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Can Abenomics Cope With Environmental Disaster? アベノミックスは環境災害に対応できるか

Andrew DeWit

Introduction

An important and little noted component of Abenomics, Japan's information and communications technology (ICT) growth strategy propounded on June 14 2013, ostensibly aims at the evolution of a new model of efficient, resilient and green urban and rural infrastructures. General Electric's leadership in applying ICT, or the "Industrial Internet," to its power systems shows that what you can monitor, you can manage, and that it is possible to realize significant efficiencies as well as innovate other capacities such as predictivity.[1] Together with domestic businesses, Japan's central agencies, big local governments, and the Abe regime's regulatory and fiscal initiatives have been working to deploy cutting-edge innovation in a swath of smart city initiatives as well as special zones. Although some observers deride these initiatives as comparable to failed technopolis policies of the 1980s, Japan's initiatives may help us address the very real 21st century challenges of expensive energy, climate change, and the sobering "death" of stationarity (wherein past hydrologic and other data can no longer be used to predict the future).[2] This latter is of deep concern to planners of water, power and other crucial infrastructures, which represent trillions of dollars of investment annually. The issues take on added urgency in light of climate denial whose effect has been to conceal the scale of the crisis from the academic community and attentive public. The loss of stationarity means we are essentially in uncharted waters concerning the stressors that our water, power, transportation, and other urban infrastructures need to be resilient against now and over time. The question is whether Abenomics can deal with the death of stationarity and help answer our urgent collective need for sustainability.

Climate Change

Global awareness of climate change risks has not kept pace with the science. This awareness deficit was seen in the run-up to, and aftermath of, the September 27 2013 release of the International Panel on Climate Change's (IPCC) Fifth Assessment Report's first installment and summary. The release was preceded by a sadly effective "denialist" media campaign that positioned the IPCC report as alarmist while also claiming that it showed the previous decade and a half had seen a "pause" in climate change.[3] Indeed, a *Der Spiegel* poll released September 23, 2013 suggested that even the "Germans are losing their fear of climate change," with those expressing fear dropping from 62% in 2006 to 39% in 2013.[4] This disinformation campaign continued after the report's release.[5]

The Der Spiegel poll seems a striking indicator of what might described as an "Alice in Wonderland" era, wherein as august a publication as the *New York Times* closed its environmental desk at the very moment that scientific evidence of the climate crisis mounted.[6] The global public debate's incredible disconnect with reality is dispiriting. But this unpleasant fact cannot be ignored here because it influences a wide range of funding and other decisions relevant to Humanities

Assistance and Disaster Relief (HADR). As we shall see, it even shapes many of the HADR agents' understanding of how dire are our collective challenges.

Because of the widely held belief that climate change is only a catastrophe for coming generations (in itself, a morally odious complacency), let us review solid evidence that climate change is very much a present and rapidly worsening peril.

Geographically, the *Global Climate Risk Index 2013* shows that the countries most affected in 2011 were Thailand, Cambodia, Pakistan, El Salvador and the Philippines.[7] A more comprehensive and nearly real-time accounting of climate risk and adaptive capacity has been pioneered since 2011 by the Alliance Development Works/Bundnis Entwichlung Hilft, a coalition of German development and relief agencies.[8] Working in conjunction with the United Nations University's Institute for Environment and Human Security,[9] the Nature Conservatory,[10] and others, they have compiled the World Risk Report. In addition to the worsening effects of climate change, the Report's risk-weighting takes into account social and economic factors relevant to adaptation and disaster response.

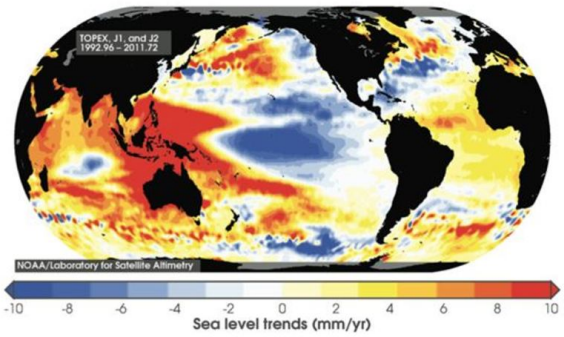
Table 1: World Risk Index

Rank	Country	Risk (%)
1	Vanuatu	36.43
2	Tonga	28.23
3	Philippines	27.52
4	Guatemala	20.88
5	Bangladesh	19.81
6	Solomon Islands	18.11
7	Costa Rica	16.94
8	El Salvador	16.90
9	Cambodia	16.90
10	Timor Leste	16.85
11	Papua New Guinea	15.90
12	Brunei Darussalam	15.80
13	Mauritius	15.18
14	Nicaragua	14.89
15	Japan	14.10

Source: WeltRisikoBericht 2013 p 9

As is evident from Table 1, the *World Risk Report 2013*, released (in German)[11] in September of 2013, indicated that the countries most at risk from the impacts of climate change were concentrated overwhelmingly in the Asia-Pacific.

