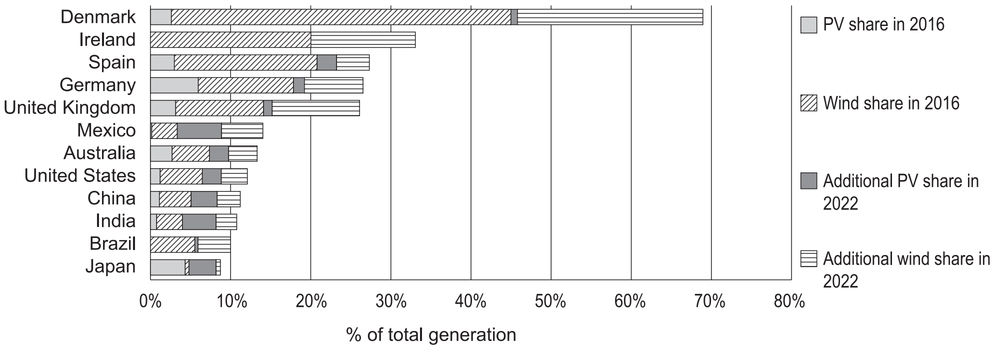
41) IEA, *Renewables 2017: Analysis and Forecasts to 2022*, International Energy Agency, October 2017, p. 22, Figure 1.5.

42) IEA, "Electric generator capacity factors vary widely across the world," International Energy Agency, September 8, 2015: https://www.eia.gov/todayinenergy/detail.php?id=22832

Table 3 Top 5 Countries for Renewable Capacity Additions, 2017-2022

Solar PV	GW	Onshore wind	GW	Hydro	GW	Bioenergy	GW
China	182.4	China	120.0	China	42.2	China	8.1
United States	72.6	United States	48.3	Brazil	10.1	India	2.6
India	61.5	India	32.9	India	9.9	Japan	2.6
Japan	20.5	Germany	16.4	Ethiopia	4.8	United Kingdom	2.4
Mexico	10.3	France	6.8	Turkey	3.4	Brazil	1.9
Offshore wind	**GW**	**Geothermal**	**GW**	**CSP**	**GW**	**Ocean**	**MW**
China	7.5	Indonesia	1.1	China	2.7	France	99
United Kingdom	6.1	Philippines	0.5	Morocco	0.5	United Kingdom	33
Germany	2.8	Kenya	0.4	South Africa	0.5	Korea	8
Netherlands	2.5	Turkey	0.4	Chile	0.4	Canada	6
Denmark	1.6	New Zealand	0.3	Israel[1]	0.3	China	5

Note: GW=gigawatt; MW=megawatt. For further country-level forecasts, see online Excel workbook that accompanies this report at www.iea.org/publications/renewables2017/data.
Source: IEA, 2017[43].



Source: 2016 generation data for OECD countries based on IEA (2017b), *World Energy Statistics and Balances 2017*, www.iea.org/statistics/.
Source: IEA, 2017[44].

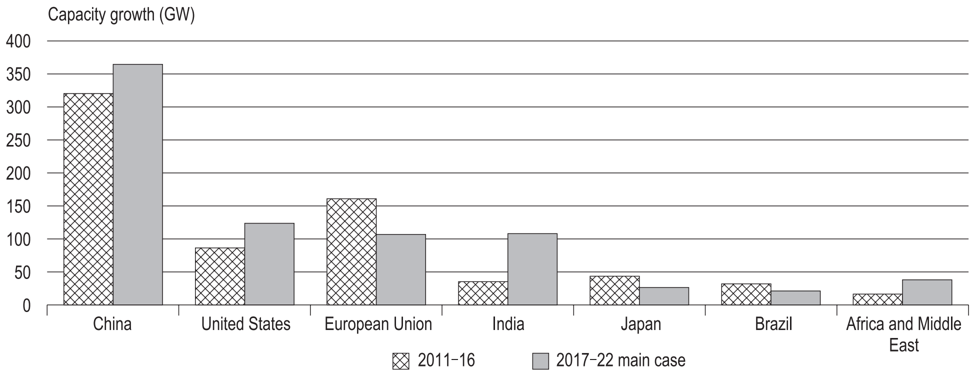
Figure 9 Wind and Solar Generation, 2016 and 2022

power generation. By contrast, all the other countries in the figure are expected to either meet or greatly exceed a 10 percent share.

Figure 10 shows the historical and projected net additions to renewable power capacity (ie, not output) for Japan and a select group of other countries and regions. Japan's capacity additions following the 3-11 disaster did indeed exceed numerous other countries and regions. But that is only to be expected, considering the scale of

43) IEA, *Renewables 2017: Analysis and Forecasts to 2022*, International Energy Agency, October 2017, p. 21, Table 1.1.

44) IEA, *Renewables 2017: Analysis and Forecasts to 2022*, International Energy Agency, October 2017, p. 32, Figure 2.4.



Source: Historical capacity data for OECD countries based on IEA (2017a), *Renewables Information 2017*, www.iea.org/statistics/.
Source: IEA, 2017[45].

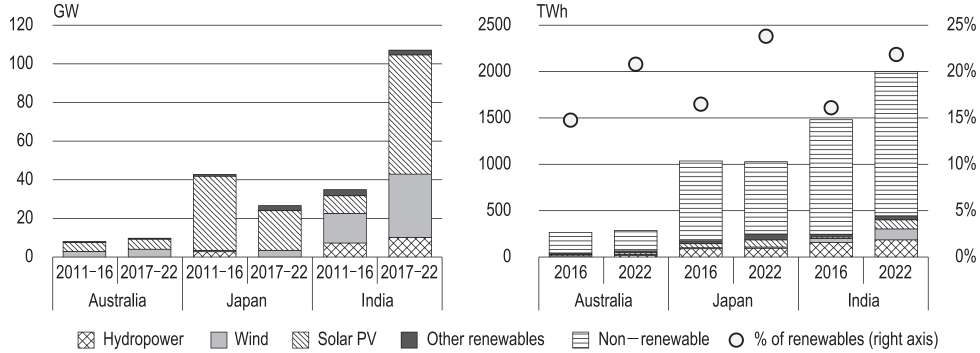
Figure 10 Net Additions to Renewable Power Capacity, 2011–2016 and 2017–2022

Japan's economy, the extent of the disaster's effects on the energy economy, and the need for alternatives. What is surprising is that Japan's capacity additions slow down so much when most other countries and regions in the figure are expected to add significantly to their stock of renewables.

Figure 11 suggests that in many respects Japan is poised to become a laggard even within its own region. The left hand of the figure shows renewable energy generation capacity growth for Australia, Japan and India for the period 2016 to 2022. The numbers include all renewables (solar, wind, geothermal, biomass, and others) in addition to conventional hydro. Japan is not expected to add appreciable amounts of non-solar and non-wind renewables. And the IEA would appear to agree with the IEEJ (whose forecast was reviewed in **table 1**) that Japan will not make significant deployments of hydro. Al the same, Japan is expected to outperform Australia, whose ample endowments of conventional resources (especially coal and gas) appear to be a disincentive to accelerated deployments of renewables. But expectations for India (over 100 GW) are nearly 5 times what Japan is slated to achieve.

Figure 11's right-hand side displays the same three countries' power output additions for all power sources. It shows that Japan, in 2016, leads Australia and India in terms of the percentage of renewable generation in the total power mix. Only in this regard is Japan expected to continue outperforming both Australia and India. By 2022, Japan is slated to achieve about 24 percent of renewable generation in its power

45) IEA, *Renewables 2017: Analysis and Forecasts to 2022,* International Energy Agency, October 2017, p. 33, Figure 2.5.



Source: Historical capacity data for OECD countries based on IEA (2017a), *Renewables Information 2017.* Historical generation data from IEA (2017b), *World Energy Statistics and Balances 2017,* www.iea.org/statistics/.
Source: IEA, 2017[46].

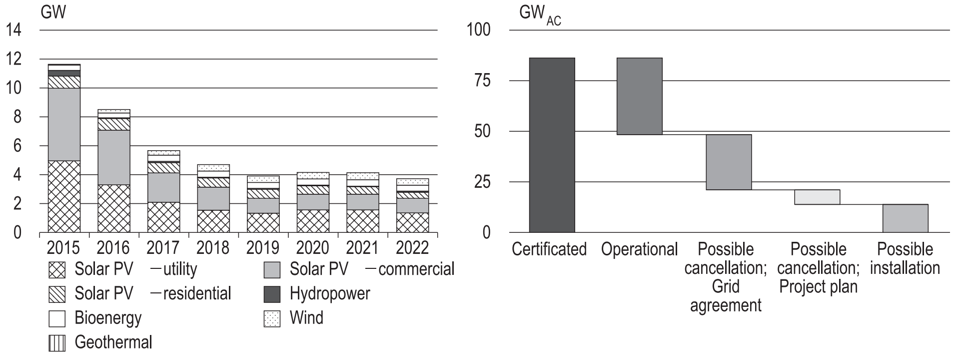
Figure 11 Asia-Pacific Renewable Electricity Growth, 2010-2022, and Generation by Source, 2016-2022

output, in spite of the prospect of considerable capacity additions of fossil fuel generation. Japan's level of renewable output is thus expected to remain ahead of India's, even though the latter is likely to deploy far more renewable capacity (as the left-hand side of the figure shows). Japan is expected to stay ahead of India because the latter is also forecast to deploy prodigious amounts of non-renewable generation (fossil fuel and nuclear).

One of the problems hindering Japan's deployment of renewable energy is uncertainty. The left-hand side of **figure 12** shows that the bulk of Japan's renewable deployment is utility and residential solar projects. Utility-scale projects are expected to comprise nearly half of all Japan's 9.6 GW in solar growth between 2017 and 2022. But ongoing policy changes have created a great deal of uncertainty for solar power, reflected in the right-hand side of **figure 12**. These policy changes include the introduction of an auction scheme in 2017, to replace the overly generous feed-in tariff (FIT) that had been in operation from July of 2012[47]. The figure shows that Japan has approved ("certificated") well over 80 GW of solar projects. But the IEA expects about

46) IEA, *Renewables 2017: Analysis and Forecasts to 2022*, International Energy Agency, October 2017, p. 43, Figure 2.11.

47) Concerning the problems with Japan's FIT, see Ninomiya Y. "Outlook for Renewable Energy Market," The Institute of Energy Economics 426th Forum on Research Work, July 25 2017: http://eneken.ieej.or.jp/data/7575.pdf



Notes: Right-hand figure represents operational status of solar PV as of December 2016; AC=alternating current.
Source: METI (2017b), *Statistics of Renewable Energy in the Feed in Tariff scheme;* METI (2017a), *Estimated solar PV cancellation with enforcement of revision of Feed in Tariff Act.* Historical capacity data for OECD countries based on IEA (2017a), *Renewables Information 2017,* www.iea.org/statistics/.
Source: IEA, 2017[48].

Figure 12 Japan's Net Renewable Capacity Additions, 2015–2022

48 GW of these projects to be cancelled due to lack of grid agreement and other reasons.

The risk of curtailment is indeed a major source of uncertainty. Though the Japanese electricity market is being deregulated, and aims at separation of generation from transmission, the legacy utilities still possess significant influence. One result of this influence has been the expansion of their regulated authority to deny renewable projects' access to the grid, citing the lack of transmission and other capacity to cope with intermittent power. The IEA emphasizes that curtailment has become a significant business risk in areas where renewable generation exceeds local demand[49]. This risk and other factors are why the right-hand side of **figure 12** includes 4 separate subcategories for solar, including 21 GW additional capacity expected to become operational by 2022.

Table 4 indicates that the IEA does expect appreciable increases in Japanese renewable deployment if grid curtailment and other barriers are reduced. The table poses two different scenarios for 2022: a "main" scenario wherein policy does not change greatly; and an accelerated ("Acc.") scenario in which significant favourable policy changes are made. As can be seen for the solar PV category in Japan, an accel-

48) IEA, *Renewables 2017: Analysis and Forecasts to 2022*, International Energy Agency, October 2017, p. 48, Figure 2.14.

49) IEA, *Renewables 2017: Analysis and Forecasts to 2022*, International Energy Agency, October 2017, p. 48.

Table 4 Asia-Pacific Main and Accelerated Policy Outcomes, 2016 and 2022

Total capacity (GW)	India			Japan			ASEAN			Australia		
	2016	2022 Main	2022 Acc.	2016	2022 Main	2022 Acc.	2016	2022 Main	2022 Acc.	2016	2022 Main	2022 Acc.
Hydropower	46.8	56.7	59.2	50.1	50.7	50.8	40.6	45.6	45.8	8.7	8.7	8.7
Bioenergy	6.0	8.6	10.3	3.1	5.7	6.9	6.4	9.5	10.1	0.8	1.2	1.2
Onshore wind	28.7	61.6	70.1	2.9	4.9	6.7	0.9	2.6	3.4	4.4	8.2	8.9
Offshore wind	—	—	—	0.1	0.5	0.6	0.1	0.6	0.6	—	—	—
Solar PV	9.0	70.5	90.8	42.0	62.5	79.4	4.2	10.1	13.6	5.2	10.2	10.8
CSP	0.2	0.3	0.3	—	—	—	0.0	0.0	0.0	0.0	0.2	0.2
Geothermal	—	—	—	0.5	0.6	0.6	3.4	5.0	5.2	0.0	0.0	0.0
Ocean	—	—	—	—	—	—	—	—	—	0.0	0.0	0.0
Total	**90.8**	**197.8**	**230.7**	**98.8**	**125.0**	**144.9**	**55.5**	**73.4**	**78.7**	**19.1**	**28.4**	**29.8**

Note: Acc. =accelerated. Rounding may cause non-zero data to appear as "0.0" or "-0.0". Actual zero-digit data is denoted as"-".
Source: IEA, 2017[50].

erated scenario results in roughly 17 GW of additional capacity compared to the main scenario. The IEA also projects a significant change for bioenergy and onshore wind deployments, whereas hydro barely changes. The result is that Japan's renewable deployment, under an accelerated policy regime, leads to 144.9 GW of additional capacity by 2022 versus the 125 GW of capacity addition forecast under continuation of current policy.

In short, the most authoritative forecasts see renewable energy as, at best, achieving a comparatively moderate role in Japan's power generation over the next five years. The forecasts are particularly pessimistic concerning the prospects for non-solar renewables, especially hydropower.

One major question is whether these forecasts are actually based on comprehensive assessments or are overlooking important evidence. One example would be the policy integration that is already shaping renewable energy and related elements important to Japan's strategy of mitigation and adaptation. This paper contends that the forecasts are indeed overlooking a great deal of evidence. For thing, Japan's MLIT has lots of dams used for flood control, and is planning to convert some of them to power generation. The MLIT and its advisors believe Japan's hydro output can be doubled or tripled from its current 9 percent of power. At the same time, the MLIT aims to bolster the dam network's role in flood control and stable water supply, linking the network advanced radar systems and supercomputers. This project, called the "Dam Revival Vision," was decided by MLIT on June 26 of 2017 and is funded in the

50) IEA, *Renewables 2017: Analysis and Forecasts to 2022*, International Energy Agency, October 2017, p. 52, Figure 2.6.

2018 fiscal requests. It is a clear example of Japan's adaptation-led maximization of synergies between mitigation and adaptation[51].

In order to explain in greater detail, we turn first to consider the policy background of Japan's smart communities. The argument being developed herein is that conventional analyses are overlooking the impact of policy integration on macro, meso and micro-level energy.

Japan's Smart Communities and Evolving Policy Integration

To be sure, the scale of Japan's smart community policies and projects remains little known or understood, even among experts on smart cities. The flagship "Japan Smart Community Alliance" (JSCA), a consortium of 258 firms (as of November 2, 2017) is remarkably poor at communicating, even in Japanese. The JSCA was established on April 6 of 2010 and declares (in Japanese and English) that its role is to promote smart communities in Japan and globally. It defines the smart community as "a community where various next-generation technologies and advanced social systems are effectively integrated and utilized, including the efficient use of energy, utilization of heat and unused energy sources, improvement of local transportation systems and transformation of the everyday lives of citizens[52]." This definition is virtually the same in English and Japanese, and has not changed to reflect the powerful role of disaster resilience following 3-11.

Nor has the JSCA Japanese-language listing of domestic microgrid projects[53] been updated to include the Higashi Matsushima City Smart Disaster Prevention Eco Town[54] and other recent projects[55]. The site includes no comprehensive list of smart

---

51) The details concerning the "Dam Revival Vision" are available (in Japanese) at the MLIT website: http://www.mlit.go.jp/report/press/mizukokudo05_hh_000029.html

52) The JSCA website is available (in Japanese) at the following internet website: https://www.smart-japan.org/index.html

53) The JSCA list of microgrid projects is available (in Japanese) at the following website: https://www.smart-japan.org/reference/l3/Vcms3_00000134.html

54) The Japanese press and other sources run ample material on the Higashi Matsushima City Smart Disaster Prevention Eco Town. See, for example, Kaneko, K. (in Japanese) "A Japanese First! Solar and Battery Storage via a Microgrid: Higashi Matsushima City Takes on the Challenge of Building Disaster-Resilient Community," *Nikkei BP,* August 5, 2016: http://techon.nikkeibp.co.jp/atcl/feature/15/415282/080200009/?ST=msb

55) These more recent projects include Panahome's microgrid-centred "Smart City Shioashiya"

communities. Its most recent Japanese-language publication on smart community projects dates back to May of 2015, and only includes a brief mention and truncated listing of the disaster-resilient projects that were adopted after 3-11[56]. This failure to provide up-to-date information is especially puzzling because Sekisui House, a member firm of the JSCA, was one of the prime contractors on the Higashi Matsushima City Smart Disaster Prevention Eco Town.

