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# Realizing the Carbon Reduction Potential of the Cloud in Japan

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Commissioned by AWS

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# Introduction

Cloud technology can provide several technical and business advantages over traditional forms of on-premises computing. There is a wide body of research on the direct benefits and impacts of the cloud on business operation. This has focused, for example, on the convenience of broad network access and services accessible from a wide variety of devices and locations, as well as the advantages of resource pooling to serve multiple customers and create significant efficiencies and economies of scale. Additional key reasons cited why businesses and public sector stakeholders are increasingly shifting toward the cloud include rapid scalability, the reduction in time required to get up and running on cloud-based systems, cost predictability, and a more balanced Return on Investment (ROI).

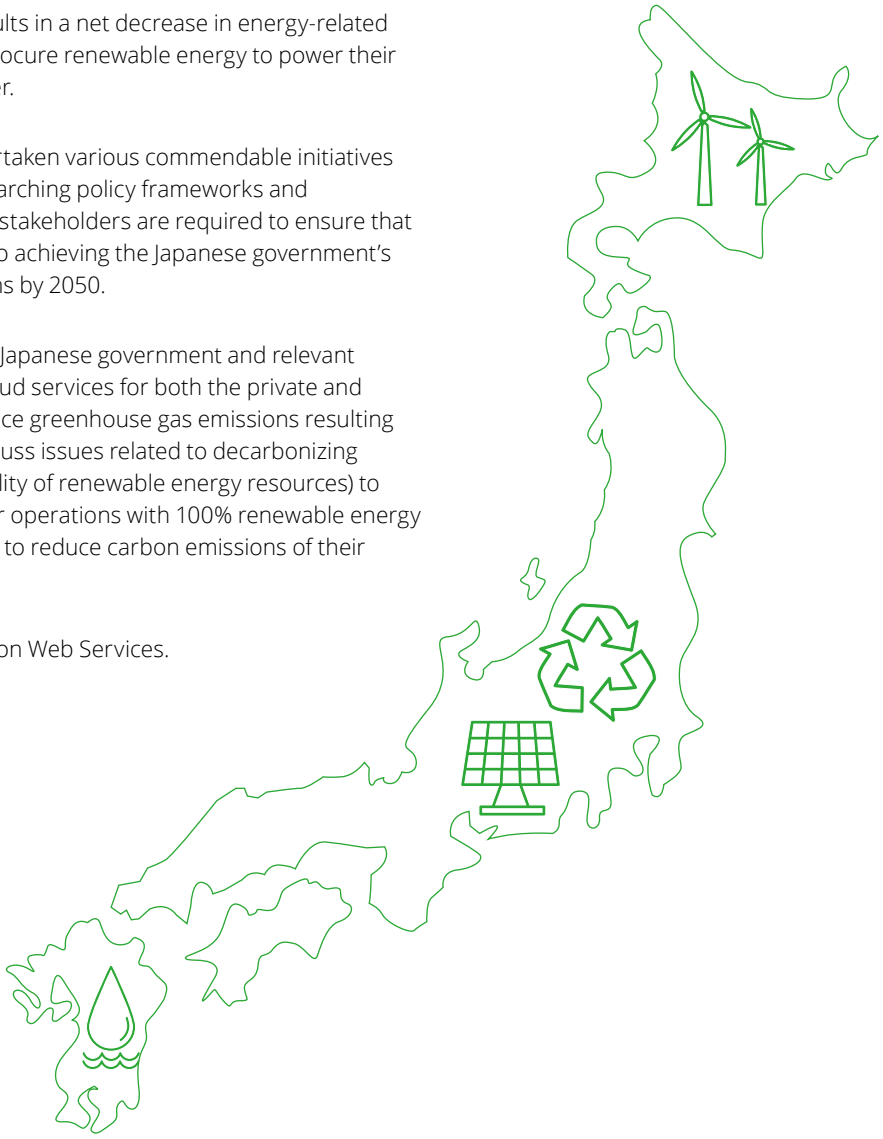
However, often less explored are the environmental benefits associated with a shift to cloud technology and – especially in Japan – how this can help the government in achieving its ambitious net-zero carbon goals by 2050.

A shift from on-premises infrastructure to the cloud has environmental benefits due to the consequent increase in energy efficiency, which results in a net decrease in energy-related greenhouse gas emissions. If cloud providers can procure renewable energy to power their operations, carbon emissions will be reduced further.

In recent years, the Japanese government has undertaken various commendable initiatives to accelerate cloud adoption. However, further overarching policy frameworks and increased collaboration between public and private stakeholders are required to ensure that encouraging migration to the cloud can contribute to achieving the Japanese government's pledge to achieve net-zero greenhouse gas emissions by 2050.

In this paper, we highlight several initiatives that the Japanese government and relevant ministries should consider to increase the use of cloud services for both the private and public sectors and to leverage opportunities to reduce greenhouse gas emissions resulting from optimizing computing energy use. We also discuss issues related to decarbonizing the Japanese power grid (and increasing the availability of renewable energy resources) to ensure that cloud providers in Japan can power their operations with 100% renewable energy and provide cloud solutions that customers can use to reduce carbon emissions of their operations.

This report has been prepared by Deloitte for Amazon Web Services.



The views and data reflected in this whitepaper are updated as of Mar 23, 2021.