Incredibly, Japan's immense wealth – second only to that of the US - was not enough to offset its exposure, and its risk assessment placed it 15th. This is in sharp contrast with the other developed states, as the US is ranked at 127th (3.99%) and Germany is 146th (3.24%).



Geographic variability in the rate of global sea level change (1992 to 2010) based on three satellite records: TOPEX, Jason 1 and Jason 2

(Source) NOAA Laboratory for Satellite Altimetry – Accessed November 2, 2011

Figure 1: Sea Level Trends (mm/yr) for 1992 to 2010[14]

The US National Oceanic and Atmospheric Administration (NOAA) satellite measurements of trends in sea surface levels provides another arresting indication of the threat level in the Asia-Pacific. Figure 1 is taken from a December 2012 report compiled by the NOAA in conjunction with the United States Geological Survey, the US Army Corps of Engineers and the US Department of Defence Strategic Environmental Research and Development Program (SERDP). The SERDP is co-managed by the Department of Defence, the Department of Energy and the Environmental Protection Agency, serving to bond these agencies, and is thus a key institution in the American military-centred green industrial policy initiative.[12] These federal agencies continue to expand their collaboration, as we see in this December 2012 report, which was background material for America's 2013 National Climate Assessment.[13] Especially relevant to our purposes here, the SERPD et al. report warns

that:

"[a] wide range of estimates for future global mean SLR [sea level rise] are scattered throughout the scientific literature and other high profile assessments, such as previous reports of the NCA [National Climate Assessment] and the Intergovernmental Panel on Climate Change (IPCC). Aside from this report, there is currently no coordinated, interagency effort in the US to identify agreed upon global mean SLR estimates for the purpose of coastal planning, policy, and management. This is an important gap because identifying global mean SLR estimates is a critical step in assessing coastal impacts and vulnerabilities."

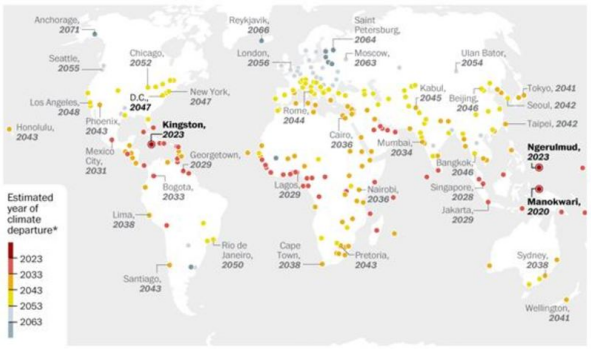


Figure 2: Hot Spots: Global Temperature Rise SOURCE: Nature. GRAPHIC: Leonard Bernstein and Gene Thorp - The Washington Post. Published Oct. 9, 2013.

These agencies' collaboration centres on satellite data and other objective measures. They show that sea-level rise from 1992 to 2010 was not uniform across the world ocean, but rather varied greatly by region. Figure 1 portrays that quite clearly. The various gradations of blue reveal areas where sea levels decreased from 1992 to 2010, while red indicates areas of sharp increase. To be specific, sea levels in the mid-oceanic area of the Pacific decreased over the relevant period, whereas the Western Pacific and South Asian regions saw dramatic increases. These regions' trends in sea-level rise exceed those recorded elsewhere, and are one powerful indicator of increased vulnerability to storm surges, coastal erosion, and similar threats.

The IPCC report's findings were labeled as alarmist by denialists bent on defining the limits of debate. Would that the IPCC were indeed an exaggerated account of what we collectively confront. But in fact the IPCC process omits from its purview such significant feedback effects as methane release from thawing permafrost,[15] the dramatic increase in "anthropogenic" forest and bushfires, and other factors.[16]

Yet another very pertinent oversight is detailed by urban planning expert Brian Stone in his 2012 book *The City and the Coming Climate*. He warns that climate scientists rely on about 6000 weather stations globally, and that scientists deliberately adjust the temperatures recorded at the urban-area stations in order to have them conform to temperature readings in nearby rural areas. Yet this adjustment of the data means that "climate scientists are effectively removing the known effects of land-use changes from the global temperature record." As a result, their data do not reflect the absolute warming of the planet, but only that due to greenhouse gases. Stone points out that cities comprise only about 3% of the Earth's surface, so this practice of adjusting the data does not mean that we are missing much of the big picture of warming per se. Rather, we are missing what is happening in cities: "global-scale climate trend analyses carried out by GISS [NASA Goddard Institute for Space Studies] and other global climate research groups provide little insight into the pace and extent of climate change underway in urban environments."

