Executive Summary

To achieve net-zero emissions by 2050, it is essential to strengthen measures to tackle climate change, ensure a stable supply of energy, and realize a just transition. Decarbonization of the power sector is especially crucial. It is a sector that can accommodate a rapid shift thanks to falling costs of solar and wind power, and decarbonization of the power sector can have ripple effects on other sectors.

The Clean Energy scenario developed by Lawrence Berkeley National Lab shows that it is possible for Japan to decarbonize 90% of its power sector and reduce electricity costs by 2035, through a massive shift to solar and wind. To realize this shift, the government would need to overhaul its energy policies and significantly strengthen and/or change policy measures. In this report, we present three key elements for a national vision and seven policy measures that are essential if Japan is to achieve the Clean Energy scenario.

National vision

1. A grand design centered on a shift to renewables

To align Japan's climate change policy with the 1.5℃ goal of the Paris Agreement and the 2050 net-zero emissions target and make the policy cost-effective, Japan needs to develop a grand design and a roadmap to supply the electricity sector with 100% renewable energy, then devise industrial policies and select technologies accordingly. Formulation of such a grand design should be coordinated by the Cabinet Office with the aim of policy integration among the many government ministries and agencies, while ensuring citizen participation in decision-making processes.

2. Ambitious targets and policy review

Given that the United Nations is calling for more ambitious targets for 2030 and that Japan has great wind and solar potential, Japan needs to strengthen its 2030 targets for GHG emission reductions and share of renewable energy. It should aim to increase the share of renewable electricity in the power generation mix to 50% or higher by 2030, and 85% or higher by 2040, with a lofty goal of 100% renewables by 2040. Policy targets should include a phase out of coal-fired power. Such a phase out is essential to realize the Clean Energy scenario. There also needs to be a staged reduction of gas-fired power generation, and a ban on new construction of gas-fired power plants. As they are not aligned with the Paris Agreement and are not economically justifiable, hydrogen and ammonia co-firing should not be promoted, and existing nuclear power should not be replaced. Instead, the government should aim to achieve 100% renewables.

3. National strategies for a just transition

A dramatic shift to renewables in the electricity system would mean the downsizing of the fossil fuel and nuclear power industries and a massive expansion of renewables-related industries. In formulating national strategies, the government needs to place an emphasis on policies for a just transition for workers and a transformation of industrial structure. The government should support consensus-building with stakeholders to assess impacts on the local economy and employment, formulate support measures, and create new industries in affected regions, and should also provide fiscal measures for a just transition.

Policy measures

1. Making carbon pricing more effective

Japan's Tax for Climate Change Mitigation has been set at low levels. The government plans to introduce full-scale emissions trading in fiscal year (FY) 2026, auctioning of emissions from power plants in FY2033, and carbon emissions surcharges in FY2028, and plans to use revenues from these measures for the redemption of "GX Economy Transition Bonds." We recommend that the government set the target price of at least 6,000 yen/ton (CO_2 equivalent), and accelerate plans for staged increases to reach that level, which is necessary to achieve the Clean Energy scenario. When introducing carbon pricing policies, Japan should implement a carbon tax, rather than surcharges (which lack public oversight through deliberation in parliament). Revenues from carbon pricing need to be decided in a fair, transparent way, and the majority should be redistributed through measures such as direct dividend and reductions in social security taxes.

2. Expanding renewable energy in ways that benefit communities

Renewables are a distributed energy source that can be developed and utilized by regional communities. However, many local governments in Japan have introduced ordinances to rein in solar and wind developments, in response to opposition to inappropriate projects. It is important to notify and engage in dialogue with local residents at an early stage of proposed renewables projects, in order to build consensus and facilitate the massive expansion

of renewable energy. The government should ensure that full information is available to the public and that local residents are part of the development process. It should also build frameworks for central-government-led zoning to promote renewables, and schemes for circulating benefits and revenues within the community, and support community-led power generation projects.

3. Enhancing flexibility in Japan's power system

Due to the variability of solar and wind output, a flexible electricity system is a prerequisite for a massive expansion in renewable energy. To better manage electricity supply and demand, the government needs to update its current curtailment rules to a new framework that prioritizes electricity sources that make economic sense. Japan's power grid needs physical upgrades, and there is a need to improve the management of existing transmission lines with rule changes and technologies. Japan should also improve the ability to further control demand and supply by integrating measures and technologies such as output adjustment, cross-region transmission, demand response, power storage and sector coupling.

