

Japan's Radical Energy Technocrats: Structural Reform Through Smart Communities, the Feed-in Tariff and Japanese-Style 'Stadtwerke' ラジカルな日本の技術官僚 スマートコミュニティ、固定価格買い取り制度(FiT) □日本式Stadtwerke □地元のエネルギー供給公社) を通じて構造改革

Andrew DeWit

Japan's December 14 general election is essentially a rigged referendum on Abenomics. Despite the dismal economic news, team Abe can hardly lose against the splintered and poorly led opposition parties at the national level. The hapless Democratic Party of Japan (DPJ) seems likely to gain some seats; but Abe has defined defeat as the loss of his parliamentary majority, which is simply not going to happen.¹ Electioneering per se is set to begin on December 2. It will almost certainly not feature substantive debate on the stark choices confronting Japan, meaning how to achieve resilient, decarbonizing, resource-lite growth in the world's most rapidly ageing society. There will be no serious discussion of the fact that Japan faces among the direst threats from climate change, the developed economies' most gargantuan public debt, extreme dependence on increasingly precarious fossil fuels, an unprecedented economic experiment (Abenomics) now clearly in deep trouble, dangerously poisoned relations with important neighbours, and a multiplicity of other challenges that collectively defy precedent. All developed and developing countries face dense clusters of "wicked problems," particularly on the water-energy-food nexus in an epoch of climate crisis, but surely Japan's are among the most daunting if one strips out the failed states.

Mainstream economic and business analysts are, of course, furiously pumping their bellows

of gaseous advice. They insist that Japan can fix all the above by aiming the faltering Abenomics programme at opening markets via the Trans-Pacific Partnership and structural reform that gives large firms and megabanks more freedom to allocate capital in ever more unsustainable ways. By and large, the structural reformists want Japan to be more like post-Reagan America. Key elements of this vision have little appeal for most Japanese and have been thoroughly discredited by such astute students of comparative political economy as Sven Steinmo.²

However, while the rhetoric of Abenomics has dominated international discussion, Japan is already undertaking a radical and massive public-sector-centred structural reform of a very different variety. This reform is steeped in astute application of approaches most fully realized in Germany, and Japan is already at work renovating industry, building resilience, and bolstering local democracy. The most recent summary statement of this project is found in *Smart Communities: A Smart Network Design for Local Government Infrastructure*, an important new Japanese book, organized by Japan's top mainstream energy intellectual Kashiwagi Takao, and published October 15, 2014.³ The book describes – especially its initial chapter, written by Kashiwagi – how Japan's energy technocrats are using the feed-in tariff, *stadtwerke* (municipal business), power-sector deregulation and other key elements of

Germany's green energy transition as engines for something much more ambitious. And the Japanese are also hooking up their project to multiple firehoses of fiscal and financial policy. This is a sharp contrast to the Germans, whose energy shift is hobbled by fiscal austerians seemingly bent on sacrificing the PIGS (Portugal, Italy, Greece and Spain), the entire EU, and thus themselves as well.⁴

Smart Communities as the Growth Strategy

Even before 3-11, Japan's growth strategies emphasized smart grids and other green innovation, focused on the urban contexts in which over half of the world's population already live and which are growing apace. For example, on June 18, 2010, the Hatoyama cabinet approved a New Growth Strategy that emphasized green innovation, centred on smart communities, in order to build YEN 50 trillion in new green business and 1.4 million new jobs by 2020.⁵ The METI "smart city" elite were clearly prominent among the technocrats designing this approach, as is evident from their very detailed December, 2010 presentation (in Japanese) "Policy Evolution Towards the Realization of Smart Communities." Perhaps because of the strength of the nuclear-obsessed Tepco and other power-monopolies' labour unions as the DPJ base, the Hatoyama cabinet itself was more enthusiastic about nuclear than the METI smart community technocrats. The latter's documents of course include nuclear in the centralized baseload power mix (which was explicit energy policy at the time); but they exhibit far more interest in distributed generation, smart grids, power storage, smart meters and other devices that even then were core to the fast-emerging smart community paradigm. They also evince a keen awareness of developments in Germany and elsewhere as well as deep concern at the risk that Japan might build yet another Galapagos as it already had in electronics, energy, and some

