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Towards European "Smart Communities"? EU's Energy Preoccupations and the Lesson of Post-Fukushima Japan

by Marco Zappa

ABSTRACT

While Japan notoriously suffers from a structural lack of primary energy sources while being prone to natural disasters, it has been able to attain an unprecedented industrial development. The earthquake, tsunami and nuclear crisis of 2011 pushed successive national governments toward comprehensively reviewing its energy strategy, with substantial progress being made. The policies adopted by Japanese authority since 2011 point to the materialisation of community-based power networks, which, if adopted on a wider scale, might contribute to enhanced energy self-sufficiency and security. In the light of decarbonisation strategies adopted by both the EU and Japan and of the ongoing conflict in Ukraine, this issue is even more urgent. For these reasons, increased communication and coordination on energy and urbanisation issues between EU and Japan is highly desirable.

Japan | European Union | Energy | Sustainable development

keywords

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Towards European "Smart Communities"? EU's Energy Preoccupations and the Lesson of Post-Fukushima Japan

by Marco Zappa*

Introduction

In the aftermath of the 11 March 2011 earthquake, tsunami and nuclear crisis, the concept of "smart communities" emerged in Japan as a new paradigm of urbanisation and disaster-resilient power generation and distribution. In the following decade it has become so relevant as to being included in official strategies drafted at government-level. The idea of "smart community" is associated with a "functioning part of a city [...] where various next-generation technologies and advanced social systems are effectively integrated and utilized" for numerous tasks, but primarily for efficient energy use.[1] Key to this concept is the "smart grid", i.e., information and communication technology (ICT)-based decentralised power supply networks enabling the integration of diverse natural energy sources and a demand-based energy supply, managed by local power companies on the model of the German *Stadtwerke*.[2] Indeed, "smart communities" have become a recurring theme also in the EU strategies for a sustainable future. Years of mutual friendship, common political regimes and comparable levels of technological development make Japan and the EU natural partners. Faced with periodical energy crises, caused by either political or natural factors, and ambitious decarbonisation goals in coming decades, how can they enhance cooperation on smart communities and cities by exchanging knowledge and best practices?

[1] Hiromi Okubo et al., "Smart Communities in Japan: Requirements and Simulation for Determining Index Values", in *Journal of Urban Management*, Vol. 11, No. 4 (December 2022), p. 501, https://doi.org/10.1016/j.jum.2022.09.003.

[2] Takao Kashiwagi, "Special Interview: Chiiki Kasseika to Kyōjinka Ni Mukete Kasoku o Hajimeta Sumāto Komyuniti" [Smart communities have accelerated rural areas' revitalization and strengthened their resilience], in *Kenchiku Seikei Repōto*, August 2016, https://www2.panasonic.biz/jp/solution/report/archi/vol18/adr18_01_04.pdf; Takao Kashiwagi, *Bunsan-Gata Enerugī Ni Yoru Chiiki Sōsei* [Local Revitalization through Distributed Energy Systems], presention at the seminar "Sekai shuchō seiyaku/Nihon", 27 August 2018.

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The 2018 EU-Japan Strategic Partnership Agreement (SPA) was the culmination of years of bilateral cooperation in research and innovation in urban environments.[3] It highlighted the need for bilateral cooperation on (a) preserving the environment, particularly as regards the promotion of an efficient use of resources (art. 23); and (b) tackling climate change. Recognising the importance of cities as catalysts of economic growth and innovation, as well as frontiers of climate change mitigation, Art. 25 of the SPA encourages exchanges of "experiences and good practices" to tackle challenges in urban policies, such as those caused by climate change and ageing societies.[4]

