

- Toward two ambitious goals, namely, carbon neutrality by 2050 and GHG reduction by 46% in FY2030, future directions have been stipulated in the Green Growth Strategy, the Strategic Energy Plan, the Plan for Global Warming Countermeasures, and the Long-Term Strategy under the Paris Agreement.
- The Clean Energy Strategy will show a practical roadmap for each industry that is expected to grow and organize policy responses to energy transition on the demand side, clean-energy-based transition in the economy, society and the industrial structure, as well as decarbonization of local communities and people's lives.
- It will also discuss ensuring energy security and organize responses to decarbonization taking into consideration the recent Russian invasion of Ukraine and the tightening supply/demand of electricity.

Chapter 1 Ensuring Energy Security

Responses to the crisis in Ukraine and tight supply/demand of electricity

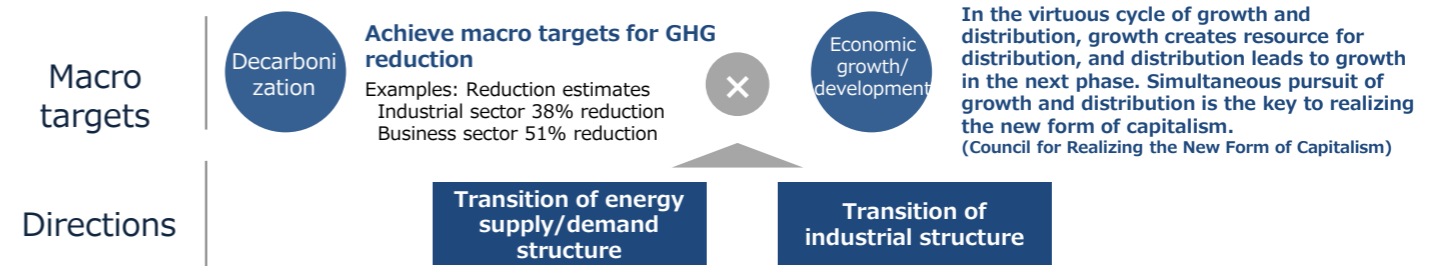
- Following the Russian invasion of Ukraine, G7 countries are taking coordinated action to strengthen sanctions against Russia. G7 countries have committed to reducing their reliance on Russian energy by measures such as phasing out or banning imports of Russian coal and oil.
- On March 22, an alert for tightening supply/demand conditions of electricity was issued for the first time in the Tokyo and Tohoku Electric Companies' service areas. It is urgently necessary to review the incident and address challenges such as securing proper supply ability and reinforcing power networks.
- Toward a short-term transition away from the reliance on Russia and a mid-to-long-term transition to decarbonization, a stable supply of energy must be secured, and on the basis of it, efforts toward decarbonization will be accelerated through maximizing utilization of power sources with high effects for energy security and decarbonization such as renewable energy and nuclear power.

Future directions of energy policy

Resources Fuels	<ul style="list-style-type: none"> •Reduce dependence on Russia for fossil fuel •Reinforce fuel supply system •Ensure stable supply of rare metals •Promote technological development toward commercialization of methane hydrate, and secure resources off the domestic coasts
Stable supply of electricity	<ul style="list-style-type: none"> •Secure supply ability in response to risks •Market development for securing power sources •Effective responses on the demand side in tight supply/demand conditions
Energy efficiency/ Conversion	<ul style="list-style-type: none"> •Promote investment in energy efficiency/conservation •High-efficiency heat utilization and decarbonization in heat pumps and other equipment •Impose stringent regulations on energy efficiency/conservation in houses and buildings •Promote electrified vehicles and related infrastructure
Nuclear	<ul style="list-style-type: none"> •Promote restarting •Measures for back-end •Enhance R&D and industrial infrastructure
Renewable energy	<ul style="list-style-type: none"> •Efforts toward maximum introduction of renewable energy •Reinforce inter-regional connecting lines •Sophisticate system operations through digitalization •Promote batteries/Demand Response
Hydrogen/ Ammonia	<ul style="list-style-type: none"> •Build large-scale supply chains •Provide support based on cost differentials with conventional fuels and infrastructure development
Ports	<ul style="list-style-type: none"> •Promote building carbon-neutral industrial complex ports
CCUS	<ul style="list-style-type: none"> •Develop business environment (legislation to promote, public support policy) toward commercialization of CCS by 2030, and promote technological development and commercialization of Carbon Recycling

Chapter 2 Reforms of the economy, society and industrial structure toward a carbon neutral society

- It is necessary to promote growth and development of Japan's economy while pursuing decarbonization. It is important to change not only the energy supply/demand structure, but also the industrial structure in a drastic manner.