And as of this writing (November, 2017), the JSCA's most recent English-language material is a June 24, 2015 document "Smart Community: Japan's Experience[57]." This material is woefully out of date, and emphasizes the four flagship smart community projects of Kitakyushu City, Yokohama City, Toyota City, and the Keihanna cluster in Kyoto Prefecture. Like its Japanese version, described above, the translation neglects to include Higashi Matsushima in an incomplete list of post 3-11 projects that stress disaster resilience. The entire document is also replete with inexcusably poor English translations, such as the following: "Smart Community being addressed in Japan has the concept involving smart grid. Whereas smart grid refers to the state being smarter by information and communication technology ICT for electric power system, Smart Community is the effort of changing social system of a defined area into smarter state with technologies not only for electric power system but also for a variety of public infrastructure including heat supply, water and sewerage, transportation and communications[58]."

The above examples reflect shoddy governance in coordinating Japan's domestic and international communication of what its smart communities are and how 3-11 has changed them. The JSCA and its member firms, along with the New Energy and

---

in Hyogo Prefecture. On the project and its particulars, see (in Japanese) Panahome Implements a Project that Links Homes With a Power System in Hyogo's Ashiya," *Nihon Keizai Shimbun*, September 22, 2017: https://www.nikkei.com/article/DGXLASHD21H2J_R20C17A9LKA000/

56) See (in Japanese) pp. 14-15 in JSCA, "Smart Communities: Projects by Japanese Firms," Japan Smart Community Alliance, May 2015: https://www.smart-japan.org/vcms_lf/library/JSCA_PR-magazine_web_single.pdf

57) The JSCA English-language pamphlet "Smart Community: Japan's Experience" can be accessed at the following internet URL: https://www.smart-japan.org/english/vcms_lf/Resources/JSCApamphlet_eng_web.pdf

58) See p. 2 and pp. 10-12 in JSCA "Smart Community: Japan's Experience," Japan Smart Community Alliance, June 24, 2015: https://www.smart-japan.org/english/reference/index.html

Industrial Technology Development Organization (NEDO) and Ministry of Economy, Trade and Industry (METI), which serve as secretariat and support organizations for the JSCA, have clearly allowed the crucial role of PR to fall through the cracks. It is ironic that Japan excels at good governance and policy integration for building resilient smart communities, but is poor at communicating the facts.

More comprehensive studies exist. For example, on May 27 of 2014 Ernst & Young Institute Japan (EY) released a Japanese-language survey, summarizing Japan's over 200 smart city projects. The EY report was titled (in Japanese) *Smart Cities: A Study of Issues Involved in Going from Testing to the Deployment Stage*. It was also subtitled *Towards Constructing Smart Cities that Produce a Citizen-Centred 'Precious Circle'*[59]. The "precious circle" refers to achieving a balance of incentives among the three major stakeholders — citizens, corporations, and governments — such that citizen-friendly and sustainable urban development is achieved.

The EY study did not examine the political economy background to Japan's initiatives, so let us take a short detour on that very important aspect with MIT expert on Japanese energy politics, Richard Samuels. Like the EY study, Samuels notes in his 2013 book *3.11: Disaster and Change in Japan* that the METI coordinated the four flagship projects with the power, gas, auto, steel and other industrial heavyweights[60]. Samuels adds the important insight that prior to Japan's natural and nuclear disasters of 3-11, Japanese policymakers aimed at test-bedding low-carbon models in a few cities, eyeing export opportunities. METI were aware of innovative developments overseas, and wanted to grow new industries. But they had to work within a centralized and nuclear-focused paradigm in the country's power economy. Japan's powerful monopoly utilities were averse to the rise of competitors through deployment of the smart grid and renewable power.

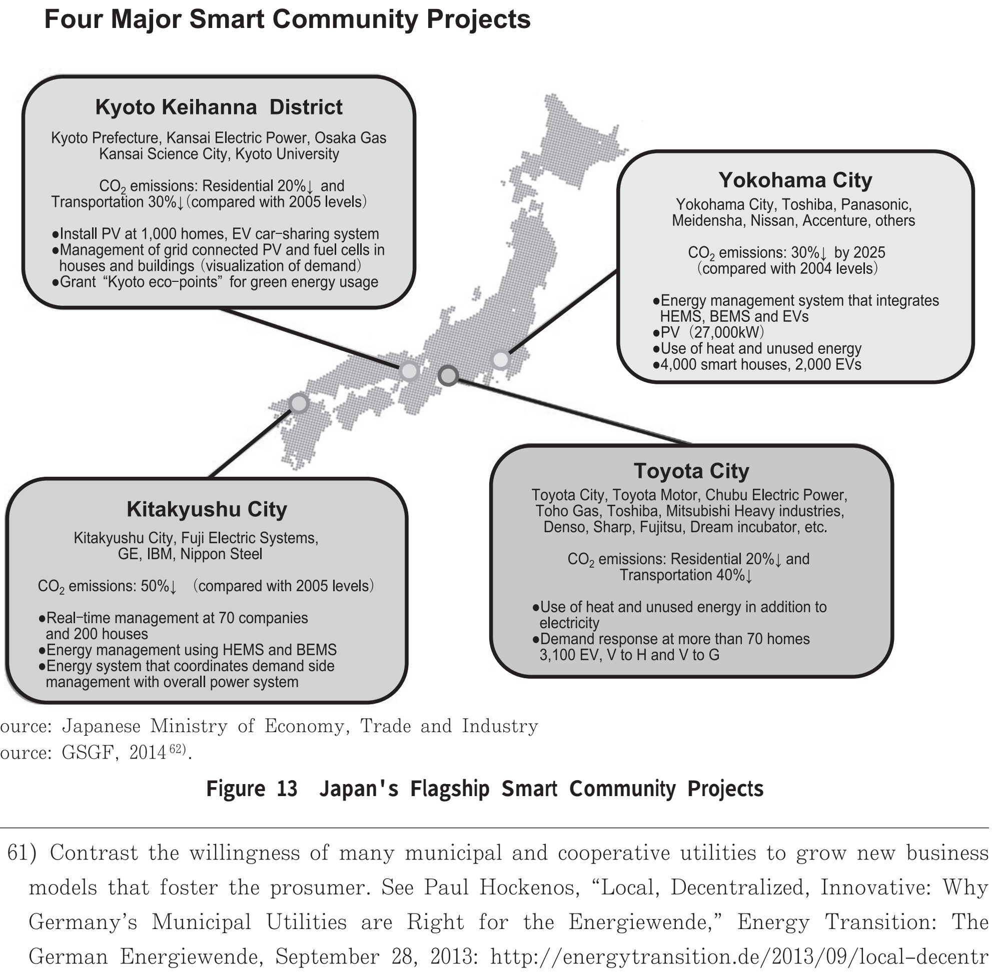
Yet 3-11 delivered a powerful shock to the "nuclear village." The nuclear meltdowns and the rolling brown-outs starkly demonstrated the vulnerability of centralized power. They also made conservation and local resilience not mere virtues but

59) See Kinjo N. and Rure K. (in Japanese) *Smart Cities: A Study of Issues Involved in Going from Testing to the Deployment Stage: Towards Constructing Smart Cities that Produce a Citizen-Centred 'Precious Circle'*, May 27, 2014: http://eyi.eyjapan.jp/knowledge/industrial-research/pdf/2014-05-27.pdf

60) See Samuels, R. *3.11: Disaster and Change in Japan*, Ithaca and London: Cornell University Press, 2013, p. 1

urgent necessities. The disasters also expanded non-METI central agencies' and local governments' incentives to carve themselves a role in the accelerating fusion of information and communication technology (ICT), distributed energy, efficiency, and other aspects of the smart-city model.

Decidedly apolitical, the EY report did not discuss the tension between Japan's conventional utilities and the producers and consumers (or "prosumers") of renewable power in the business and household sector[61]. Even so, the EY study remains valuable as a snapshot of the state of Japan's smart city programmes and debates.



Source: Japanese Ministry of Economy, Trade and Industry
Source: GSGF, 2014[62].

Figure 13 Japan's Flagship Smart Community Projects

61) Contrast the willingness of many municipal and cooperative utilities to grow new business models that foster the prosumer. See Paul Hockenos, "Local, Decentralized, Innovative: Why Germany's Municipal Utilities are Right for the Energiewende," Energy Transition: The German Energiewende, September 28, 2013: http://energytransition.de/2013/09/local-decentralized-innovative-why-germanys-municipal-utilities-are-right-for-the-energiewende/

62) GSGF, "Japan's Approaches to Smart Grid and Smart Community Deployment," Global Smart Grid Federation, May 28, 2014: http://www.globalsmartgridfederation.org/2014/05/28/japans-approaches-to-smart-grid-and-smart-community-deployment/

The EY report pointed out that smart cities had already been an object of specialist attention for several years. Most prominent in Japan, for example, the METI started its flagship "next-generation energy and social systems test-bed" smart-city approach in the four sites of Yokohama City, Toyota City, Keihanna (in Kyoto Prefecture) and Kitakyushu City in 2010. These projects and their particulars are displayed in **figure 13**. As can be seen in the figure, energy efficiency and carbon reduction were the common threads uniting the projects.

EY's 2014 report was also especially well timed. Among other developments during the same year, June 2 saw the global giant Apple join a long list of firms including Toyota Home[63] by entering the "smart home" market[64]. The global background includes thousands of smart-city projects, assessed as worth at least USD 650 billion in 2014 and projected to be USD 1.2 trillion in 2022[65]. At over USD 40 billion, Korea's Songdo smart city project alone is one of the costliest private-sector real-estate development ever undertaken[66]. And in 2014 Japan's core smart-city projects in Yokohama, Kitakyushu, Keihanna, and Toyota City were slated for accelerated deployment domestically and overseas. Based on research by Nikkei BP Cleantech Institute, in 2010 Japanese experts estimated that the smart-city market would reach at least a cumulative JPY 5,000 trillion in value between 2011 and 2030, when such smart infrastructure as water and housing are included along with smart grids, renewable energy, battery storage and other core elements of the smart market[67].

---

63) Toyota Home is just one element of Toyota Corporation's smart city-related initiatives: http://www.toyotahome.co.jp/smarthouse/

64) See Katherine Tweed, "Apple Launches Home Kit for the Connected Home," Green Tech Media, June 2, 2014: http://www.greentechmedia.com/articles/read/apple-launches-home-kit-for-connected-home

65) The figure is from the May 2014 MarketsandMarkets report "Smart Cities Market," which estimates 14 percent annual growth in the sector but also hints at the potential for "exponential demand." The report also identifies "IBM, Alcatel-Lucent, Accenture, ABB, Cisco, Cubic, Honeywell, Intel, Siemens and Oracle" as the "major players" in the global smart-city market. See the report's press release at: http://www.marketsandmarkets.com/PressReleases/smart-cities.asp

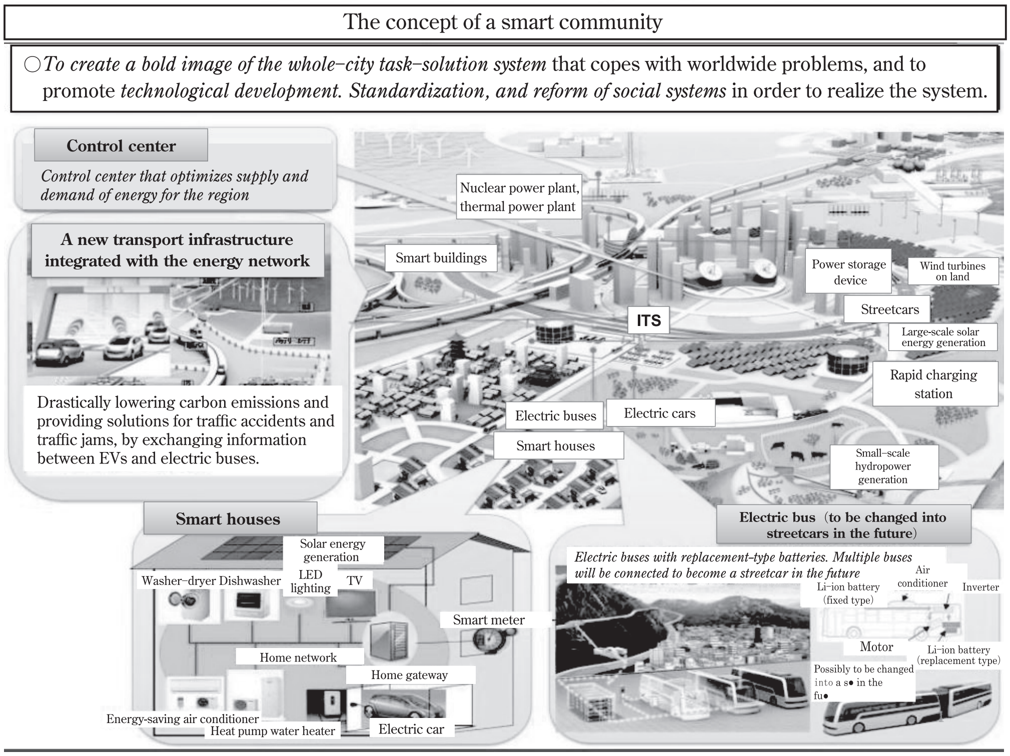
66) On Songdo, see Rick Huijbregts, "Songdo Case Study (v 1)," Presentation to Harvard Graduate School of Design, Executive Education, January 29, 2014: http://www.rickhuijbregts.com/wp-content/uploads/2013/03/Songdo-v1.0.0.pdf and Rita Lobo "Could Songdo be the world's smartest city?" *World Finance,* January 21, 2014: http://www.worldfinance.com/inward-investment/could-songdo-be-the-worlds-smartest-city

67) See (in Japanese) "The Global Smart City Market Will Be 3,100 trillion," *Nihon Keizai*

That 2010 estimate of a cumulative JPY 5,000 trillion smart city market was roughly 10 times the size of the Japanese economy. It is thus understandable that Japanese policymakers began devoting considerable fiscal, administrative and other resources to the effort.

Smart Cities in Japan

The EY report's "precious circle" refers to achieving a balance of incentives among the three major stakeholders — citizens, corporations, and governments — such that citizen-friendly and sustainable urban development is achieved.

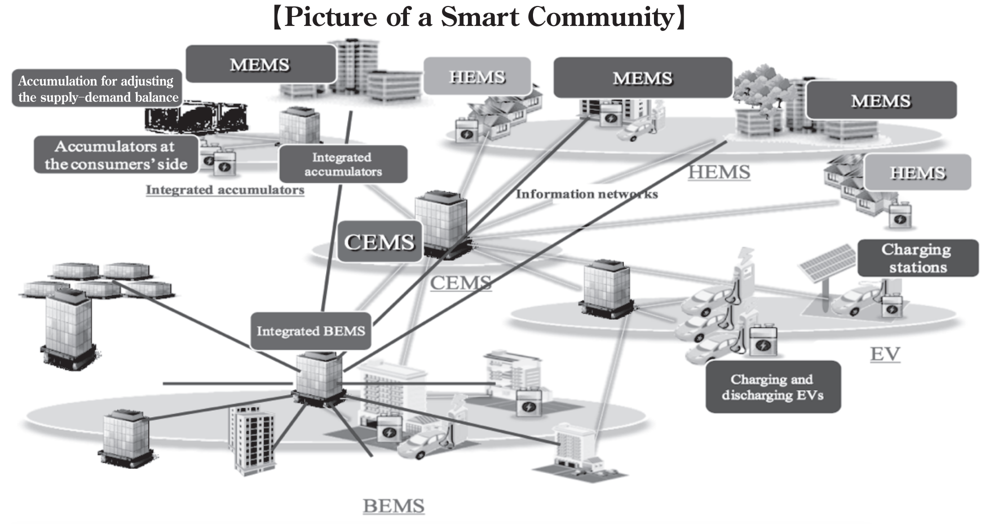


Source: METI, 2014[68].

Figure 14 The METI Smart Community Before 3-11

Shimbun, September 9, 2010: https://www.nikkei.com/article/DGXNASFK2401D_U0A920C1000000/

68) See METI, "Smart Community," Ministry of Economy, Trade and Industry, Japan, February 2014: http://www.meti.go.jp/english/policy/energy_environment/smart_community/index.html



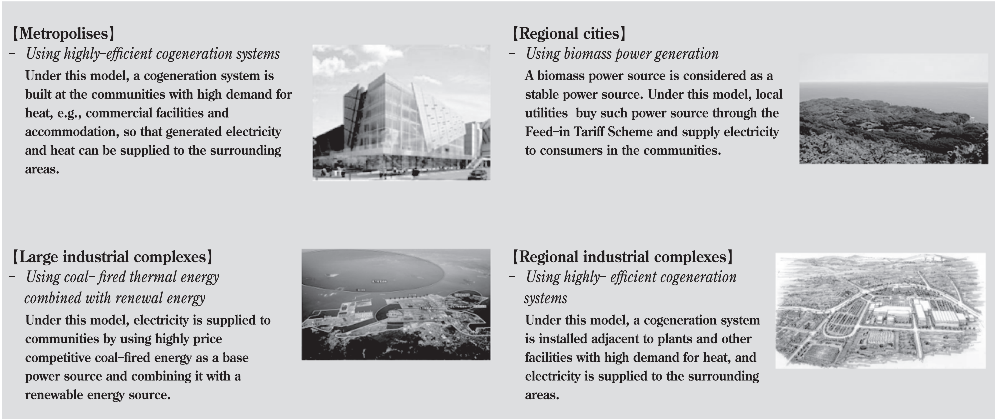
Source: ANRE, 2014[69].

Figure 15 ANRE Conceptualization of the Smart Community in 2014

The EY report points out that smart cities have been an object of specialist attention for several years. Most prominent in Japan, for example, the METI began to lead initiatives on smart cities (or smart communities) years before the 3-11 disaster. An early expression of the METI efforts is seen in **figure 14**. The figure outlines a smart community predicated on electrification and efficiency. The concept clearly seeks to reduce reliance on imported fuels though expanding both nuclear and renewables, in the context of a smart community marked by coordinated governance (rendered awkwardly in English as "whole-city task-solution system"). The conception of the smart community has hanged over the years. By 2014, the METI's Agency for Natural Resources and Energy (ANRE) was picturing the smart community as focused on energy efficiency, via Home Energy Management (HEMS), Mansion Energy Management (MEMS), Community Energy Management (CEMS) and other systems (**Figure 15**).