4. Redesigning power markets to encourage fair competition

Japan has several electricity markets, and their increasing complexity calls for a better environment for new entrants to trade electricity under fair conditions. The types of "long-term decarbonized electricity" to be auctioned on the capacity market include co-firing with fossil-fuel-derived hydrogen and ammonia, as well as liquefied natural gas (LNG) power (newly built). The government should reconsider its plan to introduce a long-term decarbonized electricity auction, and instead redesign the mechanism to secure capacity. It should redesign the power market to be fairer by starting discussions about unbundling the sales and generation units of Japan's ten major utilities, increasing trading volumes on the spot market, and introducing negative pricing.

5. Boosting offshore wind development

Offshore wind power generation must expand if Japan is to shift to renewables. To do so, Japan needs to set ambitious targets for floating offshore wind, accelerate grid development to connect regions that have abundant wind resources with areas that have high electricity demand, and adopt a centralized approach as soon as possible for government engagement with local communities. The country also needs to develop domestic supply chains and offshore wind ports, and attract energy-intensive industries to offshore wind power producing regions. Policy work across multiple ministries should be better consolidated in order to expedite procedures and boost efficiency.

6. Improving energy efficiency

Energy saving and efficiency are as important as production, and they both contribute to decarbonization. The Energy Efficiency Act and the Building Energy Efficiency Act were enacted to reduce users' energy intensity, with a focus on mandatory reporting, but more effective measures are needed. Carbon pricing is an effective way to boost energy efficiency in society and the economy as a whole. Additional measures and better implementation are needed to improve energy efficiency in the industrial, building, and transportation sectors.

7. Using fiscal measures to support the energy shift

Multiple government ministries and agencies have budgets relating to decarbonization, and subsidies are available for technology development through the Green Innovation Fund. Based on estimates that Japan's decarbonization efforts will require 150 trillion yen in public and private investment over the next decade, the government plans to issue 20 trillion yen in "GX Economy Transition Bonds." All these measures should be cost effective and aligned with the Paris Agreement. The government should take both of those criteria into account to assess each budget request and fiscal expenditure. Fiscal support for a just transition and climate tech should also be provided.

To realize the Clean Energy scenario presented by Berkeley Lab, Japan would need to swiftly implement the policy measures summarized above. It is our hope that this report will contribute to the implementation of policy changes by policymakers and civil society.

Decarbonizing Japan's Electricity System Policy Change to Trigger a Shift

Climate Integrate

10 Recommendations

Vision 1 Grand Design

Grand Design
- 1.5℃ aligned design
- Industrial policies
- Cost-effective technologies

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Measures
- Intra-agency coordination
- Citizen-participation
- Clear roles for national, subnational governments
- Budget and fiscal measures

Vision 2 Ambitious Targets

Ambitious Targets
- GHG reductions & renewables targets
- 5-year target cycle
- Sectoral targets

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Policy Review
- Coal-fired power: phaseout
- Gas-fired power: ban on new construction
- Hydrogen & ammonia: reconsideration of policies
- Nuclear: ban on new construction

Vision 3 Just Transition Strategies

National Strategies
- Impact analysis
- Support for affected areas and workers
- Creation of green industries

Dialogue
- Consensus building among stakeholders

Financial Support

Proposal 1 Effective Carbon Pricing

Implementing Carbon Pricing Schemes → **Incentives for Energy Efficiency, Renewables**

- Higher prices
- Fair and transparent use of revenues
- Carbon dividends, support for just transition

Proposal 2 Renewables for Communities

Utility-scale Solar, Wind Power × **Rooftop Solar, Micro Hydro**

- Information disclosure, community participation
- Zoning
- Community-led power projects

Proposal 3 Flexibility in Power System

- Market Mechanism
- Grid Management
- Grid Flexibility
- Sector Coupling

Proposal 4 Redesigning Power Market

- Capacity Market Reform
- Separation of Generation and Retail Units
- Fair Burden Sharing
- Trading on the Spot Market
- Negative Pricing

Proposal 5 Boosting Offshore Wind

- Floating Offshore Wind Target
- Transmission Lines
- Centralized System
- Domestic Procurement
- Port Development
- Local Electricity Consumption
- Centralized Tasks and Duties

Proposal 6 Energy Efficiency

Industries
- Review of energy efficiency standards
- Emissions trading scheme and carbon tax
- Energy saving consultants

Buildings
- Tougher standards
- Mandatory PV for new buildings
- PV, insulation for existing buildings

Transportation
- 2035: new gasoline-powered car sales end
- Bikeable, walkable communities
- Efficient freight transport

Proposal 7 Fiscal Measures

- Paris-aligned, Cost-benefit Analysis
- Just Transition Support
- Investment in Climate Tech