automotive technology.⁶

Working in the context of an archipelago, with minimal reserves of conventional fossil fuels, and desiring to maximize domestic energy independence, the pre 3-11 Japanese technocrats looked to expand nuclear and renewables as much as possible. The Fukushima disaster appears to have taken the nuclear role off the table, so far as smart communities are concerned. Hence, after 3-11 nuclear reactors tend to disappear from the smart-community power schemes, and renewables move to the fore. Though the technocrats do not write it out explicitly - and perhaps they never actually debated this - the logic of distributed power and resilient communities also leads away from nuclear. Unless one is prepared to offer the world smart communities with a small-modular nuclear reactor (SMR) underneath, low-carbon (or even no-carbon) smart communities mean green power. This claim is not tree-hugging craziness, but rather what makes economic and environmental sense. The US Navy's Office of Naval Research is, for example, taking a central role (via a DC smart grid and other gear) in such projects as 100% renewable Chiang Mai World Green City (ASEAN's first), with explicit aims to broaden that collaboration elsewhere in Thailand as well as Vietnam, and explicitly as part of the pivot to the Asia-Pacific.⁷

Of course, the enthusiasm for SMRs remains strong within the nuclear industry. Toshiba's 4S ("Super safe, small and simple") micro sodium reactor is said to be ready to be buried 30 meters underground and relied on to pump out several dozen megawatts of power.⁸ For its part, Hitachi has the GE Hitachi Nuclear Energy's Power Reactor Innovative Small Module (PRISM) project.⁹ Yet even Toshiba and Hitachi's corporate PR for smart communities emphasizes 100% renewable energy. So perhaps somewhere along the recent time-line the smart energy engineers, within those

power-unit makers, kept the enthusiasts of underground mini-nuke from slipping an SMR in blue-chip Japan’s smart community design and thus making their offerings an unmarketable NUMBY (“not under my backyard”) waste of investment and opportunity.¹⁰

Kashiwagi and his Cohort



In his book *Smart Communities: A Smart Network Design for Local Government Infrastructure*, Kashiwagi deliberately and explicitly positions smart communities as the key item in Japan’s growth strategy. He has been doing this very assertively for well over a year, judging from dozens of articles and events that centre on him. Kashiwagi appears to have helped immensely to realize the June

14, 2013 New Growth Strategy’s explicit commitment to ICT-led growth as well as coordinate the expansion of smart-community projects and the increasing streams of finance flowing from the various ministries of the central government plus their allied quangos (Quasi Autonomous Non-Governmental Organization) such as the New Energy and Industrial Technology Development Organization (NEDO).

Kashiwagi seems able to do this because he is an enormously influential figure in Japanese energy policymaking circles. He plays multiple key roles such as specially appointed professor at Tokyo Institute of Technology, chair of Japan’s Hydrogen/Fuel Cell Strategy Council,¹¹ chair of the Ministry of Economy Trade and Industry’s (METI) new energy subcommittee of its Committee for Natural Resources and Energy, Project Leader of Tokyo Institute of Technology’s Advanced Energy Systems for Sustainability,¹² to name just a few. Aside from the content of his recent activism and writing, what makes Kashiwagi especially interesting is that he is both a core member of the nuclear village as well as an enthusiast for renewable energy.

Kashiwagi thus straddles both Japan’s deeply damaged paradigm of nuclear power as well as its rapidly emerging paradigm of distributed power and smart communities. He is not ready to dump nuclear yet, but neither does he write about its role in the smart community. With a technological imperative driving smart communities towards green, as well as the need to make smart choices in the midst of multiple constraints, Kashiwagi has evidently decamped from the nuclear village. Kashiwagi is the designer of Japan’s first smart community, a 100% renewable microgrid project, linking NEDO (New Energy and Industrial Technology Development) and other facilities, that went live at the 2005 Aichi World’s Fair,¹³ so he has a lot of emotional and 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, stand in the way of a nationwide diffusion of smart communities. Hence true deregulation of the power sector is key to Kashiwagi's argument. So also is the diffusion of distributed renewable power supported by the feed-in tariff (FIT). Kashiwagi argues that, for starters, Japan's local governments stand to gain YEN 5 trillion of the YEN 15 trillion power economy through distributed energy supported by the FIT.