# Chapter 1

## Energy efficiency as a key benefit of accelerating the private sector's transition to cloud-based technology in Japan

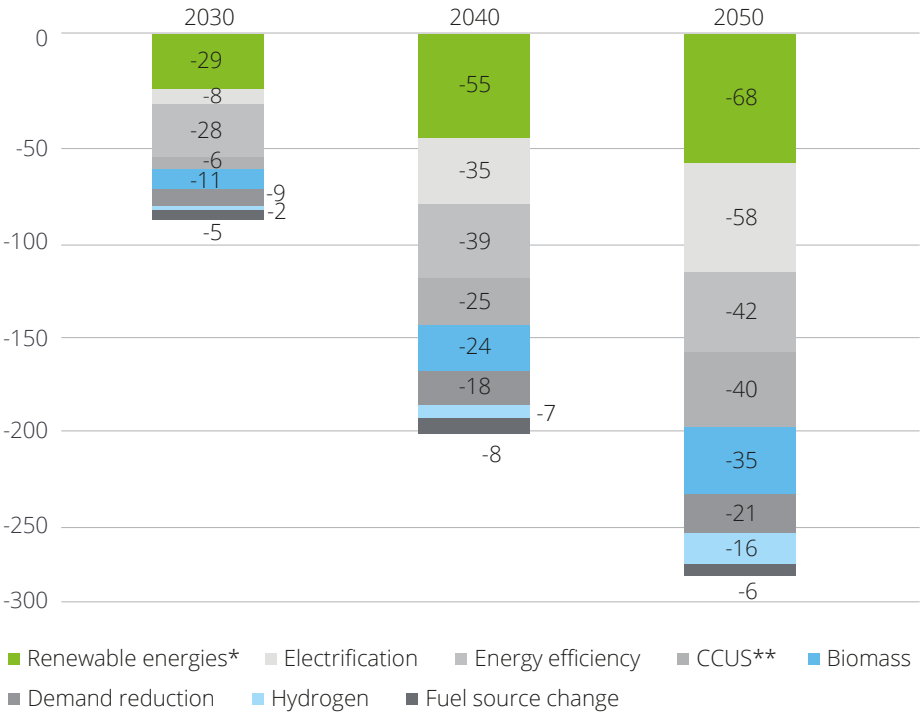
## 1. Current State

### 1.1 Japan's newly established net carbon neutral objectives

During his first policy speech in October 2020, Prime Minister Yoshihide Suga committed to achieve net carbon neutrality by 2050[1] . As a part of Japan's pledge under the Paris Agreement to achieve nationwide carbon reduction targets, this announcement sets the tone for both the country's public and private sectors.[2]

Meanwhile, global bodies, such as the International Energy Agency (IEA), have called on countries around the world to invest in three areas of energy innovation that present the most promising opportunities to help reduce carbon emissions by 2050: namely, increasing shares of renewable energy (6.8 billion tons of CO2), encouraging the electrification of buildings and transportation (5.8 billion tons), and promoting energy efficiency (4.2 billion tons).[3]

**CO2 emission reduction (100 million tons/year)**

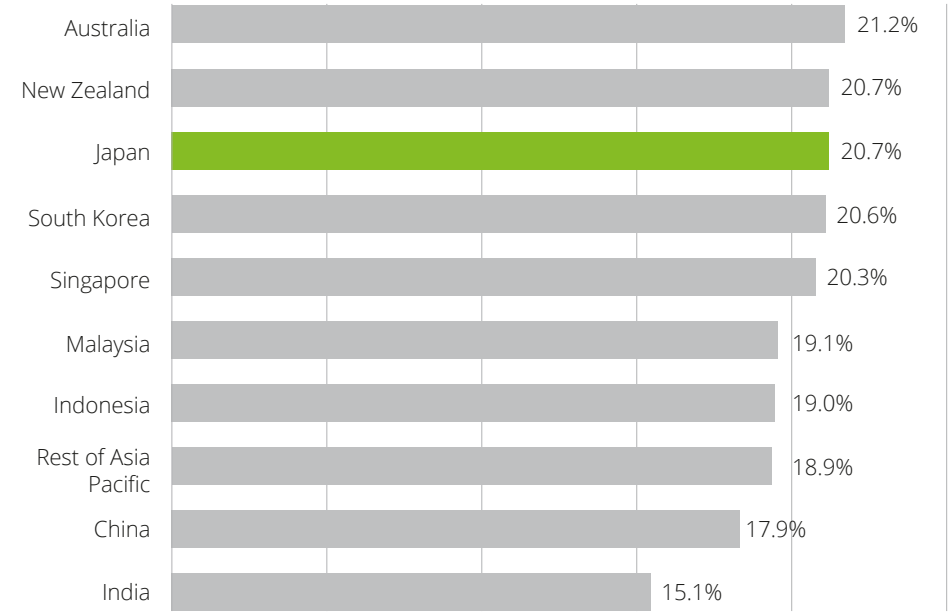



*Renewable energies do not include biomass or hydrogen. **CCUS: Carbon dioxide Capture, Utilization and Storage.
**Source:** https://www.cas.go.jp/jp/seisaku/seicho/seichosenryakukaigi/dai2/siryou2.pdf

Japanese business interests, including the Japan Business Federation (JBD) and the American Chamber of Commerce in Japan (ACCJ),[4] have generally expressed support for decarbonization through business-led innovation in energy efficiency as well as cleaner energy solutions.[5] And while welcoming the government's leadership in accelerating Japan's carbon reduction targets, some, such as the Japan Association of Corporate Executives (JACE, one of Japan's three major business associations) and the Japan Climate Leaders' Partnership (JCLP) and its member companies,[6] have called for even more ambitious near-term renewable energy targets to more rapidly decarbonizing energy use in Japan.[7]

Promoting migration to the cloud and adoption of cloud-based technologies is one such example of innovation that could not only help to accelerate decarbonization in computing-related energy use, it could also help to enable a "smarter" power grid supporting a greater variety of distributed energy resources—e.g. through the deployment of 5G networks, advances in the Internet of Things (IoT), and artificial intelligence (AI) technologies, all of which are enabled by cloud infrastructure expansion.