This oversight seems likely to be of enormous significance over the coming years. Most large

cities lie on coasts, or near other bodies of water, and over 50% of the 7 billion global population now live in cities.[17] This share is expected to increase to 60% urban by 2030 and 70% by 2050, the latter number representing some 6.4 billion people.[18] Thus, under business as usual, most of humanity will be in heat islands close to increasingly dangerous shores. In spite of these sobering statistics, there are no regular surveys of urban-area warming being undertaken to fill in the gap left by the cautious smoothing of the weather-station data. Stone also notes that Tokyo is a special case among urban heat islands, as it actually produces more heat than it receives from the sun in winter.[19] Considering the peril implied by this state of affairs, Stone appears right to depict this "approach to climate change monitoring that effectively ignores the most heavily populated regions of the planet" as "an irony seeming worthy of a Seinfeld skit: ask a climate scientist how rapidly the climate is warming and you will get an answer; ask a climate scientist how rapidly your city is warming and you will get a shrug."[20]

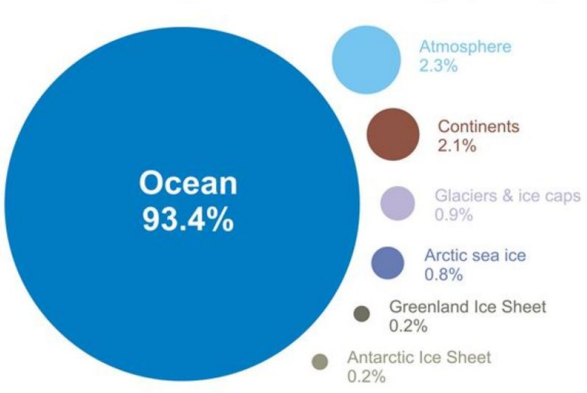


Figure 3: Heat Absorption By Terrestrial Climate Systems. Source.

As of October 13, 2013, that shrug can be replaced with a sobering citation. In the wake of the IPCC Report's release, a meta-analyses of climate trends sought to calculate "The projected timing of climate departure from recent variability."[21] The analyses used historical (1860 to 2005) temperature data for areas of the terrestrial surface, and then ran a meta-analysis of climate models to determine when any given area's coolest monthly temperature would exceed the historical average for the hottest year. They determined that on average, with no mitigation of emissions, temperatures across the globe would exceed the historical norms by about mid-century. As Figure 2 reveals, the Indonesian city of Manokwari is expected to exceed its historic temperature norms by 2020, and Tokyo will follow roughly two decades later.

And contrary to the dangerously distracting denialist claims, there was no pause in climate change. Atmospheric temperatures plateaued at the 1998 peak, but the heat content of the world ocean did not. The ocean is roughly 800 times the density of air at sea level, covers just over 70% of the terrestrial surface, and comprises 98% of the 1.4 billion cubic kilometres of water on Earth.[22] This immensity makes the world ocean the biggest element of the climate system, an element that absorbs well over 90% of the roughly 4 Hiroshima bombs per second of excess heat trapped by anthropogenic greenhouse gas emissions.[23] The percentages are depicted in Figure 3 below, which illustrates heat absorption by major climate system components over the period 1993 to 2003, as calculated by the IPCC's 2007 report (AR4, Section 5.2.2.3.).[24]

The role of the ocean in absorbing heat over time – since 1960 – is portrayed in Figure 4. To repeat: the colossal role of the ocean is due to the fact that water is roughly 800 times the density of air at sea level and there is so much of it. Waves have 1000 times the kinetic energy of wind.[25] These are just a few clues as to why the US Navy is a leader on climate change and

renewable energy. It works in the water, and hence understands climate change as an empirical fact.

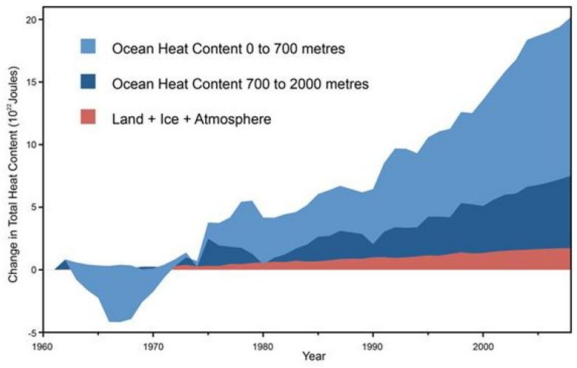


Figure 4: Trends in Climate System Heat Absorption, 1960-2008.Source.