Figure 16 shows how the projects were differentiated by region and application. One category was dividing metropolises and regional cities, to allow for the evolution

69) See ANRE "ANRE's Initiatives for Establishing Smart Communities," Policy Planning Division, Energy Conservation and Renewable Energy Department, Agency for Natural Resources and Energy, February 2014: http://www.meti.go.jp/english/policy/energy_environment/smart_community/pdf/201402smartcomunity.pdf



Source: ANRE, 2014[70].

Figure 16 ANRE Regional Differentiation of the Smart Community in 2014

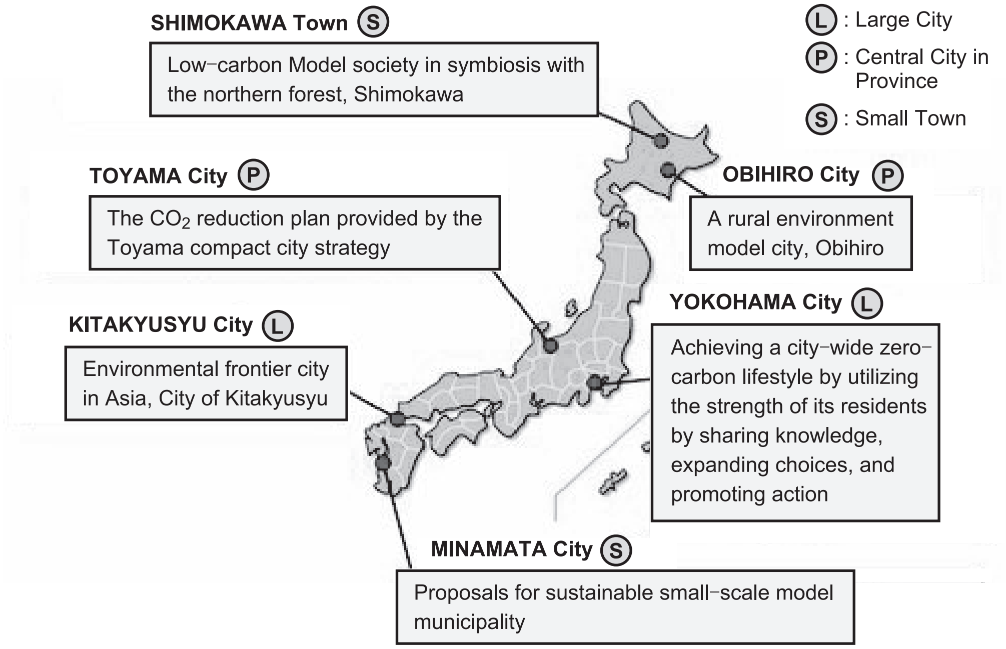
of approaches suitable to their often diverging needs. A second division was large industrial complexes and regional industrial complexes. As can be seen from the figure, energy systems are the common thread that links all the cases.

In fact, the design and implementation of these projects has a decade-long history. In 2008, Japan's Promotion Council for Low Carbon Cities was instituted, with the Cabinet's Office's Regional Revitalization Bureau as its secretariat. The low-carbon program undertook a competition for "Eco-Model Cities" between April 11 and May 21 of 2008. It received 82 submissions and selected 6 in July of the same year. These 6 and their respective differences are shown in **figure 17**.

By the end of the same year, 2008, the number of Eco-Model Cities selected had risen to 13. Later, in 2011, a new category of "Future Cities" was declared. This new designation was not greatly different from the Eco-Model Cities, though it included a focus on aging in addition to environmental challenges. As seen in **figure 18**, the new category allowed for overlap, such that Kitakyushu was both an Eco-Model as well as a Future City. The most important aspect of the new category was that it included several of the cities in the Tohoku region, which had been hit by the 3-11 disaster.

As displayed in **figure 19**, subsequent initiatives in 2012 and 2013 selected a broader variety of cases, adding the designation "Future Cities." The figure also

70) See ANRE "ANRE's Initiatives for Establishing Smart Communities," Policy Planning Division, Energy Conservation and Renewable Energy Department, Agency for Natural Resources and Energy, February 2014: http://www.meti.go.jp/english/policy/energy_environment/smart_community/pdf/201402smartcomunity.pdf



Source: JFS, 2009[71].

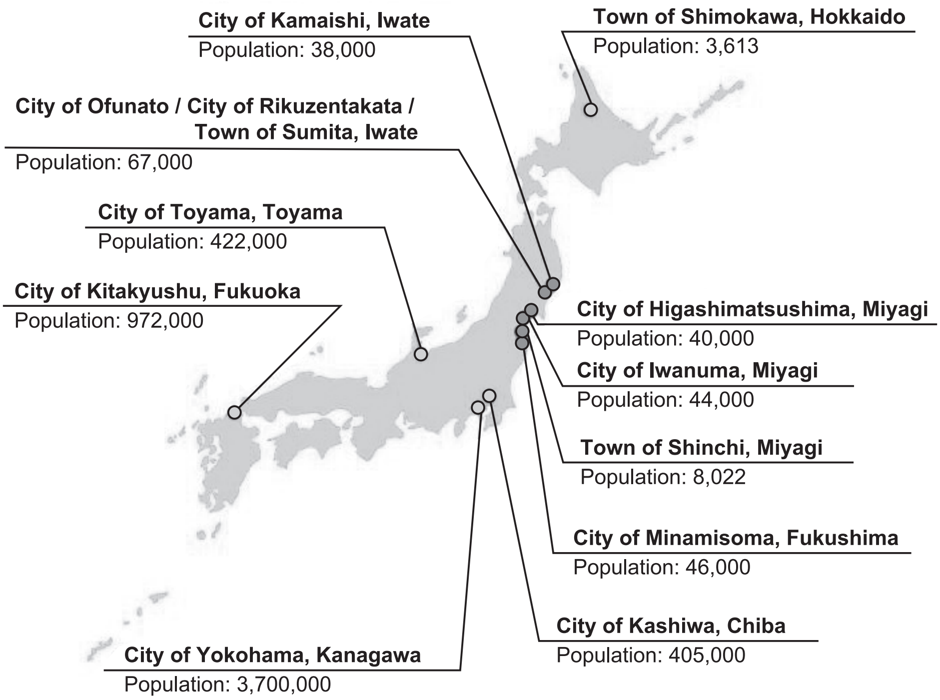
Figure 17　Japan Initial Selections for Eco-Model Cities, July 2008

shows that the 2012 and 2013 selections came with a special focus on the Tohoku region that had been devastated by the 3-11 natural and nuclear disasters.

Defining the Smart City

The EY authors argue there are several issues that require attention in rolling out the flagship smart cities, not to mention the myriad other projects underway. First, there is no precise definition of the smart city itself. In addition, the expanding scope of the initiatives as well as the broad range of stakeholders involved cross over multiple jurisdictions. This complexity makes the smart city difficult for administrators, voters and others to grasp let alone plan for and implement. The published documentation (in Japanese) on smart cities indicated that there was poor understanding of the issues involved in operationalizing the projects. So the EY authors sought to define the elements of the smart city as clearly as possible on the basis of Japanese

71) Edahiro, J. "Conceptual Basis of the Movement to Create and Propagate 'Eco-Model Cities,'" Japan for Sustainability, March 9, 2009: https://www.japanfs.org/en/news/archives/news_id028824.html



Source: JFS, nd[72].

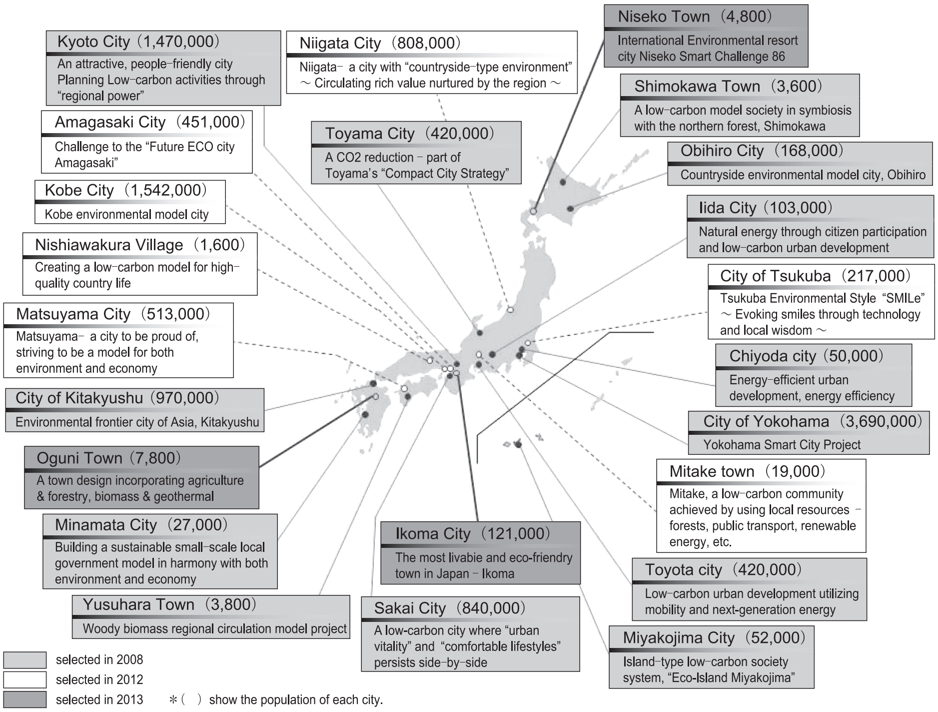
Figure 18 Future Cities Selected in 2011

documentation.

The EY authors sought a concise definition of the smart city, and found none. We have already seen that the JSCA provided little guidance in this regard. The EY report remarked that there were various definitions even within the rather narrow cluster of administrative agencies (such as the ANRE) grouped around METI. One might add that there is also a bewildering array of terms such as "smart community," "smart towns," "smart villages," "eco-towns," and so forth.

The EY authors showed that METI itself defined the "smart community" as a next-generation social system wherein households, buildings, transport systems and other elements are linked by IT networks and achieve an effective deployment/use of energy across the region. Similarly, the Natural Resources and Energy Agency in its 2011 Energy White Paper described the smart city as one in which electricity supply and demand is monitored with technology, and energy management is done at a re-

72) See JFS, "'FutureCity' Initiative," Japan for Sustainability, no date: https://www.japanfs.org/en/projects/future_city/



Source: JFS, nd[73].

Figure 19 Japan's Eco-Model and Future Cities, 2008, 2012, 2013

gional level with distributed generation or energy systems[74]. And the lead agency for test-bedding the smart cities, the METI's New Energy Promotion Commission (NEPC)[75] was even more ambiguous. It defines the smart city as one where ICT and other technologies are deployed in new ways and residents' quality of life is enhanced while the environmental burden is reduced and the city is able to grow sustainably. These rough definitions are not only rather tentative, but also open to multiple interpretations.

The EY report argued that the various definitions as well as the approaches of the Japanese government and private sector actors offered a rough summary of what

73) See JFS, "'FutureCity' Initiative," Japan for Sustainability, no date: https://www.japanfs.org/en/projects/future_city/

74) The Agency's glossary for the 2011 Natural Energy White Paper (in Japanese) is available here: http://www.re-policy.jp/jrepp/JSR2011/JSR2011_glossary.pdf

75) The NEPC's material on the smart community is here: http://www.nepc.or.jp/smartcommunity/

makes a smart city "smart." The authors themselves sought to refine the definition by suggesting that "smart" is underpinned by the following factors: 1) increasing the convenience of urban dwellers, 2) pursuing sustainability through a focus on the environment, security, safety, resilience and other factors, 3) increasing the efficiency of services and other business.

The EY effort was a useful contribution to achieving a more coherent understanding of what constitutes "smart." What the EY authors overlooked, however, was that while Japanese smart city definitions were indeed vague, they were nevertheless clearly focused on energy. The projects also increasingly stressed disaster resilience. These key features helped Japanese smart communities stand out against the thousands of projects then underway or in the planning stages globally. Many smart projects outside of Japan (and a few in Japan as well) have at best a tangential relationship to reducing material flows of energy and water, not to mention bolstering their critical infrastructure against the ravages of climate change[76). While the world's "smartest smart city" in Santander Spain is sharply focused on energy and water, and deeply engaged with its citizens in managing flows[77), critics have noted for example that the Glasgow Future Cities project is overly devoted to their surveillance[78).

Japan's Smart Communities

The EY authors point out that, in policy terms, Japan's smart cities were given a significant boost by the 2012 Japan Revival Strategy as well as the 2013 Abe Administration's Japan Reconstruction Strategy. There certainly was ample finance: the Abe government more than tripled its ICT spending from FY 2013's roughly YEN 300 billion to over YEN 1 trillion in FY 2014[79). The Abe Cabinet also set up a

76) On the characteristics of smart cities in the EU, see in particular chapter 2 of the "Mapping Smart Cities in the EU" study by Urenio, March 7, 2014: http://www.urenio.org/2014/03/07/mapping-smart-cities-eu/

77) See Newcombe T. "Santander: The Smartest Smart City," *Governing*, May 2014: http://www.governing.com/topics/urban/gov-santander-spain-smart-city.html

78) See Sally Davies, "Glasgow aims to be the first 'smart city,'" *Financial Times*, June 3, 2014: http://www.ft.com/intl/cms/s/0/d119ac06-e57e-11e3-a7f5-00144feabdc0.html#axzz33y6k5pbG

79) On this spending increase, see (in Japanese) Okui N., "Details: The Big Picture on the

Government "Chief Information Officer" (CIO) agency within the cabinet secretariat in June of 2013, specifically to coordinate ICT projects and avoid overlap and incoherence due to silos in the bureaucracy and business worlds[80]. The CIO agency has since maintained a relatively steady posting of information up to October of 2017. But the CIO's site has yet to itemize and publish a listing of smart cities and their budgets. Nor does it offer a guide to policy integration on smart and compact city projects[81].

In the absence of an official list of Japanese taxpayer-financed smart cities, the EY study had to search for and add up all the central-government initiatives it could find. The EY authors determined that Japan's national government agencies alone were undertaking over 160 projects. The EY results would appear to confirm a Japan Research Institute survey of April 2013 that determined Japan's government-sponsored smart-city projects had increased from 22 prior to 3-11 and reached well over 100 as of April 2013[82]. Moreover, the EY count of 160 projects did not include those being led by the prefectural as well as the smaller local government level as well as private-sector-led initiatives. Many of these latter have some kind of direct or indirect subsidy (eg, tax breaks), so arguably should be included.

A lot of projects thus were not included in the EY assessment. Among Japan's many local-government-led smart city projects were the "Smart Hikari Town Kumamoto Project" being undertaken in the newest of Japan's designated cities[83]. The prefecture of Saitama, just north of Tokyo, was also building "eco-towns" centred on smart grids, distributed generation (primarily renewable but also fuel cells) and conservation through home-energy and business-energy management systems as well as smart meters. Indeed, a January 2014 survey by the Kanto-area METI (the regional

---

2014 ICT-Related Budget," in *Nikkei BP ITPro*, June 2, 2014: http://itpro.nikkeibp.co.jp/article/COLUMN/20140527/559602/

80) On this promised role of the cabinet in coordinating the ICT projects, see (in Japanese) p. 6 "This Time It's Different: Cabinet Leadership" in LDP Dietmember and ICT Strategy Special Commission Chief Hashimoto Gaku's June 14, 2013 presentation "The Abe Regime's ICT Strategy" : http://ga9.cocolog-nifty.com/130614Interop.pdf

81) The CIO's portal is here: http://cio.go.jp/policy

82) Sato K., (in Japanese) "Issues and Projects Toward Realizing the Smart City," Japan Research Institute, Paper, no. 2013-02, April 30, 2013: https://www.jri.co.jp/MediaLibrary/file/report/researchfocus/pdf/6743.pdf

83) Kumamoto City became Japan's 20^{th} designated city on April 1 of 2013. The smart city project, a joint effort of Kumamoto City and Kumamoto Prefecture, is described (in Japanese) at: http://www.hikarikumamoto.jp/index.html

bureau) determined that among the roughly 500 local governments in the entire region about 10 percent (44) were undertaking smart community initiatives[84].

In addition to the subnational-government-led projects, Japan featured a significant number of private-sector-led smart cities, towns, and communities. These latter include 16 "smart towns" under development by the conglomerate Sekisui House[85]. Another significant development was Panasonic's Fujisawa SST "smart city" initiative[86]. Hitachi also has, not surprisingly, a smart-city development underway in Hitachi City in addition to multiple other projects in Japan and overseas[87]. Toshiba, in turn, lists several initiatives — such as the greenfield Ibaraki City Smart Community Project in Osaka Prefecture — among its ventures[88]. Mitsui Fudosan also had several projects underway, particularly within the metropolitan region of Tokyo[89]. If all of these public and private-sector projects are added up, it is clear that in 2014 Japan had well over 200 smart communities. It is also clear that the projects were nationwide, even though there was significant clustering in Tokyo and the broader Kanto region.