**Asia pacific cloud computing market CAGR, 2018-2023**




Source: GlobalData 2023 market opportunity forecasts: Cloud Computing

It is precisely the rise of these technologies that has, in recent years, propelled Japan to become one of Asia Pacific's largest public cloud markets, expected to grow at a compound annual growth rate of over 20 percent from 2018 to 2023. With a policy approach that highlights the environmental benefits that cloud data centers and cloud technologies provide on top of their operational benefits, Japan has the opportunity to further its digital transformation and the realization of public and private carbon reduction targets at the same time.

## 1.2 The environmental benefits of cloud technology

Research by the U.S. Department of Energy (DOE), the Lawrence Berkeley National Laboratory (LBNL),[8] and the IEA,[9] in addition to peer-reviewed research published in numerous academic publications including the journal Science,[10] has found that shifting computing from on-premises data centers to the cloud has significant energy efficiency benefits. As a result, increased energy efficiency at cloud sites has lowered the carbon intensity of associated computing power, despite a concurrent surge in Internet traffic and data center workloads over the last two decades. In particular, moving servers from on-premises to hyperscale cloud data centers has the most significant impact as servers are configured for maximum productivity and operate at higher utilization rates.[11]

### Structural efficiency

While on-premises data centers often rely on outdated, energy-heavy cooling systems to maintain low-level temperatures, cloud data centers (hyperscale facilities in particular) typically use advanced cooling systems that maintain energy consumption at a strict minimum and enable these centers to function in environments where temperature ranges are wider. This results in lower service costs for users and a tangible reduction in energy consumption.[12]

### Utilization efficiency

Cloud data centers provide users with greater computing capabilities than on-premises data centers. Whereas on-premises data centers often run underutilized and idle servers, which limits energy efficiency, cloud data centers' higher central processing unit utilization makes them more energy-efficient and better able to optimize power consumption by connecting server workloads with available resources.[13]

### Increased grid-wide energy management capability

Cloud services reduce the overall carbon footprint associated with computing energy use.[14] By enabling energy suppliers and end-users to more easily deploy and use smart systems relying on cloud solutions (e.g. smart power grids and transportation systems), cloud technology can further aid Japan's net-zero carbon goals by contributing to the transformation of myriad physical goods and services (and their associated carbon costs) by 2050. They can provide energy suppliers with enhanced computing capabilities that enable real-time control over distributed energy resources on the grid, as well as giving energy consumers the tools to better manage and rationalize their energy use.[15]

## 2. Policies and opportunities relevant to the private sector's cloud adoption

This section highlights policy initiatives that currently privilege hardware adoption and on-premises mainframe solutions (to the exclusion of cloud options), and offers recommendations to Japanese policymakers to better enable businesses and organizations to reduce their carbon footprint through cloud adoption.

### 2.1 Applicability of the Energy Conservation Act (1979) and the Collaborative Energy Efficiency Plan

Under the Energy Conservation Act, Japanese energy consumers with annual power requirements greater than 1,500 kilowatts (kW) must make demonstrated efforts to reduce their energy consumption by 1 percent each year. They also need to submit periodic reports on their energy consumption to Japan's Ministry of Economy, Trade, and Industry (METI) and other relevant authorities.[16] To date, however, energy efficiency measures encouraged under the Energy Conservation Act have focused almost exclusively on hardware-based solutions (i.e. updating onsite energy-intensive equipment and technologies with newer/more efficient versions).

The 2018 revision to the Energy Conservation Act helped with diversifying suggested approaches with a Collaborative Energy Efficiency Plan mechanism. These targeted energy users can share costs while optimizing energy supply through upstream and downstream supply chain collaboration, optimized logistics scenarios, and facility-integration for businesses operating in the same industry.[17] Regrettably, cloud computing and/or the use of cloud-enabled virtual energy resources are still not considered under current regulations.[18]

**Recommendations**

**2.1a. Consider cloud adoption as a qualified energy-saving solution**

In addition to current hardware-focused options, the act of moving operations from on-premises energy-intensive infrastructure to more efficient cloud computing infrastructure should be recognized as an acceptable energy-saving measure under the Energy Conservation Act and related Collaborative Energy Efficiency Plan.

### 2.2 Enabling energy management innovation

In contrast to the strictly hardware-focused Energy Conservation Act, METI actively supported virtual measures aimed at improving energy efficiency and minimizing waste. They also work to reduce carbon emissions via smart grids and virtual power plants (VPP) and build energy management systems (BEMS). Cloud solutions are particularly well suited to support the deployment of such innovations by enabling advanced computing and analytics capabilities as well as data storage and processing power for small and large operations alike.

**Recommendations**

**2.2a. Promote cloud-based smart grids, real-time energy management, and VPP solutions**

Cloud technology can propel METI's effort to implement innovative energy management solutions and accelerate the modernization of the Japanese power grid and should be embraced and promoted as a central part of these efforts.