Section 1 Industrial GX starting from energy

- Toward carbon neutrality by 2050, it is important to closely monitor supply and demand of decarbonization measures as well as competition/complementarity between them. In doing so, the following factors should be taken into account: the domestic and overseas business environments (such as domestic infrastructure constraints, capital investment, and regulations at home and abroad) and market sizes for individual industries at home and abroad.
- In order to survive the severe international competition in the clean energy sector, large-scale investment is to be brought into the fields with high potential such as hydrogen/ammonia by increasing predictability.

Hydrogen/ammonia

- Toward building supply chains, and rapid expansion and commercialization, a detailed study will be conducted to advance support measures based on cost differentials with conventional fuels in terms of production, transportation and storage together with development of common infrastructures such as storage tanks and pipelines.
- Advance new synthetic technologies for hydrogen/ammonia, demonstration of hydrogen utilization in power generation, infrastructure development in the transport sector, and technological development and demonstration for ammonia co-firing and single firing burners.

Offshore wind power

- Create and foster domestic demand by formulating a vision for offshore wind power to attract investment as well as accelerating project materialization.
- Promote international collaboration and standardization for acquiring overseas markets.

Batteries

- Reinforce production capacity for liquid LiBs and again expand our presence in overseas markets, with the goal of securing 600 GWh of annual manufacturing capacity in the global market by 2030 for Japanese companies as a whole; by around 2030, put all-solid-state batteries into commercialization and maintain and secure Japan's position as a technology leader.
- In the domestic market, expand the manufacturing capacity of batteries and develop the infrastructure for the diffusion of stationary energy storage systems, with the goal of establishing a domestic annual manufacturing base of 150 GWh of batteries and materials by 2030.

Nuclear power

- Provide support to maintain **supply chains, technologies and human resources** by ensuring continuity of technologies and services that are becoming critically difficult to obtain, as well as making use of digital technology.
- Provide support to create business opportunities for suppliers by **acquiring international standards for innovative reactors** such as high-temperature gas-cooled reactors and fast reactors, forming **a strategic team** for suppliers to participate effectively in international projects, acquiring **accreditation of international standards**, and offering **project matching with overseas companies**.

Carbon Recycling

- Toward early **establishment of separation and collection technology for CO2 with low density (10% or less)** at gas-fired thermal power plants and factories, promote **development of innovative materials and demonstration of system technology** that enable low energy separation and collection.
- Regarding concrete production using CO2 and decarbonization of cement production processes, efforts will be made toward **cost reduction** with technological development, **expansion of sales channels in Japan and overseas through licensing business**, and **clarification of value added** through **domestic/international standardization and guidelines**.
- Toward further dissemination of **SAF, E-methane, synthetic fuels and green LPG**, development of **manufacturing technology, creation of supply chains, and development of necessary environment** will be advanced.
- Establish the social foundation for **resource circulation** in order to **disseminate carbon-recycled plastics**
- In **bio-manufacturing**, the **source of value added** will be secured by fostering players with platform technology at each phase of the value chain.

Steelmaking

- **Development and social implementation of innovative technologies** such as hydrogen-reduction steelmaking will be accelerated. **Investment will be promoted** in energy efficiency and electrification **leading to energy transformation in the steelmaking process** while controlling operational expenditure.

Automobile

- **Range of pathways will be pursued** aiming to achieve 100% of new passenger vehicle sales being electrically driven by 2035. Efforts will be promoted toward transition of energy structure such as building **large-scale manufacturing bases for batteries** in domestic locations, providing **support for purchases of electrified vehicles and infrastructure development**, and providing **support for small, medium, and micro-sized suppliers, etc. to embark on aggressive business transformation**.
- Promote **transition finance**, disseminate **hydrogen/CR fuels**, **decarbonize heat processes** and **reduce CO2 in stock**.