Figure 5 from the US National Oceanographic Data Center gives an indication of trends in oceanic heat content, together with disturbing evidence of recent acceleration. These data are also confirmed by the European Centre for Medium-Range Weather Forecasts' Ocean Reanalysis System 4 (ORAS4), using buoy and other data inputted into a highly sophisticated model. The ORAS4 assessment cautions that "recent warming rates of the waters below 700m appear to be unprecedented."[26]

With this evidence in mind, the IPCC hardly seems alarmist. Indeed, in a startling demonstration of – to be frank – how hobbled the IPCC's inherently conservative reporting process has become, its scenarios are generally ignored by SERPD and other agencies that require comprehensive and real-time assessments.[27] The IPCC certainly deserves high praise as humanity's biggest-ever collaborative scientific endeavor, and justly received the 2007 Nobel Peace Prize for its work. But the IPCC compiles its roughly septennial reports from already published research, several years old. It also has to reach a consensus. These and other problems leave it dangerously far behind the curve of scientific discovery. Hence, military and other institutions that see the world in terms of risk and are compelled to act have turned elsewhere. The global insurance industry, for one, has been emphasizing catastrophe modeling for over a decade, and is moving towards an "open modeling platform."[28] And as SERPD reveals, "In coordination with the efforts of the other federal science providers, SERDP's goal is to ensure DoD [Department of Defense] has the necessary science and tools to support climate change-related vulnerability and impact assessment. A suite of SERDP projects are *developing the methodologies and tools* [emphasis added] needed to assess the physical effects of sea level rise and storm surge and the impacts to mission-essential infrastructure over a broad range of both geophysical settings and extant climate conditions."[29]

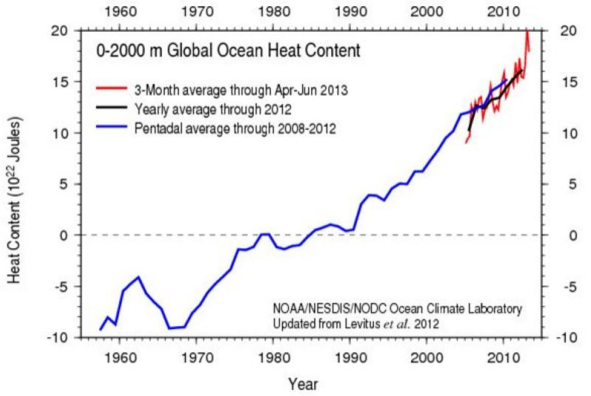


Figure 5: Five Decades of Global Ocean Heat Content, 0 to 2000 meters. Source.

That point deserves to be underlined. These US federal agencies, with the military at their core, are in the process of constructing analytical mechanisms to appraise and adapt to a multifaceted phenomenon of unprecedented speed and scale. They have good reason to: the current pace of climate change has recently been authoritatively assessed as "at least 10 times faster than any climate shift in the past

65 million years."[30] Most of the institutions of civil society and public governance – 19th century institutions using 20th century policy to address 21st century crises - are distracted by the well-funded denialist politics of climate change.[31] But climate change's increasingly expensive impact on energy, water and other infrastructure has forced military and other institutions sensitive to atmospheric and oceanic signals to respond. Most national governments are too beholden to vested interests in large swathes of the economy, leaving militaries, many cities[32] and other actors to implement wide-ranging programs to reduce greenhouse gases and respond to environmental disasters.

Sayonara Stationarity

The OECD has provided a glimpse of the scale of the threat posed by the failure of national governments and their international agencies to prepare. Roughly co-incident with the September 2013 release of the IPCC summary, the OECD published the survey "Water and Climate Change Adaptation: Policies to Navigate Uncharted Waters." The OECD study examined all 34 member countries and the European Commission's policies on water and climate change adaptation. These surveys are usually quite dry and of interest only to a very few specialists. But fortunately the OECD framed the survey with a concise and cogent argument that "[c]limate change is to a large extent water change. Climate change affects all aspects of the water cycle and water is the main way through which the impacts of climate change will be felt." The OECD also advises that there is a "growing recognition that climate change presents a singular challenge for water systems by rendering the historical assumption of stationarity increasingly irrelevant." The best short definition of "stationarity" is "the idea that natural systems fluctuate within an unchanging envelope of variability."[33] In the OECD's view, the end of stationarity "means that a fundamental assumption upon which water management, infrastructure design and planning, and ultimately many economic and resource management decisions are founded will no longer be a reliable basis for future planning and management."[34]

This observation is profound in its implications. It not only backs up the meta-analysis of temperature shifts described above; it also details some of the implications. The end of stationarity means that expensive, multi-decadal infrastructure decisions lack reliable measures for how hardened they should be to contend with water, the biggest element of the climate system. Urban managers and others can have no confidence in future levels of precipitation as well as how rapidly to try and adapt. The loss of stationarity also means that past investments in roadways, waterworks, energy systems, and the like may be vulnerable. The global community saw a startling display of that possibility when Hurricane Sandy hit New York City in late October of 2012, knocking out its power grid and turning parts of its subway system into a sewer.[35] More recently, in late August of 2013, 60% of the Philippine capital Manila was flooded by torrential rains that unleashed more than a month's worth of precipitation in a single day.[36] Much of the urban infrastructure that has been built and is being built – and, post-Sandy, is *even being re-built* - could become death-traps, particularly for children and the elderly, in the midst of natural disasters.[37]