As a follow-up to the SPA, the 2021 EU-Japan Summit brought about a new commitment by the parties to foster a "Green Alliance to protect [the] environment, stop climate change and achieve green growth". In the official statement released at the end of the 27th EU-Japan Summit, Tokyo and Brussels pledged to "share knowledge and experiences" in order to achieve "climate neutrality" through specific actions for "smart cities research and innovation" that can involve third parties, particularly in developing countries.[5] Furthermore, earlier this year the EU and Japan signed a "Digital Partnership", a historic first, to enhance cooperation in both the hardware (supply of semiconductors, 5G and above networks, high performance computing, quantum technology etc.) and software (cybersecurity, trusted flows of data, digital trade, digital education, etc.) components of the global "digital transformation". With a clear objective of establishing a "human-centric and sustainable digital society", the strategy highlights the importance of establishing an "open, free and secure internet", while providing up-to-date energy efficiency and sustainability standards for digital technologies.[6]

The 2015 Paris Agreement on climate change continue to shape European and Japanese policies for greenhouse gases (GHG) reduction and energy efficiency. In their respective comprehensive energy and climate strategies, both parties have highlighted smart communities and cities as a priority area to achieve carbon emission reduction, energy efficiency and quality of life improvement through the enhancement of ICT and cloud-based services in such areas as mobility, energy

[3] Japan's Ministry of Foreign Affairs, *The 3rd Joint Committee on Scientific and Technological Cooperation between the EU and Japan*, 18 May 2015, https://www.mofa.go.jp/dns/isc/page3e_000347.html; European Commission and Japan Government, *Towards a New Strategic Partnership in Research and Innovation between the European Commission and the Government of Japan. Joint Vision*, 29 May 2015, https://www.mofa.go.jp/dns/isc/page18e_000124.html.

[4] European Union and Japan, *Strategic Partnership Agreement between the European Union and Its Member States, of the One Part, and Japan, of the Other Part*, 17 July 2018, art. 25, https://eur-lex.europa.eu/eli/agree_internation/2018/1197/oj.

[5] European Union and Japan, *Towards a Green Alliance to Our Protect Environment, Stop Climate Change and Achieve Green Growth*, 27 May 2021, https://europa.eu/!Jk86Uk.

[6] European Union and Japan, *Japan-EU Digital Partnership*, 12 May 2022, https://www.consilium.europa.eu/media/56091/%E6%9C%80%E7%B5%82%E7%89%88-jp-eu-digital-partnership-clean-final-docx.pdf.

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and environment, disaster risk reduction and medicine and healthcare.[7] To do this, since 2011 the European Commission has promoted several initiatives to implement its "Climate-neutral and Smart Cities Mission", including the allocation in 2022 of a total 159 million euro to support European cities to achieve climate neutrality in compliance with the decarbonisation targets laid out by European Green Deal.[8] Following the February 2022 Russian invasion of Ukraine, these initiatives have become key to Brussels' ambition to reduce its energy dependence on energy imports from Russian through the RePowerEU initiative.[9] Conversely, the Government of Japan (GOJ) has allocated 111.7 billion yen (765 million euro) to several smart-city related financing schemes.[10]

The Japanese case appears worth analysing for the consistent development and steady diffusion of "smart" communities, a local adaptation of the concept of self-sufficient energy communities. Known in Europe since the 1970s, the concept of "smart communities" was revamped by the 2016 Clean Energy for All Europeans Package (CEAEP) and several Commission directives aimed at promoting "prosumer-based" Renewable Energy Communities (RECs).[11] Since the implementation of such directives is subject to single member-country's institutional and legal frameworks, the dissemination of RECs is uneven and concentrated in countries with regulatory systems promoting renewable energy installation.[12] Following the examples of communities in Germany, the Netherlands and Denmark, RECs have grown in Italy too, one notable example being that of Magliano Alpi in Piedmont in northwest Italy.[13]

[7] Andrew DeWit, *Japan's Smart Cities*, 2018 (unpublished), https://doi.org/10.13140/RG.2.2.31383.06561; European Commission and Japan Government, *Towards a New Strategic Partnership in Research and Innovation...*, cit.; European Commission website: *2020 Climate & Energy Package*, 2021, https://europa.eu/!yxTYYY; Japan Government, *Action Plan of the Growth Strategy*, 17 July 2020, https://www.kantei.go.jp/jp/singi/keizaisaisei/pdf/ap2020en.pdf.