There also appeared to be plenty of scope for growth. A contemporary survey of Japan's smart communities was undertaken by EcoNet Tokyo 62 (an association of the 62 governments in the Tokyo Metropolitan Region), between June 19 and July

---

84) On the survey and its results, see (in Japanese) p. 6 of Kanto METI Natural Resources and Energy Division, "Towards the Establishment of a Kanto-Area Smart Community Collaborative Association (Tentative Name)," February, 2014: http://www.kanto.meti.go.jp/seisaku/smacom/data/20140219shiryo_3.pdf

85) The Sekisui House "smart community" promotional literature includes a convenient map of their projects: http://www.sekisuihouse.co.jp/bunjou/smarttown/

86) The project's promotional website was opened on April 26, 2014: http://fujisawasst.com/JP/

87) Hitachi provides an overview, in Japanese, of several of the projects as "case studies" in a September 2015 special edition of its corporate magazine *Haitakku:* http://www.hitachi.co.jp/products/it/portal/info/magazine/hitac/document/2015/09/1509.pdf

88) Toshiba's Ibaraki City project appears to have been in planning since 2008, according to (in Japanese) "Redevelopment of North Region's Demolished Factory Area Accelerates, with Universities, Hospitals, Residences and Other Elements Planned Between Hitachi and Panasonic," Construction News, March 18, 2014: http://constnews.com/?p=1552. Toshiba lists its domestic and global smart city projects at (in Japanese) "Toshiba Smart Community Centre" : http://www.toshiba.co.jp/vs/casestudies/company/scc.htm

89) Mitsui Fudosan Group's smart city strategy began in 2012, and is detailed (in English) here: http://www.mitsuifudosan.co.jp/english/corporate/csr/2013/special/smartcity/index.html?id=global

4th of 2014[90]. The survey sampled all 62 of the EcoNet Tokyo 62 governments, and all of them responded. Among the survey results was evidence of a dramatic increase in regional awareness of smart communities. Moreover, whereas only 2 of the area governments were in the midst of deploying a smart community in 2012, the figure had risen to 10 by 2014. All told, in 2014, 22 of EcoNet Tokyo's 62 member governments were either initiating projects or preparing to, versus a total of 14 in 2012.

The results of the EcoNet Tokyo survey also showed a consistent focus on energy throughout, even among governments that were simply thinking about smart communities. In 2012, there were 156 replies (with multiple choices allowed) on the desired goals of the smart community. Of these, 40 sought increased residential energy efficiency, 31 increased office-building energy efficiency, 17 community economic stimulation, 8 enhanced tourism, 11 increased industrial development, 8 area energy independence, and 36 opted for greater resilience of schools, hospital and other facilities. In other words, fully 79 of the 156 replies focused on energy, either through efficiency or generation.

By 2014, the total number of replies in the EcoNet Tokyo survey had risen to 176. Of these, 38 sought increased residential energy efficiency, 29 increased office-building energy efficiency, 15 desired community economic stimulation, 11 enhanced tourism, 11 increased industrial development, 29 area energy independence, and 36 opted for greater resilience of schools, hospital and other facilities. That is, 86 of the 176 replies focused on energy, either in the areas of efficiency or generation. Resilience remained a steady concern. Moreover, the desire for localized energy independence (*eria ni okeru enerugii no jiritsuka*) leapt from 8 in 2012 to 29 in 2014, showing by far the greatest increase among all categories.

The Masuda Report: Integrating Demographic Challenges

Simultaneous with the expansion of smart city policies and projects, the Japan Policy Council published May 8, 2014 a study titled (translating directly) "Stop Declining Birth Rates: The Local Revitalization Strategy[91]." The report sought to gal-

90) The survey results (in Japanese), presented to the EcoNet Tokyo 62 research commission on October 8, 2014, are available at: http://all62.jp/saisei/meeting_h26/meeting_h26_03/meeting_h26_03_05.pdf

91) See (in Japanese) "Stop Declining Birth Rates: The Local Revitalization Strategy," Japan

vanize debate and policymaking on the intersection between aging and the economy. The report is often referred to as the "Masuda Report," after its chairman Masuda Hiroya. The Masuda Report attracted widespread public attention with its stark warning that 896 local governments — roughly half the total — risked "extinction" by 2040 through further declines in their populations of young women. The report argued that the best response to regional decline would be a strategy of building "regional cities attractive to young people," by forging a "new structure of agglomeration" and a "choose and focus" strategy of investment. The report emphasizes the need to make these regional cities into the nodes of networks that function to "dam" the flow of younger people into the big cities. The Masuda Report was presented to the Council on Economic and Fiscal Policy, the Industrial Competitiveness Council and other ranking policymaking organs. Its warnings and recommendations, and subsequent interventions by the same Japan Policy Council, became a core part of the Abe government's revitalization strategy.

The context of the Japan Policy Council report merits examination. The Masuda report reflected a broad-based consensus among reformist politicians and policymakers in the national government and bureaucratic district of Kasumigaseki. Theirs is an ongoing technocratic effort to overcome sectionalism and systemic inertia, and thus deserves scrutiny based on the details that have emerged in Japan's quality press and specialist media. Masuda Hiroya, the report's lead author, is a former ranking bureaucrat from the Ministry of Land, Infrastructure and Transport (MLIT), who from the mid-1990s went on to become a notable governor of Iwate Prefecture and later a Minister of Internal Affairs and Communications (MIC). When Masuda was first elected governor of Iwate in 1995, he was 43 and the youngest-ever prefectural governor in Japanese history. Masuda subsequently served three full four-year terms until 2007, building for himself a strong reputation as a fiscal reformer. During the reformist years of the former PM Koizumi's cabinets (2001 to 2006), Masuda made deep cuts to prefectural spending on public works as well as other areas of administration. Masuda also went so far as to apologize in the prefectural assembly, on March 2, 2005, for past spending on public works. Masuda also highlighted what he regarded as the core factors responsible for the prefecture's fiscal difficulties. Masuda emphasized the deleterious role of repetitive rounds of public works — the

Policy Council, May 8, 2014: http://www.policycouncil.jp/pdf/prop03/prop03.pdf post-1980s bubble economy fiscal stimulus — as well as the special fiscal measures introduced in the Local Allocation Tax (Japan's interregional fiscal redistribution) in order to compensate for inadequate revenues in its base structure[92].

Masuda then served as Minister of MIC (and special minister for decentralization) between August 27 of 2007 and September 26 of 2008. During that time, Masuda turned his attention to localizing sustainable development, stressing demography. For example, Masuda established a measure that focused local policymaking resources to allow midsize cities more means to build attractive alternatives for young people and thus limit their incentives to relocate to large urban centers. This initiative became the "autonomous settlement region" (*teijuu jiritsuken kousou*) which the MIC inaugurated in 2008. The measure is anchored on "core" regional cities of at least 40,000 residents, building on transport, ICT and other networks to link them with surrounding towns and villages and rationalize the region's distribution of health, education, and other services. In February 27, 2015, there were 85 of these regions, and that number had grown to 119 by October 5 of 2018. The programme is financed with special incentive measures in the special LAT (ordinarily used for emergencies). From fiscal year 2014, these incentives were increased to JPY 85 million for the core city and JPY 15 million for each area community[93].

Masuda also presided over the implementation of a "provisional measure" in the LAT. This measure sought to relieve intergovernmental fiscal inequalities through pooling revenues from a portion of the "local business tax" and the "corporate residence tax." These revenues were then distributed preferentially to fiscally weak local governments. Importantly, this measure was adopted after it proved impossible to secure the Ministry of Finance's agreement to move business taxes to the national level in return for a higher share of the consumption tax for local governments[94].

Masuda's background and stance on issues related to local revitalization are of

92) Horiguchi, H., (in Japanese) "Masua Hiroya, Iwate Prefecture Governor: How I Put the Prefectural Primary Balance into the Black," *Foresight*, April 2007: http://www.fsight.jp/3341

93) Details on the programme and its financing are available (in Japanese) at the Ministry of Land, Infrastructure and Transport's regularly updated internet website on "autonomous settlement regions" : http://www.soumu.go.jp/main_sosiki/kenkyu/teizyu/index.html

94) This reform remains deeply controversial. See, for example, Yamamoto I. (in Japanese) "Masuda Hiroya and the TMG's loss of JPY 1 trillion in tax revenues," Yahoo News Japan, July 9, 2016: https://news.yahoo.co.jp/byline/yamamotoichiro/20160709-00059809/

great significance. For one thing, his career's work indicates that he straddles the middle ground between bottom-up decentralization to encourage local initiative and top-down technocratic national planning. Masuda's background is reflected in the character of ongoing local revitalization policies, with their emphasis on incentives plus equity.

Moreover, Masuda also had ample influence in policymaking circles. Masuda not only had strong personal connections within the Abe government; his eponymous 2014 report saw the Abe government turn its attention to "local revitalization," something that was not prominent on its agenda prior to the Masuda Report. Abenomics thereafter was rebranded as "local Abenomics."

Masuda indeed came to be depicted as the "shadow minister for local revitalization" and an agent for driving change among bureaucrats and politicians. Japan's respected business daily, the *Nikkei* newspaper, emphasized these points in a June 9, 2015 article[95]. The article describes how Masuda was the core element of a broad-based initiative within the higher councils of government, bringing together ranking officials steeped in decades of public works-centered nation-building but now seeking means to construct a decentralized and sustainable political economy. Masuda's contacts in the Abe Shinzo cabinet include the chief cabinet secretary Suga Yoshihide, the most influential actor in the Japanese government aside from the Prime Minister. Also, Suga was himself Minister of Internal Affairs and Communications (and special minister for decentralization) between September 26, 2006 and August 27, 2007.

The political context suggested that Japan's local revitalization strategy would gain more headway were it linked to resilience and energy. Integration would help revitalization to make its way through the multiple veto points and hurdles involved in securing finance, selecting and approving viable revitalization programmes, and supervising their effective implementation. All of these stages are fraught with potential difficulties that threaten to dissipate the focus and momentum of a "local revitalization" programme that starts off rather ill-defined (being a work in progress) and lacking broad public support (though polls routinely indicate there is a potential popular base for action).

To be sure, some critics quickly wrote off local revitalization as "recycled" pol-

---

95) See (in Japanese) "Shadow Minister for Local Revitalization" Masuda Hiroya's Strategy for Incentivizing the Bureaucratic-Political Spheres, *Nihon Keizai Shimbun*, June 9, 2015: https://www.nikkei.com/article/DGXMZO87817770Y5A600C1000000/

icy. Ignoring the Anthropocene and its externalities, they argued within the traditional framework of top-down versus decentralized governance. Hence, they called for a broader debate on restructuring regional governance so as to devolve most fiscal and administrative decisions away from the central government. One critic held that postwar Japan has been witness to decades of local and regional revitalization: "'Locally-focused' policies have literally been recycled in the form of industrial decentralization, nodal development, relocation of the functions of the capital, decentralization of corporate headquarters, 'hometown revitalization', and the development of 'regional core cities' and 'wide community areas[96],'" This kind of doubt concerning the very relevance of intergovernmental policy and desire to engage in a protracted debate over a completely different strategy was indicative of the need for greater clarity in the current local revitalization programme. As will be outlined below, Masuda's interest and activism on energy issues afforded one avenue that clarified flagship projects. Smart energy came to be the common theme bonding "local revitalization," "resilience" and other initiatives.

Smart Energy and the Japanese-Style *Stadtwerke*

Japan's smart-energy technocrats — an expanding stream of intellectuals and bureaucrats — advocated structural reforms for diffusing a new paradigm of smart communities. The smart community paradigm is centred on distributed energy, but also encompasses other utility services, mobility, communications, governance, health care, and the other elements of modern urban life. One summary statement of the Japanese project was outlined (in Japanese) in *Smart Communities: A Smart Network Design for Local Government Infrastructure*. This book was organized by Japan's top mainstream energy intellectual Kashiwagi Takao and published October 15, 2014[97]. In its initial chapter, written by Kashiwagi, the book describes how Japan's energy technocrats sought to use the feed-in tariff, *stadtwerke* (municipal business), power-sector deregulation and other key elements of Germany's green energy transition as engines for something more ambitious. The Japanese technocrats were linking their

96) Sasaki, N. "Regional Revitalization: Another Perspective," *The Japan News*, February 23, 2015: http://www.yomiuri.co.jp/adv/chuo/dy/opinion/20150223.html

97) See (in Japanese) Kashiwagi, T. (ed) *Smart Communities: A Smart Network Design for Local Government Infrastructure*, Tokyo: Jihyosha, 2014.

project to fiscal and financial policy, with the potential to revitalize industry, build resilience, and bolster local democracy.

Kashiwagi's chapter depicts smart communities as the key item in Japan's Abenomics growth strategy. Kashiwagi had been making that assertion for well over a year, in previous books as well as numerous articles and smart-community events[98]. It was an argument that deserved scrutiny. One reason for examining it is that Kashiwagi is an influential figure in Japanese energy policymaking circles. Kashiwagi designed Japan's first smart community, a 100 percent renewable microgrid project, for the 2005 Aichi World's Fair. He consistently argued that the focus of Japan's public works should shift from roads and bridges to resilient, smart energy systems that maximize efficiency and the uptake of renewable energy. After 3-11, his main contribution, as a policy entrepreneur, was to help forge a broad public-private coalition that links decarbonizing smart energy systems (heat and power grids) with disaster resilience, spatial planning and local economic development.

Kashiwagi was ideally positioned to coordinate the shift to smart communities. As an academic, Kashiwagi was professor at the Tokyo Institute of Technology from 2007, in 2012 becoming specially appointed professor and head of International Research Center of Advanced Energy Systems for Sustainability (AES Center). The AES Center was inaugurated in September of 2009, with funding from some of Japan's largest firms. Its 200 specialist researchers in environment and energy are focused on solar and fuel cells. As importantly, it also collaborates with the smart-energy divisions of the leading power, gas and other firms in Japan's energy business, along with blue-chip firms in construction, home-building, engineering, auto-making, and other areas. Moreover, the AES Center includes 15 local governments (prefectures and cities), many of which are exemplar smart communities[99].

Kashiwagi was also a top-rank policy advisor. In the years preceding 3-11, he had served as a member or chair of the ANRE's main energy policymaking councils, including the Advisory Committee for Natural Resources and Energy (ACNRE), the

98) Among myriad examples, see (in Japanese) Kashiwagi T. "Growing a JPY 500 Trillion Industry: Japan Should Now Take the Initiative to Develop a Growth Strategy Built on Smart Cities," Nikkei Smart City Consortium, August 6, 2012: http://bizgate.nikkei.co.jp/smartcity/interview/000538.html

99) The corporate and local-government membership of the AES Center is listed (in English and Japanese) at its website: https://aes.ssr.titech.ac.jp/partner

Strategic Policy Committee of the ACNRE, the Energy Efficiency and Renewable Energy Committee of the ACNRE, in addition to numerous other national and subnational bodies.

Kashiwagi became an even more important policy entrepreneur after 3-11. From May 17, 2011 to August 1, 2011, Kashiwagi led the "Commission on Making the Effective Use of Heat Energy and Urban Planning[100]." The commission included major business leaders as well as observers from METI, MLIT, Tokyo Metropolitan Government (TMG) and other agencies. It met 6 times in rapid succession and plowed through an enormous amount of material on how to deploy smart heat systems to slash emissions and maximize renewables while building disaster resilience. The commission's August 1, 2011 wrap-up report is a blueprint for many of the policy reforms Kashiwagi and his collaborators have been doing since, in spatial planning, National Resilience, energy policy, and other areas that are now explicitly integrated (in formal administrative terms as well as via this cohort of smart-energy technocrats)[101].

From November 7, 2014, Kashiwagi also chaired the research group that developed the planning and financing mechanisms to implement the MIC's "Locally Led Community Energy System Improvement Research Commission[102]." Like other commissions, this was a collaborative initiative including MIC, METI, MoE, MAFF, the Finance Agency, and several local governments. That commission apparently remains in operation (meeting most recently on January 11 of 2017), developing a "one-stop" approach so that local communities can get all the assistance they need. They have organized a "task force" of METI, MIC, MAFF, MoE, and other agencies to go and help the locals apply for subsidies, revise their energy master plans, and secure expert advice. For well-done plans, they will help with technical advice on including the best ICT sensors, storage, and other options to maximize the effectiveness of the smart en-

---

100) The METI website for the Commission on Making the Effective Use of Heat Energy and Urban Planning is available (in Japanese) here: http://www.meti.go.jp/committee/kenkyukai/energy_environment.html#netsu_energy

101) The August 1, 2011 interim report by the Commission on Making the Effective Use of Heat Energy and Urban Planning is available (in Japanese) here: http://www.meti.go.jp/committee/kenkyukai/energy/nestu_energy/report01.html

102) Details on the membership and meetings of the Locally Led Community Energy System Improvement Research Commission are available (in Japanese) at the following MIC website: http://www.soumu.go.jp/main_sosiki/kenkyu/jichitai_energy/index.html

ergy system. And they emphasize local-government leadership as well as the role of local actors (such as SMEs) as this is part of local revitalization.

Kashiwagi was also named to several major committees that are at the nexus of Japan's ambitious and energy-centered industrial policy. For example, in 2013, Kashiwagi became chair of the main working group Strategy Conference (*senryaku kyougikai*)[103]. The Strategy Conference groups key scholars and business interests involved in smart energy and climate change. It role is to deliberate scientific innovation strategies. More recently, its deliberations have centred on the role of energy within Japan's overall "Society 5.0" innovation strategy. It pays increasingly close attention to smart networks and resilience. Akin to Germany's Industry 4.0 initiative[104], Japan's Society 5.0 project seeks to harness the technologies of the 4^{th} industrial revolution. But incentivized by disasters, demographics and other challenges, Japan's effort transcends Germany's smart factories and aims to deploy smart systems throughout the entire society.

Kashiwagi also chairs the working group inaugurated to achieve the goals of the National Energy and Environment Strategy for Technological Innovation Towards 2050 (NESTI 2050), in concert with top-ranking representatives from business, academe and administration[105]. The NESTI 2050 was unveiled on April 19, 2016 by the Council for Science, Technology and Innovation. Like many of Japan's energy-related policies, the NESTI 2050 emphasizes the role of smart communities, and smart energy systems. These systems are explicitly portrayed as an important basis for achieving Japan's climate goals announced at the 2015 Paris Climate Talks. The working group held its initial meeting on December 14 of 2016.