What has been missing from Japan's - not to mention the global - debate on smart communities is an explicit statement that they are focused on energy and can provide a powerful engine for their diffusion. Japan's smart communities stand out against their competitors elsewhere in being primarily about energy, whether in sustainable generation, smart and small-scale transmission, and maximizing efficiency on the consumption side. That only makes sense in an archipelago with minimal conventional resources, one that is still reeling from a massive shock to a deeply entrenched power monopoly.

As for the engine, Kashiwagi places Japan's smart community initiative in the context of creating something akin to the German *stadtwerke* of municipally owned utilities. These agents were among the major winners from German power deregulation. Germany's 900 or so *stadtwerke* are also increasingly recognized as key to that country's ability to diffuse renewables, because they have the organizational, financial and other heft together with community demand for renewables.¹⁴ So Japan's centring of smart communities on *stadtwerke* is not a model of building smart communities by stripping off functions and giving them to the private sector, together with the residents' data.

Japanese cities have long had their utility functions, especially water, serviced by public

agency, contracting with private companies for pipes, valves and other gear. But when it comes to power, postwar Japanese cities have been passive consumers of centralized and privately-owned power, delivered by Tepco and other monopoly firms that also dominated their catchment areas' political economies. Going distributed, and fast, through smart public agency, is the surest way to destroy the old business model of the power utilities. The private utilities know this, which is why they are desperate to water-down the power-sector deregulation slated for 2016 as well as get their people in charge of the new agency to police the grid.

The power *stadtwerke* in Japan offer a mechanism that puts the incentives to champion revolutionary change into the hands of the cities and towns. The Ministry of Internal Affairs and Communications (MIC), a fortuitous blend of ICT enthusiasm and responsibility for local fiscal health, has in fact set a goal of establishing no fewer than 1000 local energy firms over the five years from 2015. The national government will not only allow the locals to finance investments in these firms, but it will pick up half the interest payments.¹⁵

The Japanese model of the *stadtwerke* is technocratic, to be sure. But it also does not require replicating the German experience of building a political movement for renewables over several decades. We have seen since 3-11 that Japanese people's-power initiatives have been incredibly valuable in stopping nuclear (despite Abe administration pressures, as yet no nuclear power station has reopened), but they have not been very successful in leading an energy shift. The fact that an energy shift will not be an issue in the Abenomics election speaks volumes.

In the face of considerable inertia and a shortage of time to act on climate change and resilience, there is something radical in Kashiwagi's vision and in what the MIC and

others are doing. City walls are being raised again, not to stop commerce and control the community, but rather to ensure that the community's interests are served by the composition of interests running its core lifeline infrastructures. Kashiwagi also stresses that deregulated power and the FIT are essential to the Japanese-style *stadtwerke*, because the aim is to strengthen inter-regional equity as well as sustainable growth. He also wants to build on this, very fast, and make it regional, encompassing East Asia and elsewhere.



Komiyama Hiroshi

In short, the growth paradigm that appears to be getting hammered out in Japan is public-sector led smart communities which are making important headway despite the lack of national leadership at the center. Another

possibly very important item in that shift is Komiyama Hiroshi's explicit commitment to a 100% renewable goal by 2050. Komiyama is, like Kashiwagi, one of Japan's top energy-policy intellectuals. He is not only former President of the University of Tokyo, but also Chairman of Mitsubishi Research Institute as well as networked throughout Japanese mainstream energy and environmental institutions. Before 3-11, Komiyama was vague on the role of nuclear in the energy mix to achieve his emphasis on 70% energy self-sufficiency by 2050.¹⁶ But in the mid-October "Great Energy Challenge" debate in Tokyo hosted by National Geographic and Shell, Komiyama depicted his vision as 100% renewable by 2050 and clearly refuted former IEA-chief Tanaka Nobuo's desire to focus energy R&D on next-generation nuclear.¹⁷

Therefore, Japan's two top mainstream intellectuals of energy, Komiyama Hiroshi and Kashiwagi Takao, are thus explicitly on the same page concerning the importance of green smart communities.¹⁸ The two are most prominent among the thought leaders of Japan's mainstream technocratic energy experts. Their stress on the role of local governments brings institutionalized democratic representation into the smart community concept. Japan's smart community concept is thus evolving into a city-led paradigm, in the wake of 3-11 and the initial set of projects undertaken in Kitakyushu and elsewhere.¹⁹