[8] European Commission website: *EU Mission: Climate-Neutral and Smart Cities*, https://europa.eu/!HCwt8J.

[9] Charlie Cooper, "The Russian Gas Habit Europe Can't Quit: LNG", in *Politico.eu*, 6 November 2022, https://www.politico.eu/?p=2285447; European Commission website: *EU Mission*, cit.

[10] Tarō Tokunaga and Junko Shimobe, "2022 nendo yosan an kara mita sumāto shiti no yukue" [The future of smart cities as seen from the 2022 government budget], in *Shin-kōmin rentai saizensen: PPP machidzukuri*, 10 March 2022, https://project.nikkeibp.co.jp/atclppp/021900032/022400009.

[11] Maria Luisa Di Silvestre et al., "Energy Self-Consumers and Renewable Energy Communities in Italy: New Actors of the Electric Power Systems", in *Renewable and Sustainable Energy Reviews*, Vol. 151 (November 2021), Article 111565, DOI 10.1016/j.rser.2021.111565; Hiromi Okubo et al., "Smart Communities in Japan", cit.

[12] Maria Luisa Di Silvestre et al., "Energy Self-Consumers and Renewable Energy Communities in Italy", cit., p. 2.

[13] Ibid., p. 6; Comune di Magliano Alpi, *Why the "CER" of Magliano Alpi*, last updated on August 2021, https://cermaglianoalpi.it/?p=19792&lang=en.

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Japan's "smart communities" and Tokyo's response to energy crises

Forced to switch off the country's 54 nuclear reactors in the aftermath of the Fukushima shock, the GOJ took steps to secure its energy supply in the face of a particularly hefty consumer base. The GOJ adopted a feed-in-tariff scheme aimed at promoting the use of renewable energies (REs), mainly photovoltaic (PV).[14] Further transformations at the local level, particularly in disaster-affected areas, were accelerated. The rapid diffusion of "microgrids", i.e., local self-sufficient electric power networks supported by small-scale power generators (usually PV), storage units, and ICT-based energy management systems (smart meters, home energy management systems [HEMS], etc.) allowing for energy efficiency and CO_2 reduction, was one of such changes.[15]

In late 2020, former Prime Minister Suga Yoshihide promised to cut Japan's carbon emissions by 46 per cent from the 2013 level and reach "zero" emissions by 2050, thus laying the foundation for his and subsequent cabinets' initiatives in the energy sector.[16] With the October 2020 "Green Growth Strategy Through Achieving Carbon Neutrality in 2050", the GOJ officially incorporated the smart community model in its policy. In addition, the GOJ further stressed the importance of hydrogen in the country's future energy mix, planning to raise its utilisation quota to 10 per cent of the total energy supply by 2050.[17] To this end, Tokyo pledged to support Japanese companies in their efforts to develop new technologies curbing hydrogen production costs. The GOJ also vowed to provide incentives for the introduction of hydrogen-powered vehicles and enhance the national hydrogen supply infrastructure.[18] Against this backdrop, more than a hundred smart city projects have been supported and the recently launched Digital Garden City Nation (*den'en toshi kokka*) strategy aims to capitalise on previous experiences.[19]

[14] Kōki Nomura, *Kongo no saiseikanō enerugī seisaku ni tsuite* [Japan's Renewable Energy Policy], presentation at the 2nd joint webinar "The Key for Activating the Japanese Renewable Power Market - Learn from the Efforts of European & US Companies", 19 November 2021, https://www.eu-japan.eu/sites/default/files/imce/METI%20Noumura%202021.11.19_0.pdf.

[15] Andrew DeWit, *Japan's Smart Cities*, cit.; Ginsei Corporation website: *What Are HEMS, BEMS, FEMS, and CEMS?*, http://www.ginsei-jp.com/HEMS.html.