### 2.3 Other policies promoting investment in energy-efficient and carbon-reducing equipment

On top of central government initiatives, some Japanese prefectures and municipalities launched their programs to encourage investment in energy-efficient equipment. This included improving the energy efficiency of boilers, air-conditioning, lighting systems, industrial furnaces, and co-generation facilities at small-to-medium-sized enterprises (SMEs). Such programs can cover up to one-third of the upfront costs of installing energy-efficient equipment (up to JPY1 million) and have the added benefit of helping to lower the carbon footprint associated with users' energy use.[19] As with related national policies, these prefectural and municipal energy-saving promotional efforts and subsidies favor physical equipment and capital investment and tend not to cover investments in digital assets or cloud solutions.

**Recommendations**

**2.3a. Include cloud adoption in the scope of prefectural and municipal programs to encourage energy efficiency**

Cloud adoption should be recognized as an eligible measure as a part of prefectural/municipal efforts to promote energy efficiency at SMEs, on par with incentives to update on-premises mainframes. Such inclusion would provide SMEs with further incentives to migrate to cloud environments that will drive greater computing capability at a lower cost while at the same time helping to reduce their energy-associated carbon impact.

### 2.4 Current tax incentives schemes favor physical assets

Existing tax incentives rely on an underlying principle that the taxpayer applying for tax credits should invest in qualifying tangible assets to be eligible. For this reason, the acquisition cost of such assets serves as a basis for additional depreciation or tax credits.

A policy that grants tax incentives based only on the acquisition of qualifying physical assets is not appropriate for cloud users, as they do not need to acquire physical assets. Moreover, tax incentives requiring an investment in qualifying tangible assets may be inconsistent with sustainability principles, since the energy consumption of under-utilized on-premises assets can have an adverse environmental impact. A focus only on physical assets disregards any advantages of cloud adoption for the user and the environment.

As the Japanese government begins to review tax incentives as part of the FY2021 tax system reform to encourage companies to undertake digital transformation, current tax incentives should be re-examined accordingly.

**Recommendations**

**2.4a. Expand tax incentives to include corporation filing blue form tax return and include cloud services costs of qualified data centers as an eligible cost**

Expand the tax incentives for energy-saving facilities (tax credit) to include all corporations filing a blue form tax return and allow the cost for cloud services to be an eligible cost for the tax credit.

# Chapter 2

## Value of promoting cloud adoption as a central part of public sector energy efficiency and decarbonization efforts

## 1. Current State

### 1.1 Public sector cloud adoption

In recent years, the Japanese government made clear its resolve to accelerate the public sector's digital transformation.[20] We can see this in the 2018 cloud-by-default policy encouraging the adoption of cloud solutions by all ministries and public agencies.

A new Digital Agency will be responsible for establishing "Gov-Cloud", a standardized digital infrastructure for central and local governments that will be built on multiple cloud services, and promote migration of government information systems to Gov-Cloud.

We expect accelerating cloud adoption to save the government infrastructural maintenance costs and reduce the dependency on vendors when promoting new projects.[21] It will help realize effective operations, like through process automation at a lower cost, and enable agile service development with higher scalability.[22] Cloud adoption can also help reduce the public sector's energy-related carbon footprint as well.

### 1.2 Eco-friendly public e-services: The cloud opportunity

To meet the public sector's need for public e-services expansion and reduce public agencies' carbon footprints, the government should accelerate the adoption of cloud technology at every level of administrative jurisdiction to support the realization of the country's 2050 carbon neutrality objectives.

## 2. Policies and initiatives affecting the adoption of cloud solutions by the public sector

This section examines recent governmental policies and initiatives affecting the adoption of cloud services by business actors and offers recommendations as to how (on top of the operational and security-related benefits, which are already highlighted) Japanese government efforts to accelerate a public sector shift to the cloud could also highlight the energy efficiency and GHG emissions reduction opportunities associated with migration to the cloud.

### 2.1 Cloud-by-default principle

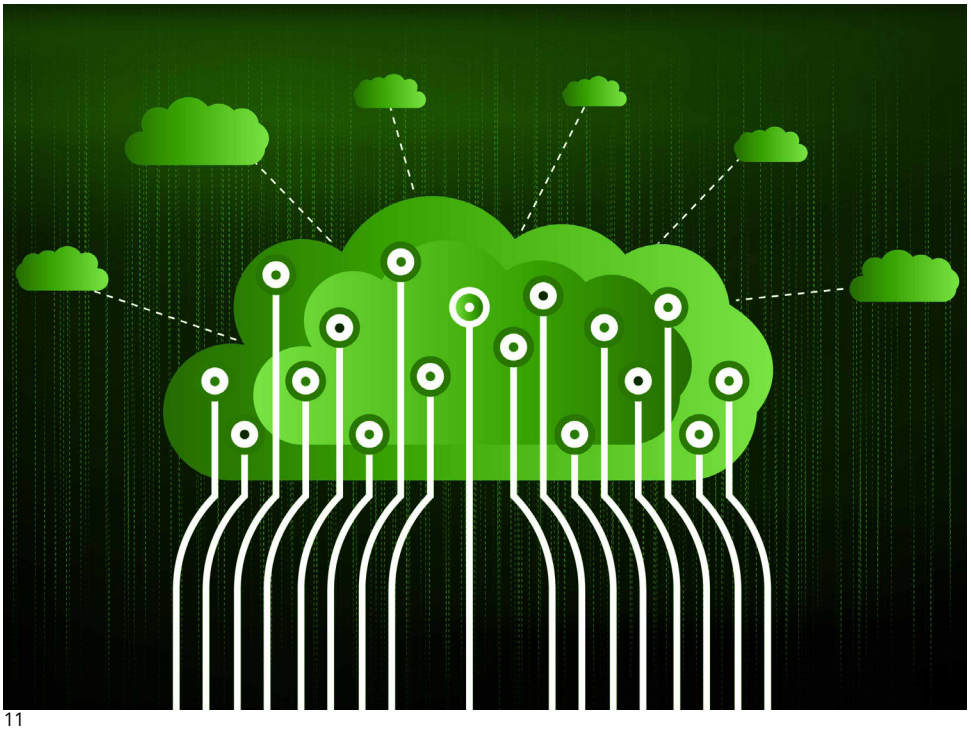
In 2018, the Japanese government set out its cloud-by-default vision. This plan introduces the cloud as the first option government agencies and ministries should consider when deploying new information systems.