In summary of the above, Kashiwagi and his cohort have been looking at the German city-business model for some time, even before 3-11. This surely made complete sense from a technocratic standpoint, as the *stadtwerke* are a handy vehicle for bundling post-deregulation expertise and institutional clout (e.g., for raising capital) without having to rely on unpredictable, distracted party politics, popular movements, and IBM and the other market players that would like to lead the smart city

rather than be led.²⁰ Reading through the past few years of their work (as well as work within the MIC²¹) suggests their studies became increasingly detailed as they realized the post-3-11 period offered an opportunity to break through the parasitism of the monopoly utilities and get the energy political economy focused on "prosumer" cities.

Japanese-Style Stadtwerk's Implications

The intellectual leadership as well as institutionalization of stadtwerk-centred smart communities opens the potential for a profound shift in the R&D investment priorities with Hitachi, Toshiba and Mitsubishi's power-unit operations. The makers are clearly aware of the business opportunity. Toshiba, for example, detailed its smart community growth strategy on December 16 2011, declaring that the smart community market was to expand to YEN 163 trillion by 2015 and that they were aiming at YEN trillion, or 8% of this total.²² The big three's operations are at present clearly divided among those who want to stick with nuclear (as well as invest in next-generation technologies championed by Tanaka Nobuo and others), those who want to emphasize Carbon Capture and Storage (CCS)-equipped fossil fuel power units, and those who want to stress all of the technology involved in the smart community as a context for renewables. These latter systems include not just solar and wind, but also waste-heat recovery in sewerage systems as well as other advanced gear that is being deployed within Japan and in a host of other countries, including Denmark, Canada, and other aggressive smart city competitors.



Toshiba Smart Community

On the energy front, the smart community debate is thus rapidly evolving a model that elaborates beyond simply smart grids, energy management and some solar and wind. It is coming to include a myriad of advanced energy harvesting systems in development and deployment, engineered wood that is being used in building high-rises, and other emergent decarbonization technologies. The more this model evolves, the greater the pressure within Hitachi, Toshiba and Mitsubishi to focus their resources on that green paradigm in order to avoid Galapagos effects.

In fact, Japan has at least 100 smart city (aka "smart community," "smart town," etc) projects underway. Next year, the flagship projects in Kitakyushu, Yokohama, Keihanna (Kyoto) and Toyota graduate from their 4-year subsidy support, to emerge as full-fledged self-sustaining projects. In their wake follow dozens of other projects that are building on the flagship model, but deepening the deployment of renewable energy (including renewable

heat), ICT-enabled efficiency (in lighting, heating and cooling, etc), mobility, health-care services and other core urban functions.

The number of players is increasing as well, opening up more room for innovation. For example, the Tokyo Metropolitan Government and its 62 area local governments (wards, cities, and towns) are organized as EcoNet Tokyo 62, and are in the process of developing a “smart community handbook.”²³ One of the three key members of the committee, Morotomi Tooru, Professor of Economics at Kyoto University, is a specialist on Germany. He is also head of the “Ider Project” at Kyoto University, which has been undertaking extensive research on the German model as a means of diffusing renewables, not just by the FIT but also by the *stadtwerke* as an institution.²⁴ Added to this leadership, the Kanto and other regional divisions of METI are also working on organizing their area local governments, so as to accelerate the diffusion of smart communities centred on energy.²⁵

Why is this Unfolding Here?

Japan has perhaps unparalleled incentives as well as technological foundations on which to build resilient, smart communities. These incentives include the fact that it is the world’s most rapidly ageing and indebted developed country, in desperate need of a credible and sustainable growth regime. As to incentives to secure a resilient future, Japan’s Tokyo-Yokohama region’s natural-disaster threat is rated by Munich Re at 710, compared to 167 for San Francisco, 42 for New York, and 15 for both Seoul and Beijing, as reported in the MEXT 2012 White Paper.²⁶ The US National Bureau of Economic Research (NBER) also assesses Japan’s risk from typhoon damage, through to 2090, as being roughly half of the global total of USD 10 trillion, with perhaps diminishing capacity to recover from repeated disasters.²⁷