In addition to his prominence in academe and policymaking, Kashiwagi is also directly involved in business circles that embody the ongoing revolution in smart en-

---

103) The Energy Strategy Conference's membership and details of its meeting can be found (in Japanese) at the Cabinet Office website: http://www8.cao.go.jp/cstp/tyousakai/juyoukadai/wg.html

104) On Germany's Industry 4.0 industrial policy, see "Industrie 4.0: Smart Manufacturing for the Future," Germany Trade and Invest, July 2014: https://www.gtai.de/GTAI/Content/EN/Invest/_SharedDocs/Downloads/GTAI/Brochures/Industries/industrie4.0-smart-manufacturing-for-the-future-en.pdf

105) The working group's membership and the particulars of its meetings are available (in Japanese) at the Cabinet Office's website: http://www8.cao.go.jp/cstp/nesti/suishin/index.html

ergy. Kashiwagi's multiple roles in academe, policymaking and business placed him at the intersection of the Japanese public and private sectors[106].

A second reason for scrutinizing Kashiwagi's argument is that he was using his policymaking roles quite effectively. It is difficult to exaggerate Kashiwagi's coordinating role in Japan's energy policymaking circles and policy changes. For example, the evidence indicates Kashiwagi that he helped realize Japan's June 14, 2013 New Growth Strategy's explicit commitment to ICT and energy-centred growth[107]. He also certainly had a hand in coordinating the expansion of smart-community projects and the increasing streams of finance flowing from the various ministries of the central government plus their affiliated quangos (Quasi Autonomous Non-Governmental Organization) such as the NEDO.

Kashiwagi's vision, as articulated in his 2014 book chapter, puts the motive force for rolling out Japan's smart communities in a vehicle akin to the German *stadtwerke* of municipally owned utilities. Germany's 900 or so *stadtwerke* that operate in energy — out of a total of 1,420 that operate in water supply, sewage, waste management and other community functions[108] — were among the major winners from German power deregulation. They are also increasingly recognized as key to that country's ability to diffuse renewable energy, whose role in Germany's power mix has risen from about 6 percent in 2000 to 30 percent in 2014. The *stadtwerke* have helped drive this impressive progress because they have organizational, financial and other heft together with a central role in servicing community demand for power[109].

106) On Kashiwagi's role, see DeWit, A., "Japan: Response of policy entrepreneurs to an energy crisis," in (Patrice Geoffron, Lorna Greening, Raphael Heffron eds) *Meeting the Paris mandate: A cross-national comparison of energy policy-making*. Springer-Verlag (forthcoming, 2018).

107) See Kashiwagi's arguments (in Japanese) detailed in Kashiwagi T. "Energy Policy as the Pivot for the Growth Strategy," Nikkei Bijinesu, May 17, 2013: http://business.nikkeibp.co.jp/article/opinion/20130513/248005/

108) On this, see p. 5 of Julian, C., "Creating Local Energy Economies: Lessons from Germany," ResPublica, July 2014: http://www.respublica.org.uk/our-work/publications/creating-local-energy-economies-lessons-germany/

109) See Hockenos, P., "Local, Decentralized, Innovative: Why Germany's Municipal Utilities are Right for the Energiewende," Energy Transition, September 28, 2013: http://energytransition.de/2013/09/local-decentralized-innovative-why-germanys-municipal-utilities-are-right-for-the-energiewende/

Stadtwerke and Japan's Local Public Corporations

The above is part of what the Japanese energy technocrats have been watching. Their use of the *stadtwerke* model as the engine for rolling out Japanese smart communities is significant. The Japanese vision appears to be more ambitious than the German efforts: while Germany is a leader on diffusing renewable power per se, it appears to be rather a laggard on the EU rollout of smart cities, perhaps because it can export and import power[110]. The fourth-largest economy in the world, Germany's FIT-driven energy shift has had a profound impact on the global public debate and policymaking. Yet if Japan's incipient model finds traction, it may have an even larger impact. Japan is the third-largest economy, well over USD 1 trillion larger than Germany, and now in the midst of an unprecedentedly large economic experiment. Japan's unparalleled need for sustainable economic growth dovetails with an increasingly powerful role of innovative local governments working in tandem with smart elements of key central agencies. The *stadtwerke* approach not only puts the local community in charge of the smart community deployment; it also institutionalizes that leadership in a vehicle with the financial, administrative and other means to take effective action. Japan's model may open an alternative to building smart communities led by behemoths of the private sector. Properly financed and incentivized local governments seem unlikely to allow large corporate actors simply to siphon income from core urban infrastructures and do as they will with data on the residents' consumption, movements and other interactions in the smart community.

Japan's own history of local public corporations also offers a fertile basis for the insertion of energy-centred *stadtwerke*. Japan's 1700-plus local governments have long had public corporations servicing such utility functions as water. Japan's local special corporations numbered only 45 in 1953, but had grown to 3,000 in the wake of the high-growth 1960s[111]. Japan has seen waves of expansion of local public corporations' roles and numbers, as the need arose. Their ranks swelled rapidly in the post-

110) See p. 32 European Parliament Directorate General for Internal Policies, "Mapping Smart Cities in the EU," January 2014: http://energytransition.de/2014/06/remunicipalization-of-hamburg-grid/

111) Samuels R., *The Politics of Regional Policy in Japan: Localities Incorporated?* Princeton: Princeton University Press, 1983, p. 38.

war years of high growth, due to the imperative of diffusing such basic infrastructures as waterworks and sewerage in cities and towns undergoing what was then an unprecedented pace of urbanization. Later on, the public corporations' welfarist role grew between 1975–1984, and for industrial promotion between 1985 and 1995[112].

The total number of Japan's local governments sharply declined over those decades. Amalgamations between 1953 and 1955 saw their count more than halved from 10,520 in October of 1945 to 3,975 in September of 1956. They continued to merge afterwards, reaching 3,229 in 2000, and then dropped to 1,718 in April of 2014[113]. That decline in the number of local governments, even as the number of local public corporations increased, underscores the significance of the latters' role.

As of fiscal year 2016 (FY 2016), Japan's 1,718 local governments boast a total of 8,534 public corporations, of which 3,639 (42.6 percent) manage the sewer systems and 2,041 (23.9 percent) the water supply. These businesses total (FY 2016) YEN 16.9 trillion in operations, and are managed through special accounts that are separate from Japan's local government general-budget (whose spending on sanitation, education, public works, and other categories is just under YEN 95 trillion). Of the public corporations' YEN 16.9 trillion in operations, the sewerage-works represent YEN 5.4 trillion (32.3 percent) and the water-works YEN 3.9 trillion (23.5 percent)[114]. These are, in short, significant local public service business operations that contribute to the economic activity of the local area as well as to the revenue base of the local governments.

Japan's local public corporations have almost no presence in electricity and gas, representing only 0.9 percent of the power supply and 2.6 percent of gas supply. These are key infrastructures for growing the smart community, as well as diffusing economic opportunity to nearby communities that could supply larger communities with power and energy. Postwar Japanese prefectures, cities and towns have been passive

---

112) Sakamoto M., "Public Corporations in Japan, with Special Emphasis on Personnel Management," in All Farazmand (ed) *Public Enterprise Management: International Case Studies*. Greenwood Press, 1996, p. 138.

113) See (in Japanese) "The Particulars of Meiji and Showa-era Amalgamations and Changes in the Number of Local Governments," Ministry of Internal Affairs and Communications, (nd): http://www.soumu.go.jp/gapei/gapei2.html

114) The details on Japan's local public corporations are available (in Japanese) at the Ministry of Internal Affairs and Communications 2016 Overview of Local Public Corporations: http://www.soumu.go.jp/main_content/000510325.pdf

consumers of centralized privately-owned power delivered by 10 monopoly firms that also dominated their respective catchment areas' political economies. Moving to smart communities and distributed power, through public agency, offered one means to bolster local communities as well as disrupt the old business model of the power utilities.

When viewed against this background, the technocrats' initiatives appear to have an unstated but potentially quite "political" dimension. As noted, the power *stadtwerke* in Japan offer a mechanism that puts the incentives to champion revolutionary change, leading smart communities, into the hands of the cities and towns. The Ministry of Internal Affairs and Communications (MIC), a fortuitous blend of ICT enthusiasm coupled with responsibility for local fiscal health, set a goal of establishing no fewer than 1,000 local energy firms over the five years from 2015. The national government would not only allow local governments to finance investments in these firms, but would pick up half the interest payments[115]. Moreover, Kashiwagi helped coordinate these initiatives as chair of the MIC "Commission for Deploying a Local-Government-Led Community Energy System." This Commission was created by MIC on November 4 of 2014, and held its first meeting on November 7. It had 3 more meetings, seeking to devise a template for local-government decentralized energy systems, through to March of 2015[116]. These and other policy initiatives suggested that smart-energy bureaucrats in the MIC were acting quickly, using the Abe regime's desperation to ignite sustainable domestic growth via a focus on "local Abenomics" and "regional revitalization" since mid-2014[117].

By the summer of 2017, these initiatives had resulted in 31 locally led energy firms, with a further 86 under consideration. These finding were the product of a 2017 survey of Japan's local governments by the Asahi Newspaper and Hitotsubashi University. The survey response rate was 79 percent (1,382 of Japan's 1,788 local gov-

115) On this, see "Small-town Japan's big hopes for energy self-sufficiency," *Nikkei Asian Review*, October 28, 2014: http://asia.nikkei.com/Politics-Economy/Policy-Politics/Small-town-Japan-s-big-hopes-for-energy-self-sufficiency

116) See (in Japanese) "Opening of a Commission for Deploying a Local-Government-Led Community Energy System," Japanese Ministry of Internal Affairs and Communications (MIC), November 4, 2014: http://www.soumu.go.jp/menu_news/s-news/01gyosei05_02000053.html

117) For a summary of the politics of "local Abenomics," see Sieg L. and Kajimoto T., "Japan's 'Abenomics' feared in trouble as challenges build," *Reuters*, September 2, 2014: http://www.reuters.com/article/2014/09/02/us-japan-economy-abenomics-idUSKBN0GX0VY20140902

ernments replied)[118]. Importantly, many of the projects listed (such as Hamamatsu City, Miyama City, and others) were fostered by the pragmatic and coordinated, post 3-11 disaster-resilience policymaking described in the above.

Making Choices

The technocratic strategies underlying this development had a long background. Kashiwagi and his cohort had been looking at the German city-business model for several years. They determined that German *stadtwerke* would provide a robust model for bundling post-deregulation expertise and institutional clout (e.g., for raising capital) without having to rely on unpredictable, distracted party politics or weak and fractious popular movements. But in addition, the public-sector-led approach means that the Japanese smart community would not merely be a construct of Hitachi, Panasonic and the other market players that would like to lead the smart city rather than be led[119]. Reading through the technocrats' work (as well as studies from within the MIC[120]) suggests their deliberations became increasingly detailed as they realized the post-3-11 period offered an opportunity to break through the dominance of the monopoly utilities and turn the energy political economy towards "prosumer" (power producer and consumer) cities.

Aside from the content of his recent activism and writing, what made Kashiwagi's involvement especially interesting is precisely that he is both a core member of the so-called "nuclear village" as well as an enthusiast for renewable energy[121].

118) See Ishii T. and Kobori T. (in Japanese) "31 Local Governments Doing Retail Power Businesses, Aiming at Local-Production/Local-Consumption," *Asahi Shimbun*, August 14, 2017: http://www.asahi.com/articles/ASK8F5FS8K8FULBJ002.html

119) On this very important question of whether the public sector will lead, see Marshall, A., "Big Data, Big Questions," *Metropolis*, February 2014: http://www.metropolismag.com/February-2014/Big-Data-Big-Questions/

120) The role of the *stadtwerke* in smart communities is especially well depicted in MIC's Local Revival Group's Local Policy Division's May 13, 2014 presentation to the governing LDP. See (in Japanese) "Concerning the Project on Distributed Energy Infrastructure" : https://www.jimin.jp/policy/policy_topics/pdf/pdf170_4.pdf

121) In a March 19, 2010 presentation, for example, Kashiwagi argued that an energy system shift was underway, towards low-carbon sources including nuclear power, "clean coal," natural gas as well as renewables linked together via ICT and smart communities. See (in Japanese) Kashiwagi Takao "The Smart Community Concept and Environmental Business," Kanto METI March 19, 2010: http://www.kanto.meti.go.jp/pickup/kankyoryoku/event/20100319kaisai_gaiyou.html

Kashiwagi straddled both Japan's deeply damaged paradigm of nuclear power as well as its rapidly emerging paradigm of distributed power and smart communities. He made sure to preface his remarks by expressing fealty to official "power mix" targets of roughly 20 percent nuclear by 2013, but would then spend the bulk of his attention on the role of the smart community. The diffusion of the smart community, and other forms of "local production-local consumption" (*chisan chishou*), posed a profound threat to traditional centralized models of power generation and transmission. This fact was already a point of expert debate in the global discourse[122]. In consequence, Kashiwagi was articulating a radical, disruptive programme from within the core of policymaking circles. He was, however, pragmatic and careful to stress the resilience, interregional equity and other benefits. This narrative arguably blunted the vested interests' capacity to stymie the deployment of distributed technologies that threatened their business models.

The severity of Japan's economic and other crises also puts a premium on making smart choices in the midst of multiple constraints. In this context, Kashiwagi opted to side with the general interest rather than the sectoral interests that dominated Japan's energy economy. This position was hardly a surprise: Kashiwagi designed Japan's first smart community, a 100 percent renewable microgrid project, linking NEDO and other facilities, that went functional at the 2005 Aichi World's Fair[123]. He had much intellectual capital invested in these initiatives. The power monopolies, with their focus on centralized power and control of the grid as the core of their business model, stood in the way of a nationwide diffusion of smart communities. Hence actual deregulation of the power sector was key to Kashiwagi's argument. So too was the diffusion of distributed renewable power supported by the FIT. Kashiwagi argued that Japan's local governments stand to gain JPY 5 trillion of Japan's JPY15 trillion power economy through distributed renewable energy supported by the FIT. He represented that opportunity as a massive boost for their finances as well as their local economies.

---

122) Hannes, B. and Abbott, M., "Distributed energy: Disrupting the utility business model," Bain Brief, April 13, 2013: http://www.bain.com/publications/articles/distributed-energy-disrupting-the-utility-business-model.aspx

123) On this see (in Japanese) Kashiwagi's description of the project in his article for the Ministry of Land, Infrastructure and Tourism (MLIT), "The Smart City: Achieving Both Economic Development and Environmental Measures," *MLIT Shinjidai*, Vol 71, February 2011: http://www.mlit.go.jp/kokudokeikaku/iten/service/newsletter/i_02_71_1.html

Importantly, one of Kashiwagi's collaborators on the community energy projects is Masuda Hiroya. We have already seen that Masuda is a major force in local revitalization. Masuda was also an advocate of renewable energy while governor of Iwate, having overseen the installation of 43 wind turbines in the prefecture's Kamaishi City while governor of Iwate Prefecture[124].

Both Kashiwagi and Masuda had also served as key members of the "Plan Subcommittee" (*keikaku bukai*) of the "National Lands Deliberation Commission" (*kokudo shingikai*). The subcommittee played a central role in overseeing Japan's National Spatial Strategy (NSS), adopted in August 2015. Kashiwagi was the first energy expert to serve on Japan's spatial planning and Masuda was alternate head of the subcommittee[125]. The 2015 NSS is a quite significant document, one the OECD *Territorial Review of Japan, 2016* deems "the most important of a number of key planning documents." The OECD added that unlike prior spatial plans, including the previous 2008 NSS, the 2015 NSS was a "truly horizontal initiative," one 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 was composed in a "whole of government" approach that brought together the MLIT and 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 gave the NSS a legitimacy that transcended its predecessor documents. That legitimacy is backed up by legal authority, because at least 20 other national laws are obligated to refer to the NSS[126].

---

124) Masuda gave a keynote talk on this and the need for distributed and smart-energy initiatives to a November 18, 2011 conference of the Japan Science and Technology Agency. See the attached transcript at Masuda H. (In Japanese) "Low-Carbon Society and Building Sustainable Communities," November 11, 2011, Keynote speech to Japan Science and Technology Agency conference on Towards a Low-Carbon Society Via Energy Conservation and Efficiency in Communities, Tokyo, November 11, 2011: http://www.jst.go.jp/lcs/result/agora20111118/index.html

125) The membership list of the "Plan Subcommittee" (keikaku bukai) of the "National Lands Deliberation Commission" (kokudoshingikai) for the relevant period (2014-2015) is available (in Japanese) at the MLIT website: http://www.mlit.go.jp/policy/shingikai/s103_kokudo_keikaku.html

126) OECD, "Territorial Reviews: Japan 2016," Paris: OECD, 2016: pp. 79-80.

The 2015 NSS also paid careful attention to smart communities, renewable energy, climate change, resilience and other factors as the context for urban policy. This was a sharp contrast with the previous 2008 NSS, evident in a survey of the frequency of several keywords in the 2008 NSS with the 2015 NSS. For example, the word "energy" appeared only 54 times in the 2008 NSS, but the 2015 NSS had 207 references to "energy." Similar results were 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, shows 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 displayed a far greater concern for climate and other disaster threats, as would be expected for a plan developed in the wake of the 3-11 disaster. Yet the NSS 2015 also reflected the emergence of a very different, distributed network paradigm for coping with disaster threats as well as the ageing and other challenges noted in the introduction to this chapter[127].

The fruits of Kashiwagi and Masuda's collaboration in such high-level planning and other initiatives was also seen in a 2015 book, (in Japanese) *The Cogeneration Revolution*[128]. In the book, Kashiwagi and Masuda discussed how an energy-centered community building and local economic revitalization can help not only to build a new growth paradigm but also to alleviate the crisis of rural depopulation and the threat of "local extinction."