The enormity of the disaster threat makes it difficult to exaggerate the degree of urgency when it comes to water. But on top of that, water has a huge and largely irreplaceable role in all aspects of conventional energy. Studies of water stress and interrelated resource crises in Asia highlight the vulnerability of China and India. These studies include work from such international agencies as the World Bank[38] and the IEA,[39] General Electric[40] and other

multinational firms, military think tanks, and national governments. The US Woodrow Wilson Center was among the first to caution that business as usual will see China's northern provinces, the source of 70 percent of its coal and 20 percent of its grain, run out of water by the end of the present decade.[41]

The flip side is the growing vulnerability of conventional-energy infrastructure to water crises, even in very developed countries. For example, the US Department of Energy's July 16 report on "U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather" details the impact that more frequent and severe floods, droughts, heat waves and other phenomena are delivering to America's energy infrastructure and other aspects of its built environment.[42] The July 2013 edition of *Public Utilities Fortnightly* also outlines America's ever more visible and costly problem in a lengthy article on "The Growing Footprint of Climate Change."[43] The denialist campaign has diverted and impeded governments and their publics from paying attention and acting, but the evidence of dire crisis is thus tangible even in trade publications.

In short, the rapidly unfolding reality of climate change is expressed most palpably and dangerously through the hydrologic cycle. That unfolding is pressing on the urban and other infrastructures that were not designed with such stressors in mind. And the loss of stationarity means that it is unclear what to do, save to maximize resilience as rapidly as possible.

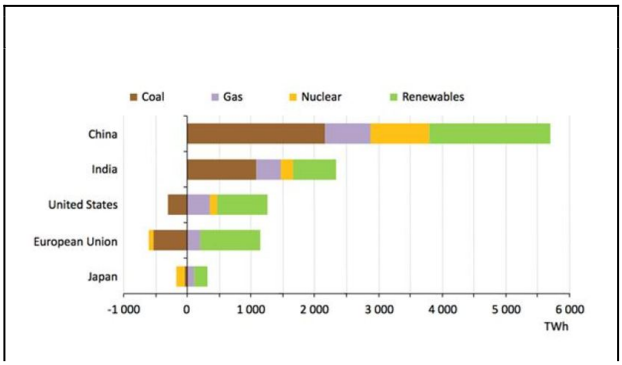


Figure 6: Change In Power Generation: 2010-2035. Source: IEA, World Energy Outlook 2012

So Is Abenomics Up to the Challenge?

If the Abe Regime is in fact interested in and aware of the above, it has yet to make that publicly known. Like many of its counterparts elsewhere, the Japanese national government, and especially the Abe cabinet, remains beholden to vested energy interests. In Japan, the nuclear village gained firm control of energy policy in the early 2000s, and was bent on an ambitious programme of new nuclear build as a way to increase domestic self-reliance as well as ramp down greenhouse gas emissions.

But as of late August, even the former Prime Minister who signed off on that energy policy, Koizumi Junichiro, has come out in dramatic opposition to the nuclear industry. Koizumi went on a fact-finding mission last August, with the heads of the major nuclear village firms' nuclear engineering departments, giving them ample opportunity to convince him that their industry was sustainable. They did not, and what he saw in Finland and elsewhere convinced him of the opposite. He therefore has been mobilizing powerfully in Japanese politics since late August in opposition to nuclear power. His argument is that the PM Abe Shinzo must choose zero nuclear energy in order to move to a truly sustainable economy. Koizumi's position is gaining increased support and attention within the governing Liberal Democratic Party and causing a great deal of consternation for the Abe Cabinet.[44]

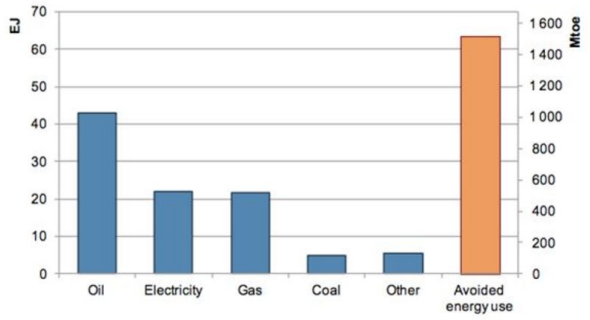


Figure 7: The "first fuel": contribution of energy efficiency compared to other energy resources consumed in 2010 in 11 IEA member countries. Source: IEA Energy Efficiency Market Report 2013, Figure 3.4

For its part, the nuclear village is desperate not merely for restarts of idled plant, but is openly pursuing a commitment to new nuclear build in the "basic energy plan" currently under deliberation.[45] So this is a crucial time for the Japanese energy economy in particular as well as the overall economy. The more political, financial and other capital Japan invests in nuclear restarts as well as new nuclear build, the lower the demand for radical efficiency and renewables. As Figure 6 shows, the IEA's 2012 World Energy Outlook suggests that Japan is not going to grow as a power economy over the ensuing two and a half decades. Indeed, its nuclear share is slated to decline.