The Japanese have powerful incentives to act and they are well endowed institutionally to move ahead effectively. Stuck on a conventional-resource-poor archipelago, one still reverberating from the shock of 3-11, Japan’s technocrats cannot fall back on nuclear power and apparently are losing their interest in doing so. Instead, particularly at the local government level, many are busy diffusing smart grids, energy-management systems and renewable power (among other advanced gear) in the context of smart communities. They are doing this, it would seem, in part because many wanted to all along, which is implicit in a commitment to distributed generation. And now they have to do it, both because of the dangerous dependence on fossil fuels - a reality that no credible scenario of nuclear restarts will fix - and because they need to put a productive focus on all that Abenomics money that thus far has failed to jump start the economy.

Moreover, in contrast to the German smart-city enthusiasts, forced to work in a federal system dominated by what Wolfgang Streeck rightly derides as intellectually bankrupt managers of the “consolidation state,”²⁸ the Japanese work within a unitary state in which 2/3 of public spending is done locally. The central agencies, including METI (economy), MLIT (infrastructure), MEXT (education), MAFF (primary industries), and MHLW (health and welfare), all have their respective reasons for preferring smart communities. These interests have in part been coordinated by the Ministry of Internal Affairs and Communications (MIC) that oversees local governments’ fiscal health and thus is eager to put the “*stadtwerke*” model at the core of the smart community.

To be sure, the Japanese initiative is neither party-led nor people-led, which will disturb and dismay many observers who would prefer to take time we simply do not have, as the UNEP, the IPCC, the IEA, the US military, Michael Mann²⁹ and a rapidly lengthening list of

agencies and experts warn is our collective reality on climate change. The striking fact is that Japan's most compelling initiative is not Abenomics. Rather it is centred on local governments, the most democratically responsive and climate-sensitive agent in our era of dangerously dysfunctional national and international governance. As we have also seen, the Japanese smart community project is deliberately aimed at building new industries, enhancing interregional equity as well as affording a means of mitigating and adapting to the profound climate and energy challenges of the Asian region.

The Abenomics referendum-election whose outcome will change nothing should be all about the smart-community growth paradigm. Japan is embarrassingly sidelined as a player in the COP 21 climate talks in Paris next year. But perhaps in spite of the dysfunctional national level, Japan has something very important to offer. This learning is starting to be understood in detail, as we see in the October 2014 EU-Japan Centre for Industrial Cooperation report on "Smart Cities in Japan."³⁰

But there is room for deeper external engagement through many international city-centred initiatives taking action of climate change and urban resilience. These agencies include the [C40](#), [ICLEI \(Local Governments for Sustainability\)](#), [Rockefeller Resilient Cities](#), [Paulson Institute](#), and others. The Japanese have a great deal to teach the world on building resilient smart communities, centred on energy and with a productive role for the public sector. There are myriad synergies to be gained by a broader exchange, as we see in the Japanese learning from Germany. These benefits include SME-level disruptive technology, business models and other innovations that need more avenues to sneak their way past the gatekeepers and into this emergent paradigm. The more fluid and diverse the exchange becomes, the more resilient and democratic the emerging smart community

paradigm is likely to be.

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Notes

¹ See Michael Cucek, ["Abe Shinzo's Mock Test Election,"](#) Shisaku, November 22, 2014.

² See Sven Steinmo, *The Evolution of the Modern States: Sweden, Japan, and the United States* (Cambridge, 2010).

³ See Kashiwagi Takao (ed), *Smart Communities: A Smart Network Design for Local Government Infrastructure* (Tokyo: Jihyosha).

⁴ On the German financial elite's antipathy to expansionary fiscal policy, for Germany itself and the EU as a whole, see Marcel Fratzscher, President of DIW Berlin and Professor of macroeconomics and finance at Humboldt University, in ["Germany's Four Neins," Project Syndicate,](#) November 21, 2014.

⁵ See pp 14-17 of the [Cabinet's growth strategy](#) (in Japanese).

⁶ See e.g. pp 8-12 for their keen awareness of developments in Germany and elsewhere and pp 40-41 for their awareness of the risk of building a Galapagos.

⁷ See Office of Naval Research, ["Energy Action Month: ONR Expands "Green" Reach in Asia-Pacific,"](#) October 27, 2014.