However, as a part of these efforts, the government could do more to highlight the additional energy efficiency gains and carbon reduction opportunities associated with the accelerated deployment of cloud technologies within the public sector.

**Recommendations**

**2.1a. Set a more ambitious cloud adoption goal and timeline for ministries and government agencies**

The government should accelerate migration to the cloud across ministries and set clear targets for cloud adoption. The government should also prompt municipalities and prefectures to adopt the cloud-by-default principle at an early stage without waiting for legacy systems to become unserviceable. As a part of these efforts, the Japanese government should signal that it sees cloud migration as consistent with its carbon-neutral objectives, highlighting the environmental benefits of cloud adoption when encouraging cloud migration in both the public and private sectors.



## 2.2 Cloud procurement policy and government expenditure budgets

The Japanese government has launched several projects to promote cloud adoption by municipalities. In 2011, the Ministry of Internal Affairs and Communications (MIC) launched a Joint Purchase of Cloud Service among Municipalities project, to foster the digitalization journey of local administrations and the migration to a common cloud environment for data storage. MIC also allocated JPY150 billion in 2018 for the Restructuring of Information Systems at the Municipal Government Project and the promotion of Cloud Sharing among Municipalities. This provided municipalities and prefectures with subsidies to cover consulting fees, staff training, and data migration costs.

In 2021, the government launched an initiative called the Information System Security Management and Assessment Program (ISMAP).[23] As part of this assessment programme, the government published a list of "ISMAP cloud services" which includes the cloud service providers that, as audited and certified by third party organizations, meet security requirements set out by ISMAP standards.[24] This list will enable government agencies to efficiently procure secure cloud services without the need for further security due diligence.[25]

The central government's efforts in improving its procurement guidelines are critical to accelerating the adoption of the cloud by local governments.

**Recommendations**

### 2.2a. Redesign the operating budget expenditures of ministries and government agencies to accelerate digitalization

Government agencies' budgets consider digitalization of government processes, including the adoption of the cloud, as an operating expenditure. We recommend that government sector leaders reconsider budgets, including potential trade-offs to facilitate a shift between capital and operating expenditure to tailor their expenditure when procuring intangible assets. Further, the government needs to consider the need to align depreciation and transition timeframes. Governance and project controls that are common for capital projects will also need to change to ensure continuous improvements of the platforms over time. This will improve the government agencies' spending capabilities to acquire technologies, including cloud services that will improve their operational efficiencies and reduce their carbon footprint.

## 2.3 Prefecture level initiatives toward the zero-emission goal

In line with the government's 2050 carbon-neutrality goals, municipal governments laid out plans and set goals to support their decarbonization objectives. For instance, in 2019 the Tokyo Metropolitan Government (TMG) released a Zero-Emission Tokyo Strategy in which it details key areas to accelerate decarbonization.[26] TMG also laid out a tentative version of a five-year Zero Emission Action Plan for the Tokyo Metropolitan Government.[27] These plans promote measures to reduce CO2 emissions produced by buildings as a key decarbonization area. We traced a sizeable part of building-related emissions back to the operation of on-premises servers, especially in service business-rich districts such as Marunouchi. However, now neither of these plans include cloud adoption as a solution to reduce carbon.

Also regarding the carbon emissions generated by buildings, in 2020 the Tokyo Bureau of Finance (TBF) issued a revision of Tokyo's Specifications for Energy-Saving and Energy-Efficient Equipment that lays out public buildings' energy-efficiency standards.[28] In line with both the Zero-Emission Tokyo Strategy and the Zero-Emission Action Plan for Tokyo Metropolitan Government, these specifications serve as references for TMG when purchasing new equipment. The guidelines detail both the methods and the equipment required to enhance a building's energy-efficiency and reduce its carbon emissions. Cloud-based energy demand monitoring systems and buildings' energy management systems are included in the list of required items, but the shift to the cloud of IT assets located inside a building is not.

**Recommendations**

**2.3a. Ensure the harmonization between the national government's carbon neutral objectives and prefectures' initiatives**

The government should make sure the national and prefectural/municipal initiatives, including relevant action plans, align in their approach to decarbonization. For instance, the government should make sure that prefectures and municipalities consider cloud adoption as a greenhouse gas emissions mitigation. Also, when renovating or building public facilities, the government should consider cloud adoption as part of its list of energy-efficient measures for decarbonization.