In *The Cogeneration Revolution*, Masuda referred to public works as having been the primary Japanese mechanism of interregional redistribution. He represented this as a contrast to what he saw as the German innovation of interregional redistribution via the feed in tariff and opportunities in energy. In tandem with this line of thinking, Kashiwagi emphasized the opportunity to bolster the energy system and decentralize it through the deployment of cogeneration as well as the enhancement of reliance on solar, wind, geothermal and other local renewable energy resources. Kashiwagi portrayed smart grids and smart communities as being key networks in constructing the framework for this decentralization of energy. He also depicted both

127) Both the 2008 NSS and the 2015 NSS are available (in Japanese) at the following MLIT website: http://www.mlit.go.jp/kokudoseisaku/kokudokeikaku_fr3_000003.html

128) Kashiwagi, T. (ed) (in Japanese) "Cogeneration Revolution: A New Card for Growth in Local Revitalization," Nikkei BP Consulting, 2015.

as infrastructural investment that lends itself readily to participation by the private sector. Masuda agreed, and argued that facilitating private sector investment is perhaps the most important condition. He conceded that the previous era's investments in infrastructure helped greatly to network the national economy and foster industries. But he emphasized that it is too costly to maintain the same approach in an era when the focus is shifting from supporting industry to supporting livelihoods. He also noted that the diffusion of infrastructure throughout the country had despoiled the environment and led to a debt burden that is difficult to pay down. He added that technological and other changes were leading to the need for different kinds of infrastructure networks, including ICT as well as distributed energy. He pointed out that the diffusion of distributed energy could bring the additional benefit of helping to alleviate Japan's mounting debt burden.

Kashiwagi illustrated productive energy infrastructure as waste heat pipelines linking local communities with incineration plants to make use of the waste heat. He noted that the cost of this infrastructure often makes it difficult to construct. However, he noted that the Ministry of Internal Affairs and Communications fortuitously unites the former Ministry of Posts and Telecommunications and the former Ministry of Local Autonomy. The old Posts and Telecommunications Ministry had jurisdiction over many underground infrastructure networks for communications cables. The replacement of these communication cables with fiber-optic cables had left considerable space in the communication networks. Kashiwagi argues that this empty space could be used for the deployment of heat pipelines. This approach would lower construction costs and adhere to the Japanese state's policy of maximizing the "effective use of extant infrastructure stock" (*kizon no infurasutokku no yuukoukatsuyou*), a policy that had emerged from the Koizumi-era reforms and become common sense in the 2010s[129].

The lower costs of installation for the thermal networks arose from the fact that the thermal networks could be placed within existing utility corridors power cables, leading to a network of fiber-optics, heat pipes and wires. Kashiwagi argued that the business opportunity from distributing heat and power through these net-

129) This policy was a guiding theme in regional policy. See, for example, (in Japanese) "Strategic Infrastructure Management: Smart Use, Densification, and Reform," Ministry of Land, Infrastructure and Transport, 2008: http://www.mlit.go.jp/sogoseisaku/region/sogoseisaku_region_fr_000026.html

works would allow for it to be a very viable option for productive public works. He added that the business generated would provide a viable economic base on which to build communities complete with day care and other amenities that lead to increasing numbers of young people. Masuda agreed that the energy-centered community offered a new approach to overcoming the inertia of the past practice in regional development.

The Significance of Japan's Adaptation-Oriented Smart Cities

We have seen that the Japanese policy regime came to focus on resilience in the wake of 3-11. How Japan restructures its urban communities is potentially important for a global community confronted with rapidly worsening climate change and increasing resource constraints. As many expert analysts and organizations argue, these crises will have to be resolved — or at least alleviated to manageable levels — in cities. This is because cities comprise 3 percent of global land area but produce 50 percent of global waste and about 70 percent of global anthropogenic greenhouse gas emissions. Cities also consume nearly 75 percent of natural resources, while generating about 80 percent of global GDP[130]. Over half the total global population of 7.6 billion[131] already lives in cities. UN and other projections suggest 2 billion new urban residents will likely be added by 2030, during which time perhaps over 2 billion new "middle class" consumers may increase the ranks of the present 3.2 billion. It is estimated that 65 percent (or just under 3.5 billion) of these middle-class consumers will be in the Asia-Pacific region[132].

Given the above, unprecedented resource efficiency and substitution is imperative. The United Nations Environmental Programme's (UNEP) June 5, 2014 report on "Decoupling 2: Technologies, Opportunities and Policy Options" warned that between 2000 and 2010, metal prices increased by 176 percent, rubber by 350 percent and en-

---

130) The figures cited are available in the United Nations Environmental Programme's "Global Initiative for Resource Efficient Cities" : https://resourceefficientcities.org

131) The figure is for 2017, and cited in "World Population Prospects: Key Findings and Advance Tables, 2017 Revision," United Nations Department of Economic and Social Affairs, Population Division, 2017: https://esa.un.org/unpd/wpp/Publications/Files/WPP2017_KeyFindings.pdf

132) See Kharas, H. "The Unprecedented Expansion of the Global Middle Class," Global Economy and Development Working Paper 100, Brookings Institute, February, 2017: https://www.brookings.edu/wp-content/uploads/2017/02/global_20170228_global-middle-class.pdf

ergy sources by a rough average of 260 percent[133]. These price signals of unsustainability were evident after just a decade and a half in which some 260 million Chinese had migrated to cities. Though prices dipped for a short period in the early 2010s, they began climbing again in mid-decade. In its October 2017 *Commodity Markets Outlook*, the World Bank noted that energy prices were set to increase and that there were substantial geopolitical, supply and other risks[134].

The forces driving these price increases are myriad. Similar to the UNEP's study, the February 2015 OECD report on *Material Resources Productivity and the Environment* warned that the sheer amount of material extracted, harvested and consumed globally had ballooned 10-fold between 1900 and 1980, reaching roughly 35 billion metric tonnes (Gt). Between 1980 and 1990, this volume rose yet again, to reach 43 Gt. The volume then further expanded to 72 Gt between 1990 and 2010. During the same 1990 to 2010 period, the OECD share of these material flows fell from 43 percent overall to 27 percent, while the BRICS share, led by China and India, rose from 34 percent to 61 percent. Meanwhile, the non-OECD, non-BRICS "rest of the world" share of this growing mountain actually declined slightly from 22 percent to 21 percent. But under business as usual, the non-BRICS, non-OECD share of material flows is likely to increase as the total is slated to exceed 100 Gt by 2030[135]. Indeed, the UNEP report projected that total material flows could reach 140 Gt by 2050, given business as usual.

The scale of "business as usual" was outlined succinctly by the OECD. Its report revealed that the average, daily per-capita consumption of materials in OECD countries in 2011 was as follows: 10 kg of biomass, 18 kg of construction and industrial minerals, 13 kg of fossil energy carriers, and 5 kg of metals[136]. That volume of material consumption is one of the reasons for the onset of the Anthropocene era[137].

133) See p. 23 of the report itself as well as summary "Factsheet" at the website report's UNEP website: https://www.unenvironment.org/resources/report/decoupling-2-technologies-opportunities-and-policy-options

134) See World Bank, *Commodity Markets Outlook*, International Bank for Reconstruction and Development/ World Bank, October 2017: http://pubdocs.worldbank.org/en/743431507927822505/CMO-October-2017-Full-Report.pdf

135) The report's overview and relevant data can be found at OECD, *Material Resources, Productivity and the Environment*, Paris: OECD, February, 2015: http://www.oecd.org/env/waste/material-resources-productivity-and-environment.htm

136) See OECD, *Material Resources, Productivity and the Environment*, Paris: OECD, February, 2015, p. 9.

137) See Krausmann, F. et al., "Material Flow Accounting: Measuring Global Material Use for

More striking is the calculation of human impact over time. Vaclav Smil, the noted student of energy and materials, calculated the increase of global "anthropomass" (the sheer mass of homo sapiens) between 1900 and 2000. Smil's calculations found that the anthropomass increased from 13 megatons of carbon (Mt C) in 1900 to 55 Mt C in 2000. Over the same period, the stock of wild terrestrial mammals halved, from 10 Mg C to 5 Mt C, while domesticated animals (especially cows and pigs) rose from 58Mt C to about 200 Mt C[138].

Moreover, this amount of material consumption omits the much larger and increasing "overburden" and other waste removed to extract useful resources. These materials do not enter the flow of consumable resources, yet also cost more and more energy as well as equipment and other inputs to dig up, separate and throw away. There is as yet no consistent international accounting for this overburden and other waste. But in the United States alone, these "extractive wastes" are estimated to total roughly 10 Gt per year[139].

"Business as usual" would mean a 140 Gt flow of resources in 2050, thrice the gargantuan figure for 2000. The UNEP argue that it would probably exceed the limit of all available resources as well as this planet's capacity to absorb the massive ecosystem damage of extracting it. So consider again the anticipated 3 billion more middle-class consumers, a near doubling of the present 1.8 billion who collectively account for 80 percent of current material consumption. Math, physics and other realities indicate that urbanization and middle-class lifestyles simply cannot follow the resource-and energy-intensive pattern common to the developed world and rapidly diffusing throughout the BRICS. Without radical change, resource and energy prices seem likely to increase significantly, especially due to interactions with water and other constraints. Moreover, accelerating climate change will — as even the US military has warned — become increasingly marked by extreme weather, declining crop yields, expanding disease outbreaks, and resource wars[140].

Sustainable Development," *Annual Review of Environment and Resources*, Volume 42, October 2017: http://www.annualreviews.org/doi/full/10.1146/annurev-environ-102016-060726

138) See Smil, V. "Harvesting the Biosphere: The Human Impact," *Population and Development Review*, Volume 37 Number 4, December 2011: http://vaclavsmil.com/wp-content/uploads/PDR37-4.Smil_.pgs613-636.pdf

139) See Hill E., "Material Wastes," in Materials, Society and the Environment, January 4, 2016: http://www.trunity.net/sam2/view/article/51cbf4897896bb431f6afcf7/

140) See the US Center for Naval Analysis Military Advisory Board "National Security and

Done collaboratively, democratically, and quickly, the smart-city paradigm may help steer humanity away from — or at least minimize — the fraught outcomes detailed by the UNEP, the OECD, the US military and a host of other agencies. The smart initiatives build on past programmes for resource-efficiency, especially in urbanization, by putting cutting-edge monitoring and management technology into the mix. In Japan, as elsewhere, the smart city essentially blends the ICT in, to take a trivial example, a smart phone with such large-scale and resource-intensive urban infrastructures as power and energy systems, waterworks, transportation, waste treatment, street lighting, administration and health care. Measuring and monitoring these massive systems, and helping urban citizens and businesses avoid waste, opens the door to radical efficiencies. This is neither the stuff of fantasy nor ICT firms' PR materials. Thanks to the rapid cheapening and miniaturization of the GPS, thermometers, accelerometers, hygrometers, ambient light monitors, and other sensors "stuffed" in the smart phone[141], the power of ICT is already enabling communities to realize significant gains in efficiency, resilience, responsiveness, and creativity.

Nor are rising resource costs the only driver: The development of smart cities, an inherently decentralized model, is also being accelerated by the patent vulnerability of large-scale and centralized power and other systems to increasingly frequent and intense natural and human disasters. Not all smart systems are inherently resilient to natural disasters and cyberattack, which is one reason for the rise of "network science[142]." As Anthony Townsend, Research Director at the Institute for the Future and Senior Research Fellow at New York University's Rudin Center for Transportation, illustrates very well[143], these profound trends are already reshaping urbanization. For Townsend and others, the real question is whether the citizens in smart cities will lead, or just be led.

---

the Accelerating Risks of Climate Change," CAN, May 2014: http://www.cna.org/sites/default/files/MAB_2014.pdf

141) On the cheapening of sensors, see Jesse Berst "A 'perfect storm' that's good news. (Falling prices on comms and sensing)," SmartGridNews.com, April 25, 2014: http://www.smartgridnews.com/artman/publish/Business_Markets_Pricing/A-perfect-storm-that-s-good-news-Falling-prices-on-comms-and-sensing-6487.html

142) On this, see Marchese, D. and Linkov, I. "Can You Be Smart and Resilient at the Same Time?", *Environmental Science and Technology*, 51, May 10, 2017: http://pubs.acs.org/doi/pdfplus/10.1021/acs.est.7b01912?src=recsys

143) See Townsend, A., *Smart Cities: Big Data, Civic Hackers, and the Quest for a new Utopia,* New York: W. W. Norton, 2013.

Policy Integration, Citizens and Resilience

As described earlier, Japan's technocrats have built an array of collaborative mechanisms, some described in the OECD Territorial Review of Japan 2016. These institutions and organizations link together all levels of government, business (emphasizing what might be deemed "fiscal affirmative action[144]" opportunity for SMEs), civil society, and academe in addressing the challenges (eg, aging, depopulation, disaster hazards, energy risks) and diffusing solutions (compact cities, efficiency, renewables, microgrids) in ways that suit local circumstances.

It is indeed indubitable that these approaches emphasize local circumstances, rather than just impose the centralized models that characterized much of Japan's centre-local relations during the postwar year. To confirm that point, one has only to read the local versions of renewable energy, compact city, disaster-resilience, and related strategies. Perusing them confirms that the plans discuss — in extensive detail — local disaster risks and resource endowments (eg, biomass, geothermal). And searching for regular updates reveals that the plans are not only being implemented but are being revised in light of changing conditions[145].

One stand-out case in this regard is the city of Higashi Matsushima, one of the Future Cities noted in **figure 18**. The Higashi Matsushima City Smart Disaster Prevention Eco Town offers a fascinating account of the institutional context that has fostered it and other rapidly proliferating cases.

The population of Higashi Matsushima prior to 3-11 was 43,142. Over 1,130 residents died in the disaster, which saw 65 percent of the city inundated by the sea. As noted earlier, the disaster led to the official opening of Japan's first microgrid-based smart community on June 12, 2016. The microgrid allows the community's power network to "island" from the regional power grid in the event of a disaster. Higashi Matsushima eco-town's renewable generation assets, complete with battery storage, are linked through the microgrid. Even in a protracted disaster, this system will pro-

144) This is because the subsidies and other supports are more generous for smaller businesses.

145) The plans are also made public. They can all be accessed (in Japanese) via the Cabinet Secretariat's National Resilience website, which links to them: https://www.cas.go.jp/jp/seisaku/kokudo_kyoujinka/tiiki.html

vide power to the municipal hall and critical-care facilities.

Higashi Matsushima's project is not the product of top-down, cookie-cutter policymaking. Higashi Matsushima Mayor Hideo Abe was a practitioner of citizen-centred city management before 3-11. He led "citizen-collaborative city planning" from 2005, allowing citizens into the centre of policymaking[146]. For example, Mayor Abe put community groups in charge of local assets, rebranding them as citizen centres (*shimin sentaa*) empowered to make decisions on public safety, aging and other issues, well before 3-11. The Japanese Association of City Mayors certainly recognized how important Mayor Abe's innovation were. On October 8, 2014, the Association asked his advice on "local revitalization" policies and how he and his city officials undertook countless workshops with residents to build trust has led a bottom-up rebuild with the ambition of energy autonomy[147].

Mayor Abe personally lost relatives in 3-11, and hence led the post-3-11 rebuild of Higashi Matsushima under the slogan of "Never Forget That Day" and with the ambition of energy self-sufficiency. The city's residents were fully in support because virtually all knew of residents who had died in the open, due to the cold, or in hospital because there was insufficient back-up power to run critical services.

The residents and local businesses are organized in the "Higashi Matsushima Organization for Progress and Economy, Education and Energy (HOPE)." HOPE was set up as a company on October 1, 2012, and include former PM Kan Naoto and environmentalist CW Nicol on its advisory board. It also lists Sekisui House, NEC, Panasonic, Nomura, Fujitsu, and other firms among its members[148].

Interestingly, Japan's resolutely anti-nuclear Institute for Sustainable Energy Policies (ISEP) was listed as an advisor organization on October 24, 2011, when Higashi Matsushima applied for "Environmental Future City" recognition and

146) On Higashi Matsushima's "citizen-collaborative city planning," see (in Japanese) the following Higashi Matsushima City website: http://www.city.higashimatsushima.miyagi.jp/city/kyoudou/index.html

147) On Mayor Abe's comments to the Japan Association of City Mayors, see (in Japanese) "Higashi Matsushima City Mayor Abe Attends October 8, 2014 5^{th} Hearing of Basic Policy Deliberation Team on Local Revitalization," Japan Association of City Mayors, October 8, 2014: http://www.mayors.or.jp/p_action/a_mainaction/2014/10/261008kihonseisaku.php

148) The membership list of Higashi Matsushima Organization for Progress and Economy, Education and Energy (HOPE) is available (in Japanese), current to April of 2017, at the following website: http://hm-hope.org/organization/

finance[149]. That was not surprising, because ISEP work with Denmark[150] and Higashi Matsushima was visited by the Crown Prince of Denmark on June 14, 2011. Among other things, the Crown Prince participated in a seminar on renewables and reconstruction. Higashi Matsushima also received USD 1 million from Maersk, the Denmark-based shipping conglomerate. In fact, the city became the focus of Danish 3-11 relief efforts in Japan largely because they knew a contact at Tohoku University (a Japanese Assistant Professor of Agriculture and with links to Denmark). Moreover, unlike many overburdened local governments in the disaster area, they were able to answer the phone on March 30, 2011 when the Danish Ambassador was seeking a 3-11 site to visit[151]. In short, the city was lucky. But Higashi Matsushima was also able to seize the opportunity because it already had smart local leadership and community trust.

Indeed, Higashi Matsushima City undertook a very citizen-centred project on relocating the 1,395 households whose domiciles were destroyed. The effort was the subject of several major conferences, including a July 25, 2013 symposium[152]. Over 2,000 city residents' were involved in the deliberations, and the plans met with an 80.5 percent approval rate[153]. The Ministry of Environment understood the depth of Higashi Matsushima's local capacity when — in the spring of 2014 — they asked the city officers to consider applying for an "autonomous and distributed power supply test-bed

149) See p. 50 of the Higashi Matsushima City October 24, 2011 application (in Japanese) for "Environmental Future City" support: http://www.kantei.go.jp/jp/singi/tiiki/kankyo/teiansyo/higashimatsushima1.pdf

150) ISEP apparently fell from favour after the DPJ lost government in December of 2012 to the LDP. Perhaps that explains why ISEP does not (evidently) discuss HOPE and Higashi Matsushima as examples of community power. But the eclipse of ISEP and return of the LDP certainly did not mean that Higashi Matsushima City's smart local leadership and community trust went away.