⁸ On this, see Anirudh Tikkavarapu, ["Towards a Decentralized Nuclear Future,"](#) February 25, 2014.

⁹ On various SMR designs, see Sharryn Dotson, ["The Promise of Small Modular Reactors,"](#)

Power Engineering, October 21, 2014: <http://www.power-eng.com/articles/print/volume-118/issue-10/features/the-promise-of-small-modular-reactors.html>

¹⁰ Toshiba and Hitachi's smart community PR is readily available, in English and Japanese as well as in videos and documents. See, for example, ["Smart Community Projects on "Eco-Island Miyakojima" of Okinawa,"](#) Toshiba Smart Community Blog, July 15, 2014.

¹¹ On this, see Kenji Kaneko, ["Japan Announces Roadmap for Hydrogen Introduction,"](#) Nikkei BP CleanTech Institute, July 3, 2014.

¹² Kashiwagi's leadership message is available [on-line in English.](#)

¹³ 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.

¹⁴ See Paul Hockenos, ["Local, Decentralized, Innovative: Why Germany's Municipal Utilities are Right for the Energiewende,"](#) Energy Transition, September 28, 2013.

¹⁵ On this, see ["Small-town Japan's big hopes for energy self-sufficiency,"](#) Nikkei Asian Review, October 28, 2014.

¹⁶ See for example Komiyama's presentation on ["Japan as Forerunner of Emerging Issues,"](#) December 6, 2010.

¹⁷ The event is summarized by David Braun ["Sustainable Cities: Challenges and Opportunities in Japan,"](#) National Geographic, October 21, 2014.

¹⁸ They make this explicit in a Japanese-language discussion from October of last year, where they emphasize smart communities as

core to growth. See Komiyama Hiroshi and Kashiwagi Takao, [“The Outlook for Energy Policy and the Role of Heat Distribution Business,”](#) Japan District Heating Council, October 2013.

¹⁹ These flagship projects are led by METI and grouped in the [Japan Smart Community Alliance](#).

²⁰ On this very important question of whether the public sector will lead or not, see Alex Marshall, [“Big Data, Big Questions,”](#) Metropolis, February 2014.

²¹ 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 (in Japanese) to the ruling LDP. See [“Concerning the Project on Distributed Energy Infrastructure”](#).

²² On the basis of Nikkei BP’s 2012 “Comprehensive Guide to Smart Cities,” Toshiba projected a total of 36 projects in Japan and 485 globally (including Japan’s), with 217 of the global projects being centred on smart grids and renewable energy (see in Japanese [“Growth Strategy for Building Smart Communities”](#)). Japan’s projects have since then increased to over 100, at least, and the 5000-member Smart City Council’s 2014 [“Smart Cities Readiness Guide”](#) suggests there are several thousand projects underway globally.

²³ See the [website \(in Japanese\)](#) for the EcoNet Tokyo 62 “Renewable Energy and Smart

Community Research Commission,” which is to produce the handbook.

²⁴ The Ider Project page and its numerous research reports (in Japanese) is [here](#).

²⁵ See, in Japanese, [the Kanto Meti’s page](#) on its “sumakomi” (smart community) collaboration group.

²⁶ See Stephen Voss [“A Risk Index for Megacities,”](#) September 5, 2006, and a more comprehensive [list in Japanese](#).

²⁷ See Jeff Spross, [“Why Tropical Storm Vongfong May Just Be The Beginning For Japan,”](#) October 12, 2014.

²⁸ Streeck brilliantly and concisely explains how the Schumpeter-Goldscheid tax state became the debt state and is now (especially in Germany) a consolidation state that manifests an “uncompromising determination to place its obligations to its creditors above all other obligations” and a coalition of forces that stands in the ways of spending increases and indeed emphasizes cuts on all expenditure other than debt-service payments. See his [“Buying Time: the delayed crisis of democratic capitalism,”](#) talk on October 20, 2014 at the LSE. The cited remarks are at the 35:00-minute mark.

²⁹ [Michael Mann warns](#) that deep cuts in CO2 have to start now, not sometime later, or humanity risks runaway warming and unimaginable, accelerating chaos.

³⁰ See the excellent work by Clarisse Pham, [“Smart Cities in Japan,”](#) EU-Japan Centre for Industrial Cooperation, October 2014.