[16] Yoshihide Suga, *Remarks at the Leaders Summit on Climate*, 22 April 2021, https://www.mofa.go.jp/files/100181623.pdf.

[17] Japan's Cabinet Secretariat et al., *Green Growth Strategy through Achieving Carbon Neutrality in 2050*, 18 June 2021, p. 157, https://www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/index.html.

[18] Agency for Natural Resources and Energy (ANRE), *Enerugī Ni Kansuru Nenji Hōkoku* [Energy White Paper 2022], June 2022, p. 237-238, https://www.enecho.meti.go.jp/about/whitepaper/2022/pdf/whitepaper2022_all.pdf. A summary in English is available in ANRE website: https://www.enecho.meti.go.jp/en/category/whitepaper.

[19] Fumio Kishida, *New Year's Press Conference*, 4 January 2022, https://japan.kantei.go.jp/101_kishida/statement/202201/_00006.html.

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Since 2011, several ministries and government agencies, including the Ministry of Economy, Trade and Industry (METI), the Ministry of Internal Affairs and Communication (MIAC) and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), have contributed to this shift by promoting technological solutions to long-standing issues such as depopulation, urban-rural divide, disaster-hit areas revitalisation and climate change.[20] Specifically, METI and MLIT-sponsored projects since 2010 have revolved around the promotion of energy efficiency, self-sufficiency and CO_2 reduction with large Japanese companies playing a leading role. Notable examples are Toyota City Smart Community (Aichi Prefecture) and Fujisawa Sustainable and Smart Town (Kanagawa Prefecture). Both projects have been designed as clusters of 2–3 story "smart" housing units with PV panels installed on the roof, surplus energy storage facilities (usually solid oxide fuel cell batteries), electric vehicles (EVs) charging facilities, HEMS and energy data management system (EDMS) connected to the Internet. Besides a 60–70 per cent use of REs and reduced CO_2 emissions, they ensured energy reserves in case of power outages.[21]

More recently, community-led "smart communities" have emerged in disaster-hit Fukushima prefecture. A case in point is that of Naraha, a small town affected by restrictions on residency after the 2011 Fukushima Daiichi nuclear accident, whose smart community management is entrusted to a local incorporated association (*ippan shadan hōjin*), Naraha Mirai, on behalf of the city government.[22] Apart from the aforementioned equipment, the 140 unit-wide compact town features a community energy management system (CEMS) enabling the mutual supply of surplus energy between commercial and disaster public housing facilities built after the 2015 lift of the residency ban. With its current 40 per cent of the total energy supply generated by PV and its goal to become energy self-sufficient and carbon neutral by 2030, Naraha's project has been flagged as a successful revitalisation project by METI.[23] Similar projects have been initiated in nearby communities, such as Soma and Namie.[24] Recent studies have shown that such smart communities may ensure reliable life continuity plans (LCPs) with regards to their capacity of securing energy in case of crisis.[25]

On top of being the site of smart community experimentation, disaster-hit Fukushima Prefecture has been identified as a test area for the "hydrogen society" (*suiso shakai*) that the GOJ is keen to materialise in the next decades. The Fukushima Hydrogen Energy Research Field (*Fukushima suiso enerugī kenkyū fīrudo*, FH2R)

[20] Tarō Tokunaga and Junko Shimobe, "2022 nendo yosan an kara mita sumāto shiti no yukue", cit.

[21] Fujisawa SST website: *Overall Targets and Guidelines*, https://fujisawasst.com/EN/project/target.

[22] Naraha Mirai website: *jigyō naiyō* [About Us], https://narahamirai.com/aboutus/service.

[23] ANRE, *2021 nendo Chiiki Kyōsei Gata Saiseikanō Enerugī Jirei Kenshō: Jireishū* [The 2021 Local Mutualism for Renewable Energy Award: Case-Studies], 2022, https://www.enecho.meti.go.jp/category/saving_and_new/advanced_systems/saiene_kensho/doc/case-studies_r3.pdf.