## 2.4 The Green Purchasing Act

The Green Purchasing Act (2000) aims to promote the purchasing of eco-friendly products and services by government entities at the national and local levels.[29] As of December 2020, the government keeps cloud technologies out of the scope of the act and none of its purchasing criteria for IT assets considers cloud solutions.[30] However, following the start of the COVID-19 pandemic, the Ministry of Environment (MoE) initiated a public consultation to amend the act and noted the need to scope-in services facilitating remote work arrangements and IT products.[31] The revised list was published in February 2021, and it now includes software license and web conference system as enablers for remote work[32] – acknowledging their added value on reducing environmental burden.[33] While this is a welcoming step ahead, there are still a long way to go before environmental benefits of cloud technologies are fully covered in the Act.

**Recommendations**

**2.4a. Increase the number of cloud-based products and services in the list set out by the Green Purchasing Act**

Cloud technology itself should be qualified as an eco-friendly asset in the context of the Green Purchasing Act, and the Act should not limit to those products and services enabling remote work. This will expand the options available to the government institutions in their pursuit to reduce their overall environmental impact.

## 2.5 Disaster risk management and cloud technology – building a more resilient Japan

In addition to supporting carbon reduction as a part of climate mitigation efforts, cloud technology can also assist with climate adaptation measures, including disaster preparedness and weather pattern projections.

In response to natural disasters, some public sector stakeholders established disaster recovery mechanisms, including using the cloud to safeguard data by replicating it across distant cloud infrastructure regions and for data backups for critical infrastructure. Also, the government took initiative to better manage climate data. For instance, the Minister of the Environment along with the Minister of State for Disaster Management set out a plan to coordinate measures addressing climate change and disaster risks, in line with the United Nations Sustainable Development Goals (UN SDGs).[34]

**Recommendations**

### 2.5a. Enable disaster recovery and climate pattern projection through cloud technology

Cloud infrastructure, with the flexibility to store data within multiple geographic regions, can effectively enable end-users to provide data accessibility and business continuity in case of a disaster scenario. Also, the government can use cloud technology to effectively analyze big data, including those related to meteorological patterns. The government can facilitate real-time data collection, enable advanced computing to support climate forecast, warning issuing, and situation monitoring, and provide advice on weather matters in Japan.

### 2.5b. Support the business continuity operation of the cloud infrastructure as it provides the important infrastructure in case of natural disaster

To support disaster recovery, it is essential to provide the business continuity of cloud infrastructure. Aside from continuous electricity supply needs, continuous water supply is also vital for cloud infrastructure, as modern data centers (hyperscale data centers in particular) can leverage efficient water cooling systems that reduce energy usage and associated carbon emission advantages compared to traditional chillers. While these systems are optimized to minimize water usage, a reliable water supply with appropriate redundancies is vital for data centers to maintain business continuity and support end-users.

As such, we recommend that the government consider continuous water supply a critical requirement alongside appropriate redundancies from data center operations. The government should capture these at the national policy framework and flow them down to the relevant sub-national entities or authorities.

# Chapter 3

## Promote renewable energy to lower the carbon intensity of Japan's power grid and enable a truly green cloud ecosystem

As established above, a shift from on-premises computing infrastructure to the cloud has environmental benefits due to the consequent increase in energy efficiency. This results in a net decrease in greenhouse gas emissions associated with energy use. Cloud data center operators can amplify these benefits when they power their operations with 100 percent renewable power.

This chapter summarizes key recommendations that relevant industry groups in Japan (including JACE, JCLP, and the ACCJ) have made to improve corporate consumers' access to renewable energy. The recommendations below are made in the spirit of enabling private investments (i.e. bypassing the need for taxpayer or ratepayer-supported subsidies) to help increase the supply of renewable power and lower the carbon intensity of Japan's power grid.

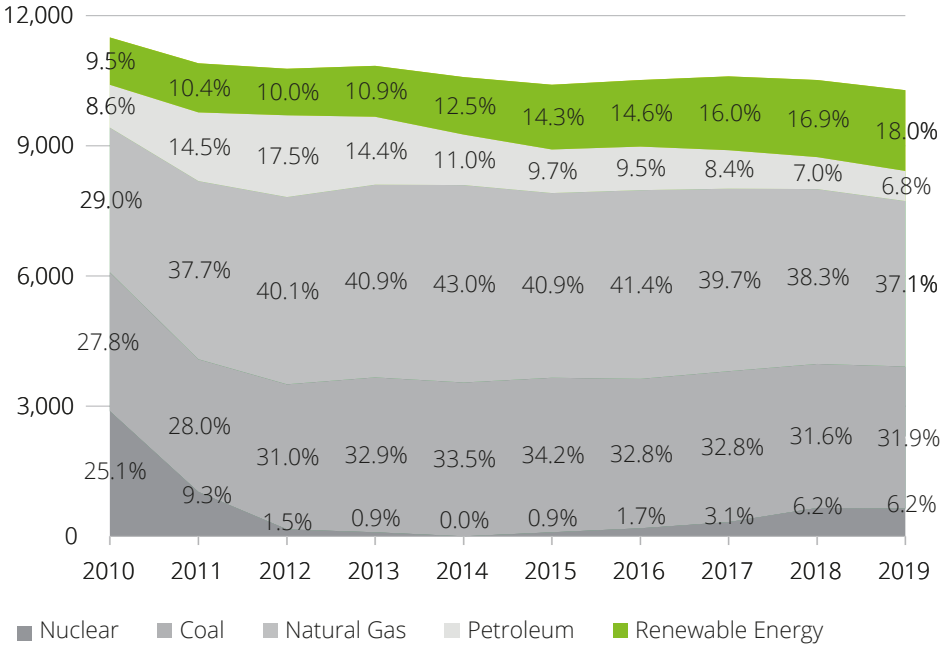
## 1. Current State

### 1.1 Japan's energy mix

Following the 2011 Great East Japan Earthquake and the Fukushima nuclear power plant disaster, to compensate for the loss of energy generated by nuclear power plants, Japan shifted towards fossil fuel and renewable energies to compensate for the loss of nuclear power plants.[35] As of FY 2019, fossil fuels like natural gas, coal, and petroleum accounted for over 75 percent of the country's power generation sources while renewable energies accounted for only about 18 percent.[36] This over-reliance on fossil fuels casts doubt on Japan's ability to meet the goals set by the Paris Agreement and realize the government's 2050 decarbonization objectives.[37]