Transport

- Toward achieving **carbon neutrality by 2050 in international shipping**, support will be provided to **R&D for zero-emission ships** using hydrogen/ammonia as a fuel and **preparation of domestic production bases** for dissemination of these ships, and Japan will **lead the discussions at the IMO**.
- SAF will account for 10% of all aviation fuels in 2030. Development and introduction of new technologies related to decarbonization including **the core technologies necessary to realize hydrogen aircraft** will be promoted.
- **Introduction of renewable energy** will be promoted by **utilizing railway assets and collaboration with areas along the railway line**. **Development and introduction of fuel-cell railway vehicles** will also be promoted.

Houses/buildings, Infrastructure

- Regulations will be strengthened toward **securing energy efficiency (ZEB/ZEH standards) of houses/buildings** to be built in and after 2030.
- Toward creating **carbon-neutral ports**, demonstration projects will be advanced for introducing new technology.
- Energy efficiency will be increased by using **innovative construction equipment**. Utilization of **construction materials conducive to less CO2 emissions** will be promoted in public projects.

Food/agriculture, forestry and fisheries

- Based on a **strategy for sustainable food systems, MeaDRI**, we will promote the transformation of food systems from **procurement through to production, processing, distribution and consumption** and create new markets domestically and internationally through sustainable food production and consumption, which will lead to a new form of international collaborations from Japan.

CCS

- **Business environment legislation to promote CCS and public support policy will be developed toward starting CCS businesses** by 2030.

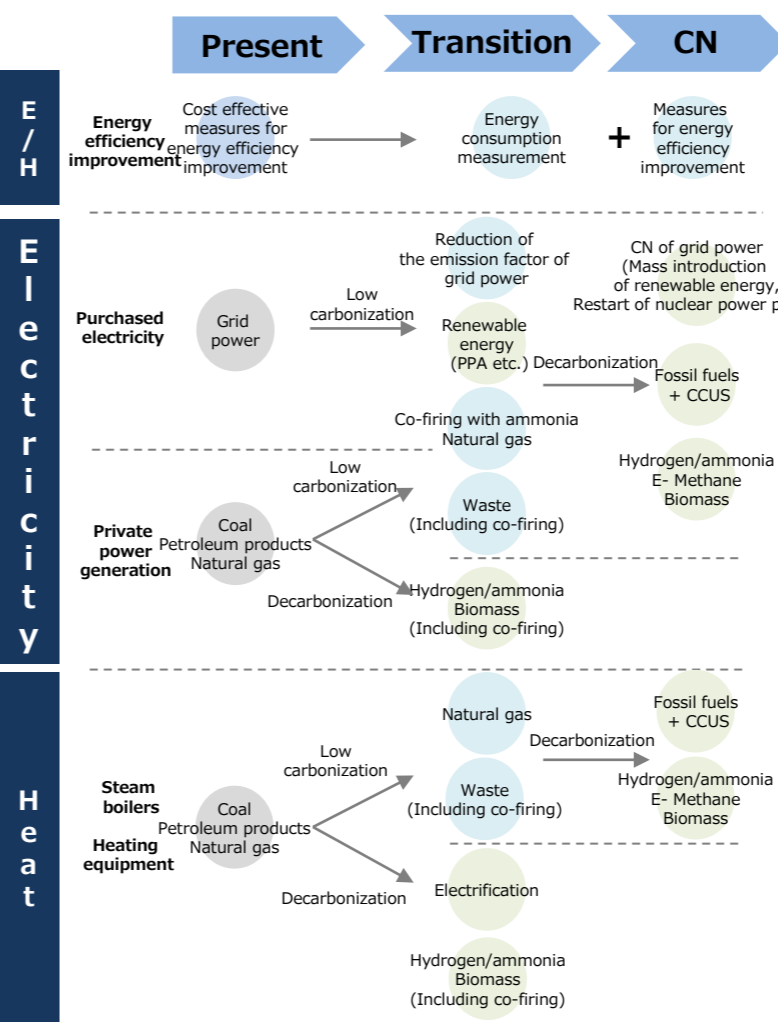
Negative emissions

- R&D will be promoted toward lowering costs and improving energy efficiency. **Initial demand creation** will be undertaken toward industrialization. Introduction will be expanded in the voluntary carbon credit market.