151) On this and other background facts concerning Higashi Matsushima, see (in Japanese) Kono H., *Community Energy*, Tokyo: Chuo Koron Shinsha, 2017, p. 84.

152) The symposium was featured in a Nikkei Smart City Consortium article (in Japanese) "The Mayor of Higashi Matsushima on Compact Community Building Through Group Relocation," Nikkei BP, July 25, 2013: http://bizgate.nikkei.co.jp/smartcity/symposium/symposium5/001299.html

153) On these numbers, see p. 7 of (in Japanese) Furuyama M., "Steps in Higashi Matsushima's Reconstruction and Building Disaster Resilient Community," Presentation to Fukuoka Prefecture Seminar on Local Approaches to Promoting Renewable Energy and Energy Conservation, Kitakyushu City, October 12, 2017: http://www.pref.fukuoka.lg.jp/uploaded/attachment/33818.pdf

project.” The city secured the funds, and was able to use them (along with other monies) to cover 3/4 of the JPY 500 billion cost of the entire disaster-resilient system. These expenditures included JPY 160 billion for solar capacity, JPY 95 million for the microgrid, JPY 60 million for a 500 kW battery system, JPY 50 million for a 500 kW biodiesel generator, along with such ancillary costs as transformers, energy-management systems, and project design[154].

Higashi Matsushima City eco-town’s 460 kilowatts of solar is just part of the story. The city-wide deployment of renewable energy multiplied by nearly 20 times between 2011 and 2015, rising to 35 percent of the city’s power consumption. The city aims at a lofty 120 percent target by 2026. Moreover, from April of 2016, the community started a local power company, “HOPE Electricity”. As of October, 2016, HOPE Electricity had a client base of 34 city and 98 private-sector facilities, delivering just over 8 megawatts (MW) of power at 1.5 percent below the cost of Tohoku Power, the regional major. HOPE Electricity’s power sales are expected to bring in JPY 10 million of profit, to be reinvested in the community. HOPE also aims to increase its power sales to over 20 MW, which seems achievable given the attraction of being local and the lack of competitors in the region[155].

Minamisoma City

A further example of local resilience and renewable energy is seen in Fukushima Prefecture’s Minamasoma City. The city’s location is outlined in **figure 20.**

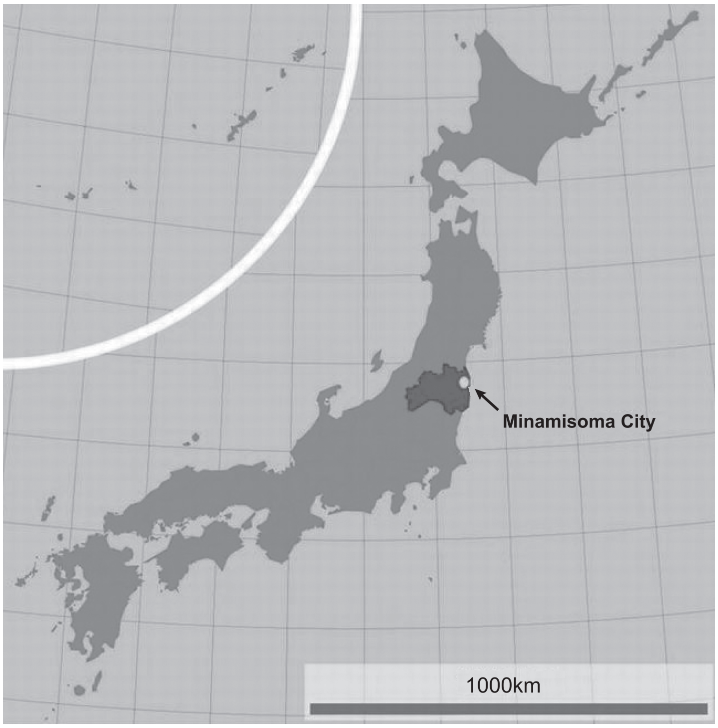
1) Minamisoma Smart Community

Minamisoma City’s population was 55,359 as of November 1, 2017[156]. The city’s smart community plan was updated to August 9, 2016. The city is very close to Fukushima, the epicenter of the 3-11 nuclear disaster, so it naturally emphasizes renewable energy and efficiency along with EVs and other green technology. The city

154) The particulars are described (in Japanese) in Kono H., *Community Energy,* Tokyo: Chuo Koron Shinsha, 2017, pp. 60-62.

155) The particulars regarding HOPE Electricity are available (in Japanese) at the firm’s website: http://hm-hope.org/denki/. See also (in Japanese) Kono H., *Community Energy,* Tokyo: Chuo Koron Shinsha, 2017, pp. 85-87.

156) See (in Japanese) the Minamisoma website for details on population and other demographic information: http://www.city.minamisoma.lg.jp/index.cfm/8,2740,44,html



Source: https://www.japanfs.org/en/news/archives/news_id035286.html

Figure 20 Fukushima Prefecture's Minamisoma City

renewable assets in 2011 were a mere 4 percent of their power mix. But the goals are to achieve 65 percent by 2020 and then 152 percent by 2050[157]. That would lead the city to become a regional exporter of power.

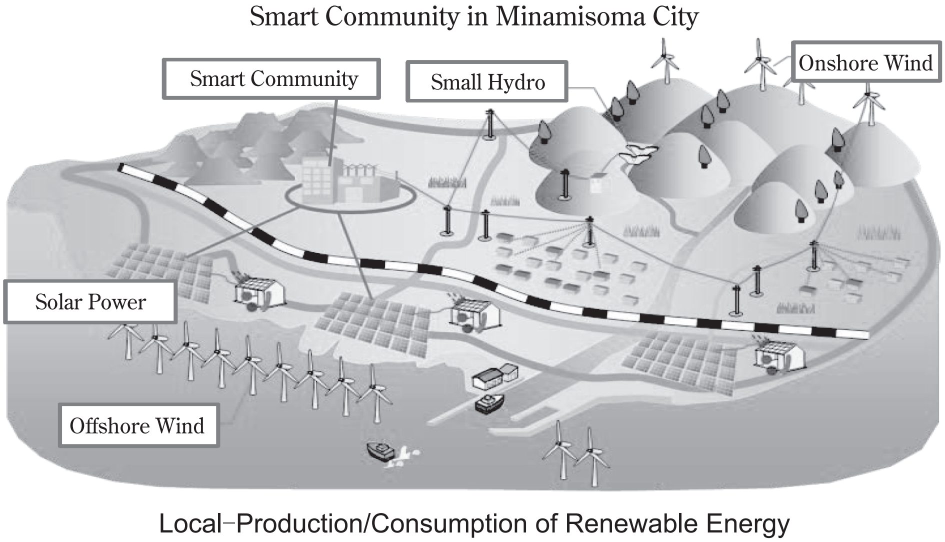
The city keeps track of its progress and publishes the details, albeit not as timely as it might. The most recent assessment shows that renewable deployment went from 4 percent of power to 8.2 percent in 2014. This number was ahead of Minamisoma's planned pace of deployment.

The city's progress on efficiency continues through the deployment of HEMS, BEMS and other energy management systems. Minamisoma has a 40 MHz battery system in place (in collaboration with Tohoku EPCO and NEPC)[158].

---

157) Minamisoma's summary smart community plan is available (in Japanese) at the following internet website: http://www.city.minamisoma.lg.jp/index.cfm/8,4168,c,html/4168/vision_01.pdf. The details concerning the energy plan are available (in Japanese) at table 4-1 of the following file: http://www.city.minamisoma.lg.jp/index.cfm/8,4168,c,html/4168/vision_02-4.pdf

158) A February 2017 report on the battery system is available (in Japanese) at the NEPC



Source: Minamisoma City[159].

Figure 21 Minamisoma's Illustration of the Smart Community

Figure 21 illustrates the model that guide's the city's smart-energy investments and their location. Key to this example and myriad others is the resilience framework developed by the policy integration outlined earlier. As can be seen from the outline and its collaboration, the efforts have built an increasingly integrated, industrial-policy paradigm. It deserves further scrutiny to see whether it can evolve vested interests (such as Tohoku EPCO) as well as normalize renewable energy among the NIMBY and distracted mainstream as resilience against myriad hazards.

Hirosaki City

Another example of a Japanese smart city is Hirosaki City, in Aomori Prefecture. The city's geographical location is portrayed in **figure 22.**

Hirosaki City's population was 174,287 as of October 1, 2017. Hirosaki Smart City's updated plan was open to public comment between March 8 and March 23 of 2017, and then adopted. **Figure 23** outlines the community energy system, which links up heat, power and information networks as well as an array of decarbonizing inputs.

---

website: http://nepc.or.jp/topics/pdf/170331/170331_1.pdf

159) The figure is a translation of the graphic posted (in Japanese) by Minamisoma City at the following website: http://www.city.minamisoma.lg.jp/index.cfm/8,4168,75,html

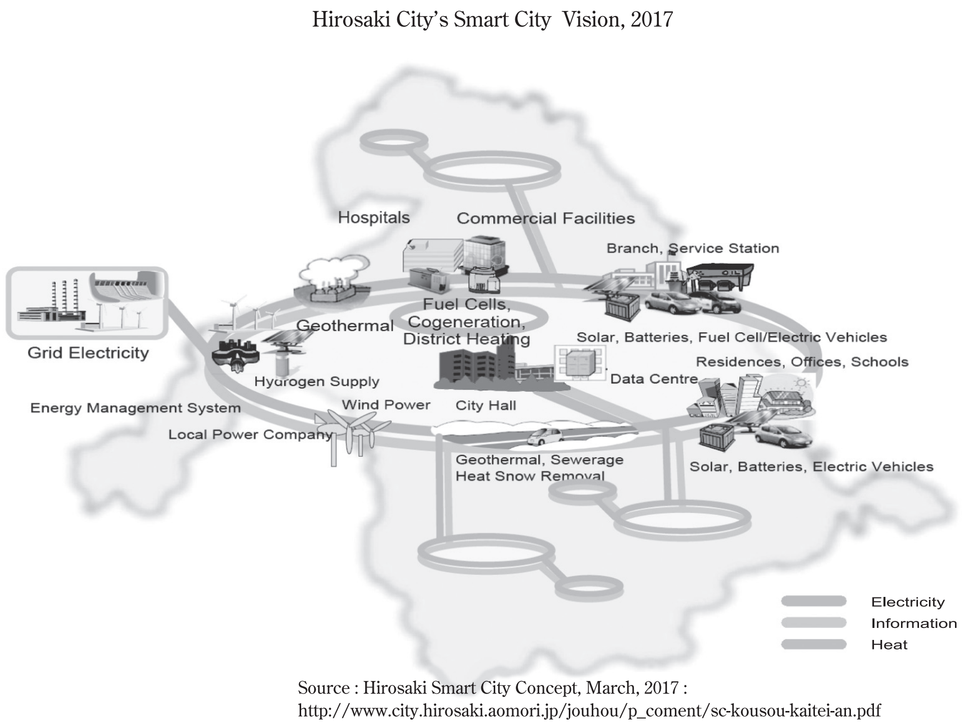
Source: Hirosaki City.

Figure 22 Aomori Prefecture Hirosaki City

In 2017, the city's initial smart city plan became 4 years old, and required updating because (as its authors emphasize) of massive and rapid technological changes and the fact that its phase 2 is about to start.

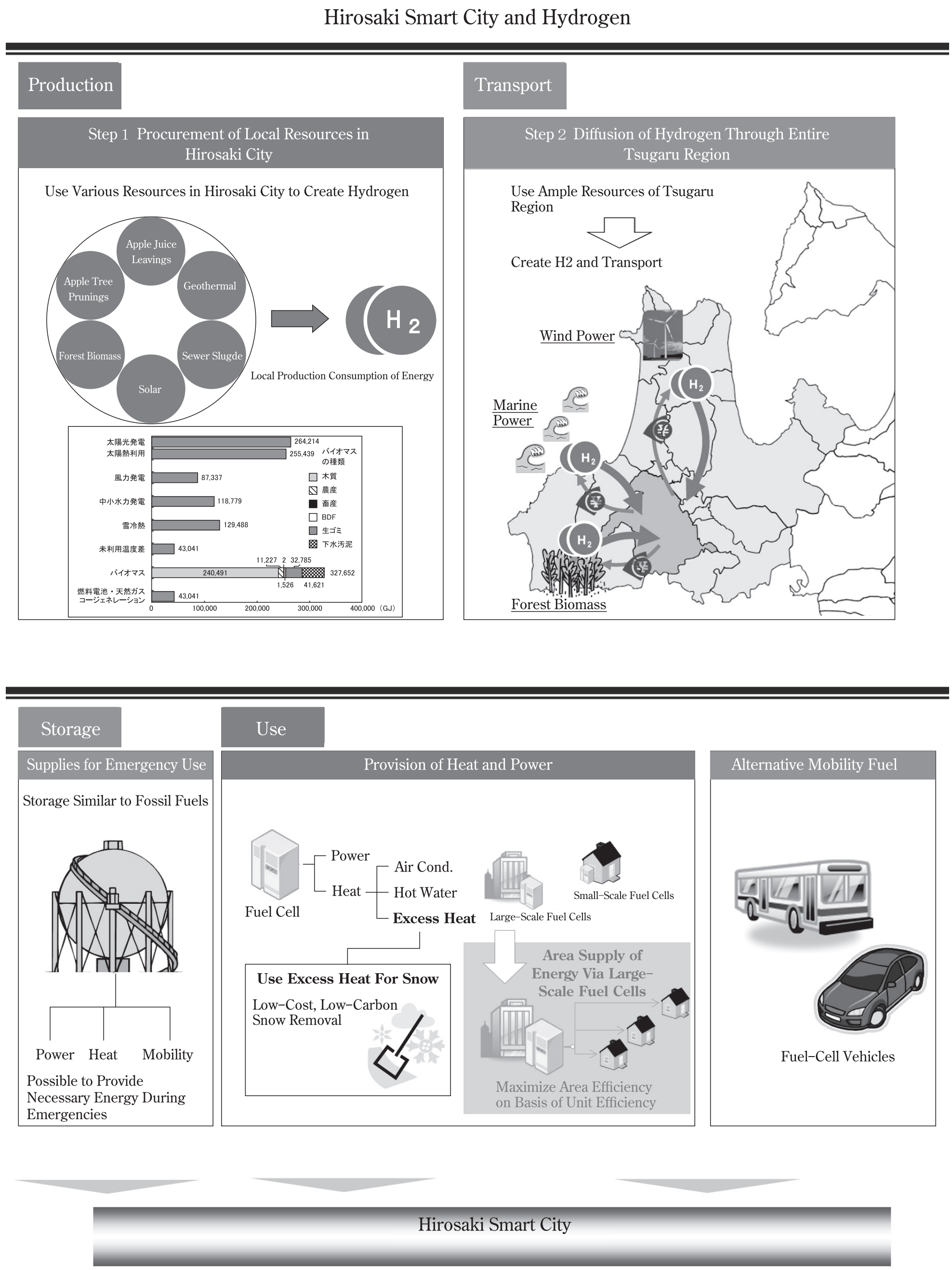
Phase 1 of Hirosaki City's smart city project ran between FY 2013 and FY 2016. The plan emphasized the deployment of extant technologies and disaster resilience. The city installed significant amounts of LED lighting, some solar, energy management, advanced waste treatment, and other technologies. The next phase of the smart city plan is to deploy the "community energy system" outlined in **figure 23**.

Figure 24 also outlines the steps in Hirosaki City's aim to produce and use hydrogen. As can be seen from the figure, the plans focus on the use of local resource endowments, including wind and biomass, to produce the hydrogen. The fuel will then be used in cogeneration systems as well as in local mobility. The promotion of hydrogen as an alternative fuel has become a major initiative for the Japanese government.



Source: Hirosaki City.

Figure 23　Hirosaki Smart City Concept



Source: JRI[160].

Figure 24 Hirosaki City's Hydrogen Plans

160) The Japan Research Institute file is a posting of Hirosaki City's 2012 plan for hydrogen diffusion. See the item (in Japanese) at the following website: https://www.jri.co.jp/MediaLibrary/file/pdf/company/release/2013/130329/130329-3.pdf

Toyama City

Toyama Prefecture's Toyama City is a particularly interesting project. The city's location is portrayed in **figure 25**.

Toyama City's population in October of 2017 was 417,966. Toyama was selected to be an "Environmental Model City" in 2008, one in which revitalization of public transport was made the core element in shifting the city towards a more compact and sustainable spatial profile[161]. The project centred on planning, with improved transport as the focus. Toyama City was also selected as an "Environmental Future City" in 2011[162]. And in June of 2012 the OECD chose Toyama City as an exemplary case

Source: Toyama City

Figure 25 Toyama Prefecture Toyama City

161) See (in Japanese) "Concerning the Selection as an Environmental Model City," Toyama City: http://www.city.toyama.toyama.jp/kankyobu/kankyoseisakuka/ondankataisakukikaku/kankyomoderutoshi.html

162) See (in Japanese) "Concerning the Environmental Future City Concept," Toyama City:

of "compact-city development[163]."

In addition, Toyama was also chosen to be one of the Rockefeller 100 Resilient Cities[164], in December, 2014. Toyama was the first Japanese city to be selected as one of these 100 resilient cities (Kyoto was added later). Since December of 2013, the Rockefeller Foundation has used the resilient cities programme to disseminate awareness of climate change and other challenges to cities. The Foundation makes its selections based on applications from the cities themselves. One major goal is to foster an international cohort of Chief Resilience Officers, each working in his or her designated city and funded by the Foundation. Ideally, these Chief Resilience Officers are empowered to build resilience within their own urban and regional contexts, borrowing from international best practice as well as contributing to it. Another resilient-city goal is to maximize the "resilience dividend," by deploying infrastructures and practices that pay off in greater resilience against disaster as well as during routine operations[165]. These are the mitigation and adaptation synergies illustrated in **figure 1** of this paper.