[24] ANRE, *Enerugī Ni Kansuru Nenji Hōkoku*, cit., p. 20.

[25] Hiromi Okubo et al., "Smart Communities in Japan", cit.

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project opened in March 2020 in the city of Namie with the goal of generating hydrogen by using solar energy and supplied it to public facilities in the prefecture and to several vehicles deployed during the Tokyo 2020 Olympics in July 2021. The hydrogen generated in Namie was used to light the Olympic torch at the event's opening ceremony.[26]

Apart from *power-to-gas*-type of energy generation experiments, the GOJ is also supporting hydrogen production from biomasses and biogas. Particularly interesting is the solution showcased in Shikaoi (Hokkaidō), where Japan's first station selling hydrogen processed from biogas opened in January 2017. Managed by Osaka-based Air and Water Inc., the facility caters for fuel-cell cars and forklifts and is supplied by two biogas plants using animal excrements and food waste collected in local farms and houses which have a power generation capacity of 6,000 kWh per day, equivalent to the average energy demand of 600 households.[27] Undoubtedly, this project is the product of the energy policy launched by the government of Hokkaidō since 2010, and rebranded "one village-one energy" (*ichi mura ichi ene*) in 2012, to foster energy security through the enhancement of the self-production self-consumption (*chisan chishō*) model. More recently, other local governments have accelerated the adoption of measures aimed at developing new hydrogen stations. The Asahi Shimbun reported, for instance, that the Tokyo metropolitan government, in cooperation with energy giant Eneos, is planning to build a gas-powered hydrogen facility in Harumi district, Chūō Ward, to supply energy to a residential district that is projected to house 12,000 people.[28]

Conclusions and recommendations

As pointed out by Paul Midford, the EU and Japan have produced a joint effort in tackling climate change for decades but still need to take decisive steps toward the complete replacement of fossil and nuclear fuel power sources in their respective energy mix.[29] The current political crisis in Ukraine and Russia's weaponisation of energy supplies to Europe have pushed gas and oil prices upwards, forcing the EU to gradually abandon its long-standing energy policy and look for a new energy security strategy for its member states.

[26] Tess Joosse, "The 'Hydrogen Olympics' Lit a Torch for the Clean Fuel's Future", in *Scientific American*, 30 July 2021, https://www.scientificamerican.com/article/the-hydrogen-olympics-lit-a-torch-for-the-clean-fuels-future1; ANRE, *Enerugī Ni Kansuru Nenji Hōkoku*, cit., p. 237.

[27] Shikaoi Town Agriculture Promotion Bureau, *Shikaoi Machi Ni Okeru Suiso Kanren Purojekuto No Torikumi* [Initiatives on projects related to hydrogen in Shikaoi Town], 2019, https://www.pref.yamaguchi.lg.jp/uploaded/attachment/60417.pdf.

[28] Shin Kasahara, "Large Hydrogen Station to Be Set up at Former Olympic Village", in *The Asahi Shimbun*, 17 October 2022, https://www.asahi.com/ajw/articles/14744994.

[29] Paul Midford, "EU-Japan Cooperation on Renewable Energy", in *EUI RSC Policy Briefs*, No. 2021/52, p. 8, https://doi.org/10.2870/83313.