Reducing costs and setting higher targets for the share of renewable energy in Japan's energy mix would help to spur private investment in non-subsidized new/additional renewable power projects in Japan.

**Electricity generation by sources in Japan, FY2010-FY2019 (100 million kWh)**




Source: https://www.enecho.meti.go.jp/statistics/total_energy/pdf/stte_gaiyou2019_sokuhou.pdf

## 1.2 Japan's renewable energy sector opportunities

Out of the list of 35 OECD countries, Japan ranked 34th least energy self-sufficient country in 2017. Heavily relying on imports to power its national energy grid, the country produced in the same year only 9.6 percent of its overall energy needs.[38] Such dependency on imports exposes Japan to market price fluctuations and supply chain contingencies. Given Japan's natural resource scarcity, the government must reduce the costs of renewable energy and support the expansion of the renewable energy sector if it is to increase national energy self-sufficiency while addressing the environmental concerns raised by climate change and global warming.

In this regard, the deregulation of the energy market involves the launch of the feed-in-premium (FIP) scheme in 2022 and the adoption of the open procurement balancing of power model. It also involves the introduction of behind-the-meter wind and solar energy storage, which in recent years have opened the market to new renewable energy retail entrants. The liberalization of the energy sector represents an opportunity for Japan to expand the market of renewable energies and reduce the need for energy imports[39] and is in line with overseas developments.

## 2. Policies and initiatives affecting the use of renewable energy in Japan

In this section, we will look at governmental policies and initiatives related to renewable energy supply in Japan. The recommendations in this chapter are a collection of viewpoints set out by major industry groups in Japan to promote the accessibility of renewable energy on the grid to reduce a country's carbon footprint.

### 2.1 The Basic Act on Energy Policy (2002), and the fifth Strategic Energy Plan (2018)

According to article 12 of the Basic Act on Energy Policy, the government must formulate the fundamentals of its energy strategy in its Strategic Energy Plan every three years.[45] In its latest 2018 plan, the government set its goal to power the energy grid with 22 percent to 24 percent of renewable energies by 2030.

**Recommendations**

**2.1a. Be ambitious in setting out higher renewable energy targets for 2030**

The planned share of renewable energies by 2030 is lower than that of coal-fired power set at 26 percent[40] by 2030. This is in opposition to the government's objective of making renewable energies the country's primary energy source. Also, this renewable energy target is low when compared to those of other major economies[41] like Spain[42] (74 percent by 2030) and Germany[43] (65 percent by 2030).

Industry associations and inter-governmental organizations, including Japan Climate Leaders' Partnership (JCLP), have been advocating for higher targets. JCLP is advocating for a target of 50 percent renewable energy by 2030.[44] Setting out higher renewable energy targets will set the tone at the top and convey the stronger direction-change to market actors and promote the removal of existing barriers hindering the expansion of the renewable energy market. Additionally, such a move will help to foster economies of scale driven by an increased supply and driving down the costs of renewable energy. This will serve a major interest of numerous business groups in Japan, and it will help to enable cloud providers to source 100 percent renewable energy.

### 2.2 The Electricity Business Act

Based on the Electricity Business Act, there is a rule to allocate grid capacity on a first-come, first-served basis. This rule limits the opportunities for renewable energy producers to obtain grid connections, hindering the actual supply and use of renewable energy.[46]

**Recommendations**

**2.2a. Review the current first-come, first-served system and increase grid-loading capacity**

Major industry groups such as the Japan Association of Corporate Executives have advocated that the Government should consider the review of the current "first-come, first-served" regime and increase grid loading capacity to improve renewable energy procurement in Japan[47]. This would enable renewable energy suppliers to provide power on the grid and further the decarbonization of the Japanese energy ecosystem.

## 2.3 Transition from Feed-in Tariffs (FIT) to Feed-in Premium (FIP) and its impact on renewable energy price

The Japanese government implemented the FIT scheme in 2012, under which electric power companies purchase electricity generated by renewable at a certain price for a designated time to secure the profit predictability for the generators. Energy retail companies collect the purchasing costs as a levy from electricity users. All energy consumers in Japan have been paying in proportion to their electricity consumption a renewable energy levy as part of their electricity bill to subsidize the FIT-enabled renewable power projects. In the past years, the unit cost of the renewable energy levy has increased steadily from JPY0.22 /kW hour in 2012 to JPY2.98 /kWh in 2020.

Under the current scheme, there is no levy exemption for renewable energy from non-FIT resources, which significantly reduces corporate consumers' appetite for non-FIT renewable energy. When corporates purchase power from the non-FIT scheme, their off-take agreement of electricity enables the development and construction of the renewable energy project, at no cost to individual consumers or taxpayers. As such, projects do not rely on subsidies from the FIT levy. Exempting non-FIT renewable energy from paying the FIT levy can foster a fair market environment.