So unlike the United States, where "all of the above" is the ostensible strategy of the Obama administration, Japan does not have the luxury of obfuscating choices. Japan's energy politics is largely a zero-sum game, wherein turning back to nuclear power will reduce its incentives to deploy radical efficiency and renewables as well as further innovate new technologies and business models in these areas.

To reduce those incentives would be the height of folly. These new technologies and business models are key to capturing the lead in the global contest to spearhead the deployment of robust mitigation and adaptation models. The IEA Energy Efficiency Market Report 2013, released on October 16, shows how potent efficiency has become in an era of high energy prices. Figure 7 shows that efficiency has led to avoided energy use for 2010 in 11 IEA member countries[46] that greatly exceeds even the consumption of oil.

Figure 8 shows that Japan's performance in achieving efficiency gains between 1990 and 2010 was respectable. Japan achieved more than the Spaniards and the Italians, but it was not a leader comparable to the UK or Germany. Just as Japan's renewable deployment was held back by flawed policies, the country has also lacked robust policies for efficiency.

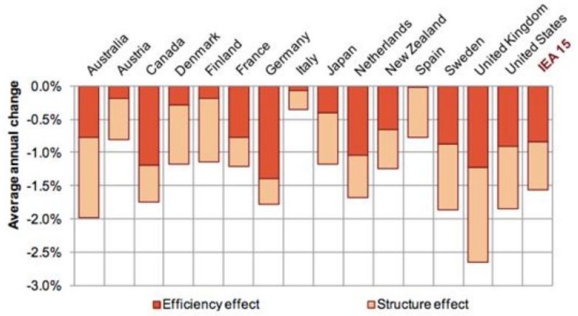


Figure 8: Changes in aggregate intensities of 15 member IEA countries, decomposed into structure and efficiency effects, 1990-2010. Source: IEA Energy Efficiency Market Report 2013, Figure 3.10

Let us be very clear that Japan's performance in the previous figure is not due to being the "wrung-out sponge" claimed by the business lobby Keidanren.[47] Keidanren routinely makes this argument in insisting that Japan's efficiency, especially its industrial energy efficiency, is number one in the world. Its rhetoric is aimed at fostering overseas sales as

well as avoiding more stringent targets than its member firms decide via their voluntary action. Their efforts are to be lauded, but it would appear that more robust policies are in order. Figure 9 will help demonstrate that Japanese efficiency in industrial energy use per unit of value-added is matched or exceeded by a growing number of competitors.

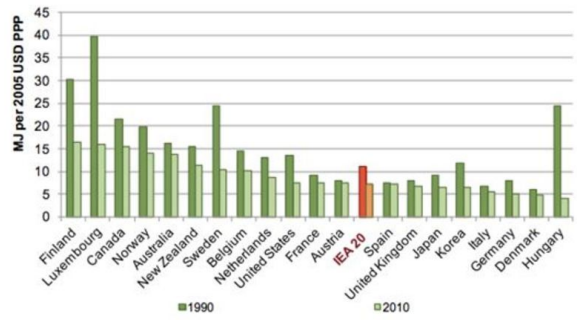


Figure 9: Industrial energy use per unit of value-added for 20 IEA member countries, 1990 and 2010. Source: IEA Energy Efficiency Market Report 2013, Figure 3.11

Notwithstanding drawing-board fantasies of small-modular reactors, it seems very unlikely that a nuclear-powered model will become the mainstream resilient community. Like other centralized power, nuclear is reliant on lots of water as well as threatened by – at the risk of seeming glib – lots of water. Perhaps this is one reason – for all their professed interest in climate change – the nuclear village do not talk about the death of stationarity: addressing the reality of climate change highlights their centralized power plants' vulnerability to the increasingly unpredictable elements. Moreover, there is no nuclear energy project that is not reliant on extensive and far more generous government subsidies than those directed to renewables, which in fact are already competitive – even against natural gas and coal – in parts of the United States, Australia, and elsewhere.[48]

At this critical juncture, for Japan to choose restarts, let alone more nuclear build, would likely see it evolve into a high cost, uncompetitive and environmentally unsustainable Galapagos. It would undermine its incentives to move ahead in renewables and efficiency. But were Japan to choose radical efficiency and renewables, with its ambitious ICT growth strategy at the core, and coordinated by a focused cabinet and Prime Minister, it could become the model for a sustainable and resilient 21st-century urban and rural economy. We have seen that Japan itself is threatened by climate change, along with its region overall, so building resilience into all infrastructures is truly in its own existential self-interest as well as its enlightened self-interest as an exporter. This argument has not yet gained the status of common sense in the overall policy debate, but Koizumi's interventions suggest it is much closer to gaining that position than the nuclear-centered power economy. The nuclear-centered power economy was the reigning common sense of just a few years ago, but its apparent decline suggests how rapidly the structure of incentives and ideas can shift. Can Abenomics recognize this reality and effectively address the real challenge of climate change that threatens Japan and the world?