Toyama City is thus a notable case internationally as well as in terms of multiple, overlapping policy lines. These policies and their main sponsoring agencies (in brackets) include compact city (MLIT); smart community (METI); distributed energy (MOE, METI); hydrogen generation and distribution (METI); heat-recovery in sewers (MLIT); ICT-enabled efficiencies (MIC); and new-model mobility, such as car-sharing, small electric and fuel-cell vehicles, buses and light rail (MLIT, METI). As noted earlier, the central element of Toyama's approach is to use revitalized public transport to focus urban functions on the downtown area as well as along urban transit lines. The city also aims to revitalize its downtown area, enhancing its walkability and thus bolstering its social capital.

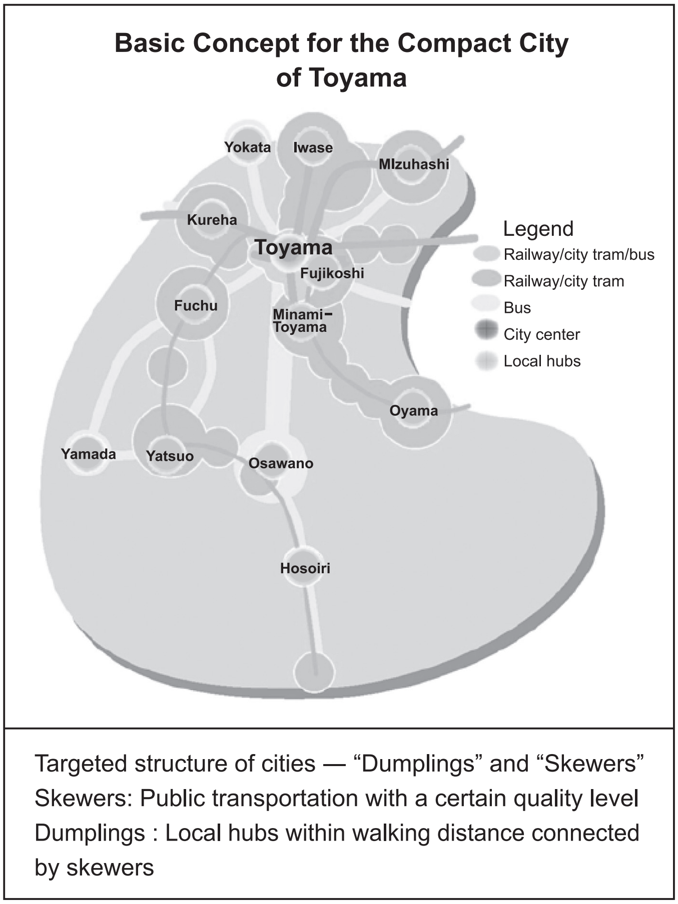
The overall image of what Toyama aims at is seen in **figure 26**. As is evident in the figure, the compact city approach seeks to counter sprawl and motorization through plans that relocate core urban services (medical, welfare) in downtown areas

http://www.city.toyama.toyama.jp/kankyobu/kankyoseisakuka/ondankataisakukikaku/kankyomiraitoshi-1.html

163) See "Governance: Compact Cities: the way of the future," OECD, June 13, 2012: http://www.oecd.org/newsroom/governancecompactcitiesthewayofthefuture.htm

164) The website for the Rockefeller 100 Resilient Cities is available at the following URL: http://www.100resilientcities.org

165) Concerning the Rockefeller Foundation's 100 Resilience Cities initiative, see: https://www.rockefellerfoundation.org/our-work/initiatives/100-resilient-cities/



Source: MOE[166].

Figure 26 The Compact City in Toyama

and link them through improved public transit options.

Toyama has also sought to increase the use of renewable energy. Toyama’s renewable energy and related projects include the deployment of solar and other power generation in the downtown area. The city also aimed at building a distributed energy and materials circulation system that includes biomass, especially marine biomass as well as a biogas network that uses leftover foodstuffs as the input resource. Toyama City’s outlying regions were also to be stimulated by a program that stresses the

166) The figure is available at “G7 Environment Ministers’ Meeting to be Held in Toyama, an Eco-City Japan Boasts to the World,” *Japan Environment Quarterly*, Ministry of the Environment, Volume 13, March 2016: http://www.env.go.jp/en/focus/jeq/issue/vol13/fea01.html

revitalization of farms via small hydro and other renewable energy projects. The city was also to build a factory for the cultivation of plants related to the pharmaceutical industry, one that uses geothermal, small hydro, solar and other energy sources. The city also aimed at building an "eco-forest Toyama," a project that aimed to increase forested area from zero hectares (ha) in 2010 to 500 ha by 2016. The amount of forest-origin biomass was also to be increased from 370 tons in 2010 to 2000 tons in 2016[167].

Toyama City's most recent reports on its progress indicate that its forested area increased to 699 ha[168]. The city had also subsidized the installation of 156 energy management systems by 2016[169].

More recently, Toyama opened a newly renovated downtown area as a model smart and compact community, as shown in **figure 27**. The project is 8,500 square meters, and contains 21 housing units and city facilities. All of the housing units include

Source: Toyama City[170].

Figure 27 Toyama City Safe and Smart Model Block

167) On this, see (in Japanese) "Toyama City Environmental Future City Plan," Toyama City, 2013: http://www.city.toyama.toyama.jp/data/open/cnt/3/9959/1/05siryou2.pdf

168) See the data in the table on p. 2 of (in Japanese) "Toyama City Forestation Plan," Toyama City, March 2017: http://www.city.toyama.toyama.jp/data/open/cnt/3/5391/1/kanseipuran.pdf

169) See p. 120 of (in Japanese) Toyama City's Environment, 2017, Toyama City: http://www.city.toyama.toyama.jp/data/open/cnt/3/3487/1/H29toyamashinokankyou.pdf

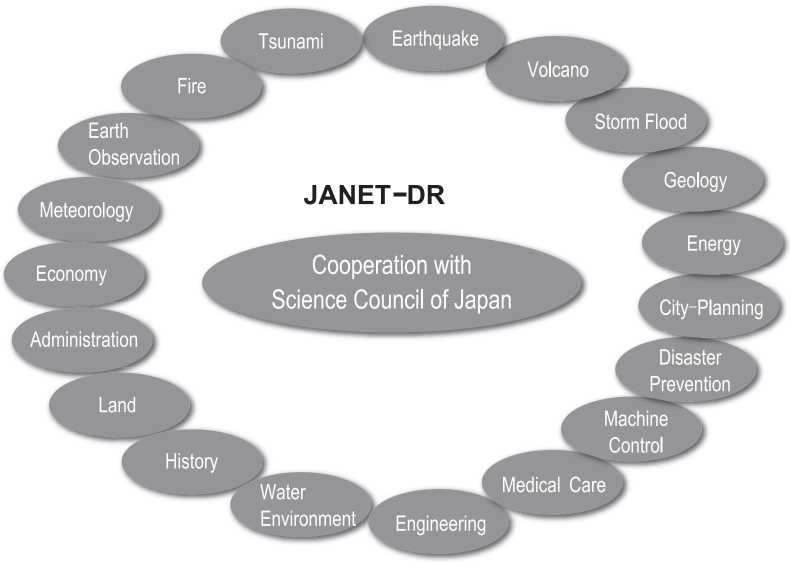
170) The figure was provided by the Toyama City Environmental Division's Office of Environmental Policy.

solar power, battery back-up, and household-size fuel cell cogeneration. There is also a community solar project of 11 kW used to deliver power to a community battery. This arrangement is to provide power supplies in emergencies to the community park, which is designated a disaster shelter for emergencies. The public facilities became operational in October of 2017[171].

Collaboration on Building Resilience

We have seen that many Japanese cities are sites of resilience collaboration that developed within and among the central agencies. Indeed, there is an impressive degree of collaboration among Japanese centre-local governments, academe, business, NGOs and other actors on National Resilience.

For example, National Residence and related policy initiatives benefit from the



Source: JANET-DR[172].

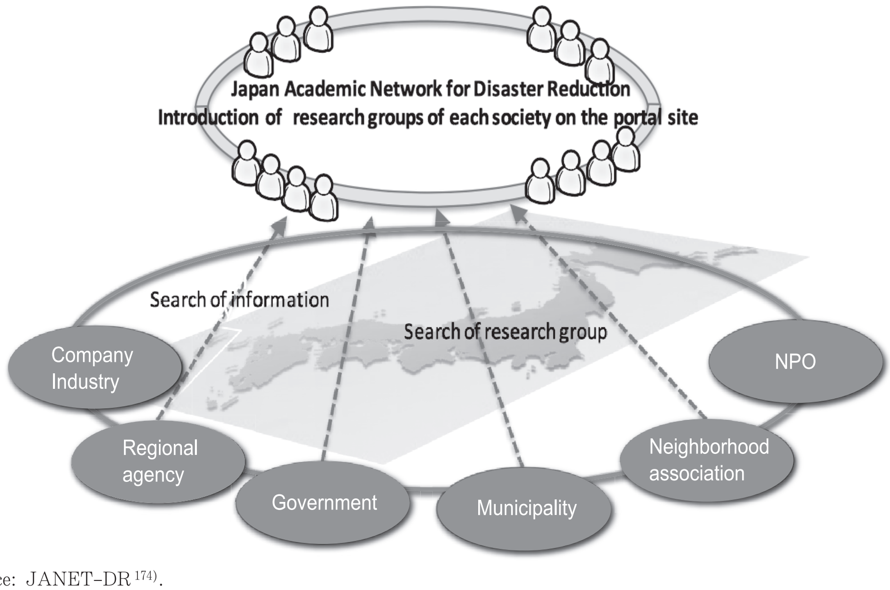
Figure 28 The JANET-DR's Scope

171) On the details, see (in Japanese) Kudo S., Zero Energy Block in Toyama City: Solar, Batteries and Fuel Cells," *Nihon Keizai Shimbun*, October 30, 2017: https://www.nikkei.com/article/DGXMZO22873290Q7A031C1000000/

172) The figure is taken for the JANET-DR's updated (to November 1, 2017) English-language brochure on its organization and activities: http://janet-dr.com/02_about/janetdr_A4_eng.pdf

Japan Academic Network for Disaster Reduction (JANET-DR)[173]. This network links 55 academic associations, as of November 1, 2017. As **figure 28** shows, these associations cross a lot of relevant disciplinary boundaries. These disciplines include energy, disaster prevention, city planning, hydrology, and several other areas especially relevant to coping with the Anthropocene. The JANET-DR also cooperates with the Science Council of Japan, whose role is akin to the US National Academy of Sciences.

The JANET-DR was formalized on January 9, 2016. It emerged from a 30-association liaison that followed 3-11 and played large role in shaping the resilience debate, through numerous major events and several publications. Since its formal founding in January of 2016, the JANET-DR has held multiple Disaster-Resilience symposia, analyzing the worsening threat of typhoons and intense rain. Their work is very impressive. They JANET-DR have been important in making sure that National Resilience is world-class in how it assesses the full range of hazards and designs counter-measures. They also push to have energy, biodiversity and other aspects



Source: JANET-DR[174].

Figure 29 The JANET DR's Broader Collaboration

173) The website for the JANET-DR is here: http://janet-dr.com

174) The figure is taken for the JANET-DR's updated (to November 1, 2017) English-language brochure on its organization and activities: http://janet-dr.com/02_about/janetdr_A4_eng.pdf

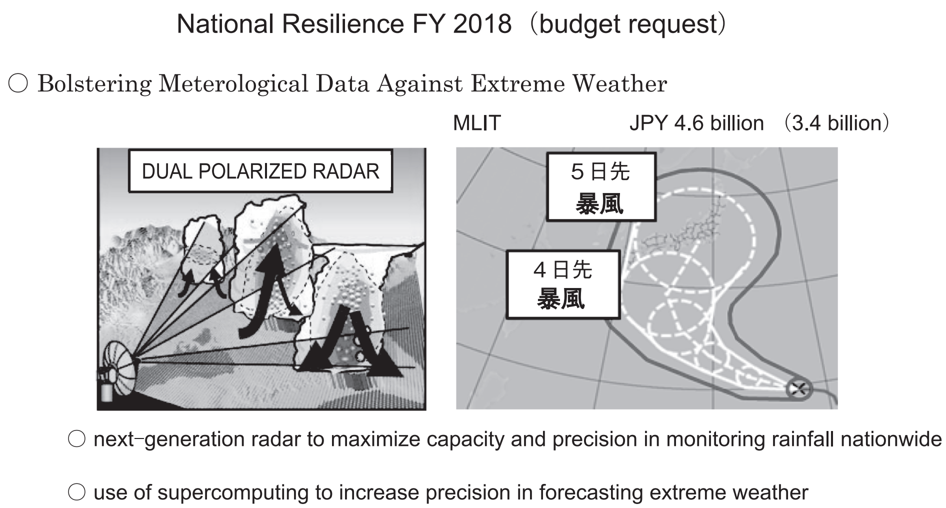
central to the paradigm.

Figure 29 also shows that the JANET-DR collaborates strongly with a variety of stakeholders, including local governments and citizen groups.

Building Resilience By Policy Integration

Japan's policy integration for coping with the Anthropocene is quite extensive. As discussed earlier, Japanese technocrats have worked the smart community paradigm into energy policy, spatial planning, disaster policy, demographic policy, ICT policy, and other areas. That diversity of goals has made it hard to follow the smart community paradigm in Japan, because it evolves through linked policies and budgets rather than as a specific policy regime per se. Yet the diversity of goals, integrated in "whole of government" collaboration, has perhaps ensured that the paradigm does not get cut back to minimalism by the MOF. The latter do not have the time to understand industrial policy.

But a lot of Japan's resilience work is clearly industrial policy. **Figure 30** gives one indication of this, in showing how the most advanced radar systems are included.



Source: National Resilience[175].

Figure 30 Networking Smart Systems in National Resilience

175) The figure is translated from p. 7 of the outline (in Japanese) for the draft National Resilience fiscal requests for FY 2018: https://www.cas.go.jp/jp/seisaku/kokudo_kyoujinka/pdf/h30yosangaiyou.pdf

These "dual polarized" radar systems are able to monitor weather systems and predict the likely intensity of precipitation. The radar is also networked to supercomputers, to enhance the capacity to handle voluminous data. Moreover, the Dam Revival Vision depends on these systems, to help adjust the overall water network's capability to maximize flood control as well as power generation.

Indeed, it is no exaggeration to say that after 3-11 Japan has seen the rise of a new kind of strategic industrial policy. This policy is rooted in distributed energy and smart-energy infrastructure as the core of disaster-resilient smart communities. After 3-11 the technocrats ramped up their test-bedding of smart-energy systems, revised spatial planning to foster density (the key to making distributed energy systems work), and put disaster resilience on par with mitigation.

Japan's National Resilience programmes (and their prefectural and local plans) also include policies for restructuring the local communities, moving hospitals, schools, daycare, community centres, and other facilities into downtown districts. This relocation is specifically designed to shift residences and other facilities away from areas with high flood potential.

Japanese can undertake this relocation because aging and rural depopulation compel policymakers to act. Another reason is there is a fair degree of public ownership of land, health care and other facilities, giving planners a large lever to use. Moreover, Japan is also a unitary state with powerful inter-regional redistribution. The Local Allocation Tax and other fiscal mechanisms are being used to cover many of the costs of this spatial restructuring.

And much of it appears to be good investment. The spatial restructuring — the centralization of previously dispersed daycare, hospital, library, community centres, and other functions — reduces the costs of maintenance and heating, cooling, lighting, water and other services. Moreover, while relocating or refurbishing, systems can be upgraded to state-of-the-art. In addition, the relocation leads to increased spatial densification of demand for energy-related services. This densification of public building makes it more cost-effective and politically easier (because they are public facilities) to install highly efficient district heating and cooling and other elements of the smart community models that Japanese specialists have been at work on since 3-11.

On top of all that, the densification leads to more interaction among the elderly and children (as daycare centres are often in multifunction buildings that include old-age facilities), reducing the risk of dementia. Moreover, the dense and interesting the downtown area, the more people walk around, helping them maintain mental and physical fitness, which also helps cut health-care costs.

All this smart densification, if done well (emphasizing walkability and green space) leads to increased property values in the downtown cores as well as increased traffic for downtown shops, restaurants and other services. These results are powerful incentives for city managers, as they see increased local revenues, a tangible reward for their opting to work with central agencies in designing and implementing the compact, resilient, smart city paradigm.

And Japan's emphasis on disaster resilience is rooted in its prominent role, since at least 1994, in international work on disaster-risk reduction. The first framework for disaster risk reduction is the Yokohama Strategy (1994), the second the Hyogo Framework (2005-2015), and the third the Sendai Framework (2015-2030)[176].

Japan was the host country for all three of the World Conferences on Disaster Risk Reduction. For the Sendai Conference (March 14-18, 2015), Japan advocated the need for "prior investment," so as to build resilience in the face of multiple hazards (including climate change) and reduce their impact. Another of Japan's proposals was to "build back better" (as opposed to merely rebuilding), through such initiatives as relocating communities threatened by tsunami, floods, or other hazards. Japan also emphasized the need for "mainstreaming disaster risk reduction," calling for a whole of government approach that makes coping with hazards a priority in all planning initiatives. These approaches are core to Japan's National Resilience and related policies.

In short, Japan is making significant progress in reaping the synergies in the overlap between adaptation and mitigation. The Japanese state's explicit goals for mitigation have not received much international recognition. But perhaps there should be a lot more attention to how Japan's policy regimes overlap and interact.

176) On the frameworks, see the website of the United Nations Office for Disaster Risk Reduction: http://www.unisdr.org