In 2022, Japan will gradually shift from the FIT to a FIP scheme[48]. FIP provides renewable energy suppliers with a markup on the wholesale market price to compensate for the difference between predefined reference tariffs and fluctuating market prices. In Japan, an increasing number of corporate consumers are seeking to purchase renewable energy. Nonetheless, in the case where the predefined reference price is higher than market rates, renewable energy suppliers would have little incentive to sell their products outside the FIP scheme.

**Recommendations**

**2.3a. Maintain FIP reference price close to market rates**

Industry groups such as the American Chamber of Commerce in Japan advocated for maintaining the FIP reference price as close as possible to wholesale market rates. This will help incentivize renewable energy suppliers to pursue corporate PPAs and encourage corporate consumers to invest in renewable energies. Globally corporate PPA has been the most significant driver for increasing supply and lowering the cost of renewable energy.[49] The total contract volume was equivalent to more than 10 percent of all the renewable energy capacity added globally in 2019.[50]

**2.3b. Exempt non-FIT renewable energy from paying the FIT levy**

Major industry groups including the American Chamber of Commerce in Japan have called for exempting non-FIT renewable energy consumption from the FIT levy scheme. This can effectively support the price-attractiveness of corporate PPAs and can encourage corporate energy users to include non-FIT renewable energy in their energy sourcing mix.

## 2.4 Current policy framework for corporate PPA

In advanced countries in Europe and North America, corporate consumers can source renewable energy and receive renewable energy certificates (RECs) directly from a generator to attest their renewable energy use.

According to the Japanese Non-Fossil Fuel Energy Promotion Act and the Electricity Business Act, energy retail companies are the sole party allowed to source electricity from power generators. Energy users cannot do so without first contracting with an energy retail company (except onsite PPAs). Only energy retailers can obtain Non-Fossil Fuel Certificates (NFCs) directly from Japan Electric Power Exchange (JEPX) market, with consumers not being provided with the possibility to do so. Under the current policy framework, corporate energy users cannot sign offsite corporate PPAs directly with a power generator for electricity and related renewable energy attribute certificates. This increases the complexity and cost of purchasing non-FIT renewable energy.

**Recommendations**

**2.4a. Enable consumers contracting via PPA to directly source renewable energy from energy generators and ensure the bilateral transferability of non-FIT non-fossil fuel certificates (NFCs)**

Some industry groups such as the American Chamber of Commerce in Japan have called on the government to diversify and simplify ways of procuring renewable electricity. For example, ACCJ is calling for direct power purchase agreements (PPAs) between power generators and energy consumers.[51] They have also advocated that bundled NFCs should be transferable from generators to consumers.

This will simplify the contracting procedures and enable consumers to more easily purchase renewable energy that meets their requirements. It will also help them reduce renewable electricity costs with no additional payment for power trading through the retailing market. Thus, direct PPAs between generators and consumers will support the cost-competitiveness of renewable energy and help make PPAs key drivers in the expansion of the Japanese renewable energy market.

## 2.5 Non-Fossil Fuel Energy Promotion Act and NFCs

The Non-Fossil Fuel Energy Promotion Act stipulates that by FY2030, 44 percent of electricity sold should be generated from non-fossil energy sources. Concurrently, the government introduced NFCs in 2018 to help monitor retailers' sales of electricity generated using renewable sources.

Also, METI launched 2019 a pilot project aiming to support the implementation of a national tracking system for NFCs collecting information on the source of the electricity supplied on the grid. The tracking system takes into consideration power generation equipment, certification date, generator locations, and more.[52] Nonetheless, the tracking system does not collect information on electricity produced by non-FIT renewable energies.

### Recommendations

**2.5a. Include electricity from non-FIT resources in the renewable energy attribute tracking system**

Some industry groups such as JCJP , are calling on Japan to establish a national tracking system for all renewable electricity.[53] The tracking system should cover renewable electricity purchased from non-FIT resources. This would enable corporate customers to make effective statements on renewable energy use while purchasing the NFCs from non-FIT resources.

**2.5b. Allow renewable energy consumers to purchase unbundled NFCs from energy generators and retailers**

ACCJ is asking that the government should allow for trading unbundled NFCs. The flexibility provided by these types of NFCs would support market competitiveness and drive down costs given consumers' ability to source such certificates at the national level. This will increase corporate appetite for such NFCs and create a virtuous cycle for the growth of the renewable energy market in Japan.

# Conclusion

As we have seen in this whitepaper, the Japanese government has set out in the right direction to encourage a shift to the cloud and create a knock-on effect for the private sector. Nonetheless, an ambitious plan with tighter implementation targets can truly propel Japan to be a leader for cloud adoption in the APAC region.

Moreover, as cloud technology provides numerous environmental benefits in addition to technical and business advantages over traditional forms of on-premises computing, the Japanese government should publicly highlight the consistency of cloud migration with Japan's net-zero carbon goal, as well as ensure that any policies or incentives associated with promoting energy efficiency upgrades and decarbonization for public and private sector customers enable cloud service providers to compete on an equal playing field with traditional on-premises mainframe providers.

As the environmental benefits of shifting to cloud technology are amplified when cloud operators can power their operations with 100% renewable energy, the Japanese government should take into consideration the proposals made by various industry groups in Japan to promote the accessibility of renewable energy and decarbonize Japan's power grid.

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