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Notes

[1] On Japan's ICT strategy as well as GE's "Industrial Internet," see Andrew DeWit "Data Will Change ICT," But Will it Change the Abe Regime?, The Asia-Pacific Journal, Vol. 11, Issue 41, No. 4, October 14, 2013.

[2] See P.C.D. Milly et al., "Stationarity is Dead: Whither Water Management?" Science, February 1, 2008.

[3] A brief account of the tendentious claims of a "warming hiatus" is found in Douglas Fischer, "How climate scientists got Swift-boated," The Daily Climate, September 27, 2013.

[4] See Axel Bojanowski, Olaf Stampf and Gerald Traufetter "Warming Plateau? Climatologists Face Inconvenient Truth," Spiegel Online, September 23, 2013.

[5] See, for example, Steven F Hayward, "Pay No Attention to the Bad Data: Behind the curtain at the IPCC," The Weekly Standard, Vol 19, No 6, October 14, 2013.

[6] See Joe Romm, "New York Times Widely Criticized for Dismantling Its Environmental Desk, Eliminating Editorial Positions," Climate Progress, January 13, 2013.

[7] "Global Climate Risk Index 2013," German Watch, November 2012.

[8] On the composition of Alliance Development Works, see their organizational overview here.

[9] The United Nations University's Institute for Environment and Human Security has its own "Expert Working Group on Measuring Vulnerability"

[10] The Nature Conservatory was founded in

1951, and is primarily a science-driven (employing 550 scientists) "conservation by design" programme that is active in all US states as well as 35 countries. They describe "conservation by design" as "a systematic approach that determines where to work, what to conserve, what strategies we should use and how effective we have been."

[11] Note that the Nature Conservancy was not a party to the 2013 Report. The English version of the Report is slated for publication in October of 2013. The German title is *WeltRiskoBericht, 2013*, and the report is available at the Alliance Development Works/ Bundnis Entwichlung Hilft's website.

[12] See the SERDP's introduction here. On the , see Andrew DeWit, "The US Military, Green Energy, and the SPIDERS at Pearl Harbor," The Asia-Pacific Journal, Volume 11, Issue 9, No. 5, March 4, 2013.

[13] As of this writing, the US 2013 National Climate Assessment is in the revisions stage and slate for publication in early 2014.

[14] The figure is from page 6 in "Global Sea Level Rise Scenarios for the United States National Climate Assessment," NOAA Technical Report OAR CPO-1, December 6, 2012.

[15] On this omission, see the UN Environmental Programme's (UNEP) call for the IPCC to "consider preparing a special assessment report on how CO2 and methane emissions from thawing permafrost would influence global climate to support climate change policy discussions and treaty negotiations. All climate projections in the IPCC Fifth Assessment Report, due for release in 2013-14, are likely to be biased on the low side relative to global temperature because the models did not include the permafrost carbon feedback." The UNEP warn that the failure to include this source of greenhouse gas emissions may lead to overshoot of the globally agreed 2C limit on warming, and that nations with significant permafrost (especially Russia, Canada, China and the US) risk being unprepared for the effect of permafrost degradation on critical infrastructure. The report is "Policy Implications of Warming Permafrost," (lead author: Kevin Schaefer) UNEP, November 2012.

[16] On the IPCC reporting process and omitted feedback effects, see the concise article by Australian National University Earth and paleo-climate scientist Andrew Glikson, "IPCC climate trends: blueprints for tipping points in Earth's climate," September 29, 2013.

[17] The World Bank's 2010 study on "Climate Risks and Adaptation in Asian Coastal Megacities: A Synthesis Report" notes that 13 of the world's 20 largest cities lie of the oceanic coast, and nearly a third of the global population is within 160 kilometres of a coast. The report is available here.

[18] On the estimates, see "Urban population growth," World Health Organization, 2013.

[19] From an e-mail communication with Brian Stone. Note also that Tokyo's heat island problem is so intense that specialists are already concerned about the health of athletes and spectators at the 2020 Olympics. See "Tokyo heat raises worries for athletes and spectators at 2020 Olympics," Mainichi Shinbun, September 23, 2013.

[20] See Brian Stone Jr. *The City and the Coming Climate*, Cambridge University Press, 2012: pp. 80-1.

[21] See Camilo Mora, et al. "The projected timing of climate departure from recent variability," *Nature* 502, October 10, 2013.

[22] See "Ocean Stratification" in the excellent lecture notes on "The Climate System" by Columbia and Barnard university professors Peter Schlosser, Stephanie Pfirman, Mingfang Ting, and Jason Smerdon.