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In this regard, the SPA offers the opportunity to strengthen bilateral cooperation and exchange to address these long-term challenges. For instance, city-level initiatives, such as the Asia Smart City Conference, have seen an increasingly proactive role by European partners. Mainly sponsored by the Yokohama City Government and aimed at promoting Japan-ASEAN cooperation on urban development, the 2021–2022 conference saw the participation of the EU-Japan Centre for Industrial Cooperation and Finetech, a precision equipment manufacturer based in Germany. In the Yokohama Declaration, issued at the conclusion of the conference, the participants vowed to enhance cooperation between Japanese and European players, reaffirming the need for cities to work "beyond regional boundaries [...] in areas such as decarbonisation, circular economy, next-generation mobility and citizens' well-being".[30] Since the entry into force of the agreement, the EU-Japan Centre for Industrial Cooperation has acted as a hub for experience and best practices exchange. A recent seminar featured the participation of representatives from Zecpower, a German RE company, and Amazon Web Services sharing insights on the activation of the RE market in Europe.[31] This kind of event should be open to small and medium-sized enterprises (SMEs) operating in different contexts and EU member states. In this regard, SMEs participation is key to the materialisation of the comprehensive digital transformation which both the EU and Japan pursue in their digital partnership.[32]

Therefore, an increased participation by EU-based actors in the institution's joint seminars, conferences, and initiatives is desirable not only from energy technology and RE regional powers such as Germany, but even from a latecomer such as Italy. In this regard, state institutions and industry associations from around the EU supporting SMEs abroad and nurturing the RE sector should encourage a wider engagement by RE operators with Japanese counterparts through these platforms.

When it comes to tackling climate change or foster sustainability in urban areas, solutions have tended to be top-down and technocratic in nature.[33] As shown above in relation to several projects in Japan, "smart" community-like experiments have had positive effects in enhancing several communities' energy self-sufficiency and crisis preparedness, by using the best available technologies and adapting them to local resources, needs and demands. However, cases such as those of Magliano Alpi in Italy and Naraha in Japan demonstrate that the key to energy transition strategies at every level lies in community participation and a more decentralised

[30] Asia Smart City Conference, *The 10th Asia Smart City Conference Official Report*, Yokohama, March 2022, https://yport.city.yokohama.lg.jp/wp-content/uploads/2022/05/The-10th-Asia-Smart-City-Conference-Official-Report-.pdf.

[31] Institute of Energy Economics and EU-Japan Centre for Industrial Cooperation, *The Key for Activating the Japanese Renewable Power Market - Learn from the Efforts of European & US Companies*, 2nd joint webinar, 19 November 2021, https://www.eu-japan.eu/node/3609.

[32] European Union and Japan, *Japan-EU Digital Partnership*, cit., Section 4-37.

[33] Marco Zappa, "Smart Energy for the World: The Rise of a Technonationalist Discourse in Japan in the Late 2000s", in *International Quarterly for Asian Studies*, Vol. 51, No. 1-2 (Spring 2020), p. 193-222, https://doi.org/10.11588/iqas.2020.1-2.10999.

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approach to energy supply. In fact, enhanced citizen participation can make REs more widely accepted and integrated in the citizens' daily life. In this regard, the role of local governments, local investors and community organisations is to be valued, particularly against the backdrop of the pledges contained in the Japan-EU Green Alliance.[34]

Against this backdrop, the EU should continue pursuing the goals of the CEAEP while supporting the diffusion of RECs in a more extensive and even manner through political pressures on reluctant member states and incentives to the creation of community-based energy policy frameworks.

Concomitantly, in the two aforementioned cases, town and community-level organisations are in charge of the "smart community" project development and implementation and in this regard valuable experiences could be shared thanks to strengthened EU-Japan communication and cooperation. In the latter case, particularly, it is noteworthy that the energy self-sufficiency is sought after along with socio-economic reconstruction and recovery. Such experiences could help local communities in poorer regions across Southern Europe facing a demographic crisis and a structural lack of know-how to identify new and sustainable routes to revitalisation, which may empower local rather than central state actors.

Therefore, new *fora* should be created within the extant SPA and EU-Japan cooperation frameworks to exchange experiences and best practices for recovery, reconstruction and regional revitalisation.

Updated 14 December 2022

[34] Aura Caramizaru and Andreas Uihlein, *Energy Communities: An Overview of Energy and Social Innovation*, Luxembourg, Publications Office of the European Union, 2020, p. 32, http://dx.doi.org/10.2760/180576.

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