[23] The calculation in terms of Hiroshima bombs is in John A Chruch, et al "Revisiting the Earth's sea-level and energy budgets from 1961 to 2008," Geophysical Research Letters, Vol 38, L18601, 2011.

[24] The orginal data are available at "Climate Change 2007: Working Group 1: The Physical Science Basis," IPCC, 2007.

[25] See "Wave Energy," Ocean Energy Council.

[26] See Dana Nuccitelli, "In Hot Water: Global Warming Has Accelerated in the Past 15 Years, New Study of Oceans Confirms," March 25, 2013.

[27] One indicator of how urgent such assessments are is seen in the draft version of the US 2013 National Climate Assessment. The assessment's chapter 29 lists research goals, and prioritizes – as "Research Goal 1" – "understanding the role of feedbacks, thresholds, extreme events, and abrupt changes that may disrupt natural and socioeconomic systems, as well as the implications of more gradual changes and also the degree and effectiveness of response actions." See p. 1035 NCADAC Draft.

[28] See Pilita Clark, "Catastrophe models give insurers insight into disasters," Financial Times, September 30, 2013.

[29] See SERDP, "Climate Change and Impacts of Sea-Level Rise," no date.

[30] An overview of the study is at Bjorn Carey, "Climate change on pace to occur 10 times faster than any change recorded in past 65 million years, Stanford scientists say," Stanford Report, August 1, 2013. For the research itself, see Noah S Diffenbaugh and Christopher B Field, "Changes in Ecologically Critical Terrestrial Climate Conditions," Science, August 2013.

[31] The best analysis of the denialist game plan and campaign is Naomi Oreskes and Erik Conway, *Merchants of Doubt*, London Bloomsbury, 2010.

[32] On the role of cities, see the detailed and well-designed visual presentation from the C-40 cities "Global Leadership on Climate Change" group. The Asian Cities Climate Change Resilience Network (ACCCRN) is also focused on the threat to the Asian region.

[33] PCD Milly, Julio Betancourt, Malin Falkenmark, Robert M. Hirsch, Zbigniew W. Kundzewicz, Dennis P. Lettenmaier, Ronald J. Stouffer, "Stationarity Is Dead: Whither Water Management?" Science, February 1, 2008.

[34] "Water and Climate Change Adaptation: Policies to Navigate Uncharted Waters," OECD, September 2, 2013.

[35] John Metcalfe, "Newly Unflooded New York Subway Still Looking Pretty Horrible," The Atlantic Cities, November 12, 2012.

[36] See Hrvoje Hranjski, "Floods cover 60 percent of Metro Manila," PhilStar, August 20, 2013.

[37] Skewed incentives in insurance regimes compound willful blindness about climate change, leading to such absurd and grossly irresponsible outcomes as rebuilding the Jersey Shore as it was prior to the devastation of Hurricane Sandy. See Scott Gurian, "In Rush to Restore the Shore, is NJ [New Jersey] Failing to Plan for Next Superstorm?" NJSpotlight, July 22, 2013.

[38] Diego J Rodriguez, Anna Delgado, Pat DeLaquil and Antonio Sohns, "Thirst Energy," Water Partnership Program, World Bank, June 2013.

[39] Alex Morales, "Water Scarcity Threatens Energy Plans From US to China," Bloomberg News, November 12, 2012.

[40] General Electric has built 270 gas turbines, 70 steam turbines, 40 gasification turbines, and well over 1000 wind turbines in China. The company's "China Technology Center" in Shanghai is one of GE's four top global research centres. See "China," General Electric, Energy, 2013.

[41] Coco Liu, "Water Demands of Coal-Fired Power Drying Up Northern China," Scientific American, March 25, 2013.

[42] "U.S. Energy Sector Vulnerabilities to Climate Change and Extreme Weather," US Department of Energy, July 16, 2013.

[43] See Michael Kintner-Meyer and Ian Kraucunas, "The Growing Footprint of Climate Change," *Public Utilities Fortnightly*, July 2013.

[44] On Koizimi's fact-finding mission and subsequent interventions, see Suzuki Tsuyoshi "Koizumi's call for nuclear-free Japan raises speculation about his intent," Asahi Shimbun, October 2, 2013.

[45] On this, see (in Japanese) "Let's Go for New Nuclear Build: METI Holds Meeting on the Energy Basic Plan," Nikkei Shimbun, October 16, 2013.

[46] The countries are Australia, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom and the United States.

[47] On this and related matters, see Andrew DeWit, "Abenomics and Energy Efficiency in Japan," The Asia-Pacific Journal, Vol. 11, Issue 6, No. 2, February 11, 2013.

[48] These facts have even been recognized by the Financial Times. See Pilita Clark, "Ibderola chief sees coal losing out to gas and renewable energy," Financial Times, October 9, 2013.