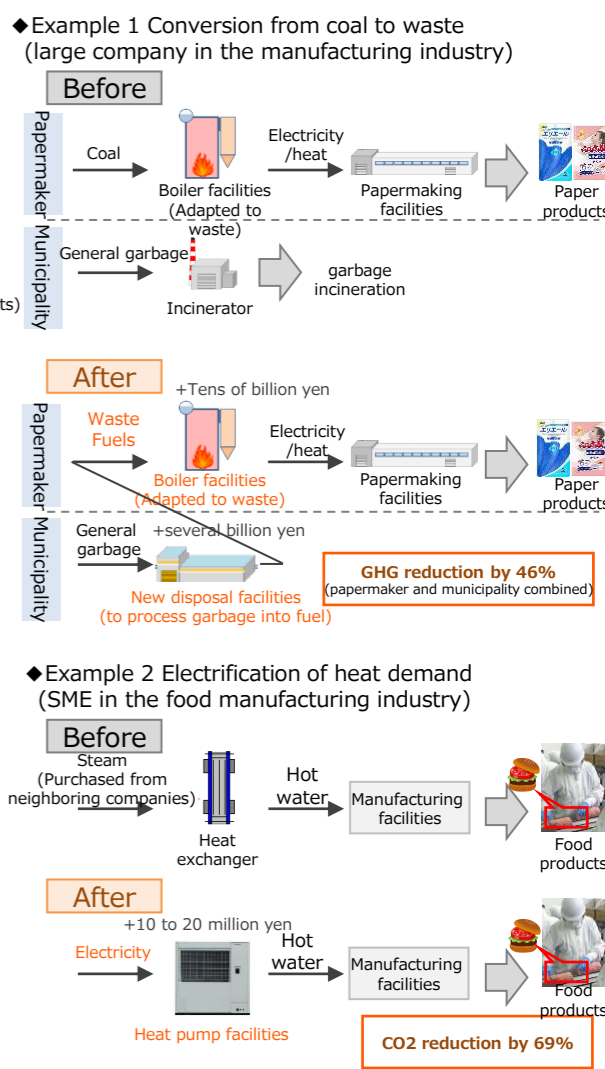
Section 2 Transition of energy supply/demand structure in industry

- **The principle shared by all sectors** is to pursue thorough **energy efficiency improvement** and follow a direction toward **energy consumption without CO2 emission**. However, there are different paths to carbon neutrality for companies depending on **available technologies** and **their positions in the supply chain**. It is necessary for companies to **advance investment with a proper transition path** developed based on their own circumstances.
- Regarding SMEs, in order to **visualize GHG emissions** and **promote investment** toward carbon neutrality, push-type support will be provided while promoting human resource development by local financial institutions and SME associations.

Energy transition to carbon neutrality (CN)



Examples of decarbonization efforts



Section 3 Efforts toward decarbonization in local communities and daily living

- Transition to decarbonization in local communities should be **promoted in a timely manner in view of the progress in transition of the economy and society as well as energy infrastructure**. **Proactive efforts by stakeholders** such as local municipalities will be encouraged.
- Maximum **utilization of unique local resources** such as renewable energy will be promoted in order to **circulate local economies**. Those efforts will be advanced on a win-win basis contributing to **disaster prevention** and **improvement of quality of life**.
- **Consumer consciousness and behavior also need to be changed**. Reforms of economy and society will be promoted by **expanding demand for products and services conducive to decarbonization**.
- Development of **resource circulation-related industries**, mitigation of negative impacts on **biodiversity** and **adaptation to climate change** should be pursued together with **decarbonization**, contributing to transition to carbon-neutral economy and society.

Chapter4 Efforts toward development of a social system and infrastructure to achieve GX

- Transition to carbon-neutral society where mainly clean energy will be used demands a drastic change in the economy, society and industrial structure, which have been heavily dependent on fossil fuels since the Industrial Revolution. Hence, the **transition requires large-scale investment**. The strategy consists of the following two basic concepts. The policy skeleton will be comprised of the following 5 pillars, which are to be embodied toward the end of this year under the concepts of **maximum utilization of pro-growth carbon pricing and utilization of investment promotion measures that are based on a combination of regulation and support** including a roadmap to improve investment predictability.

GX realization

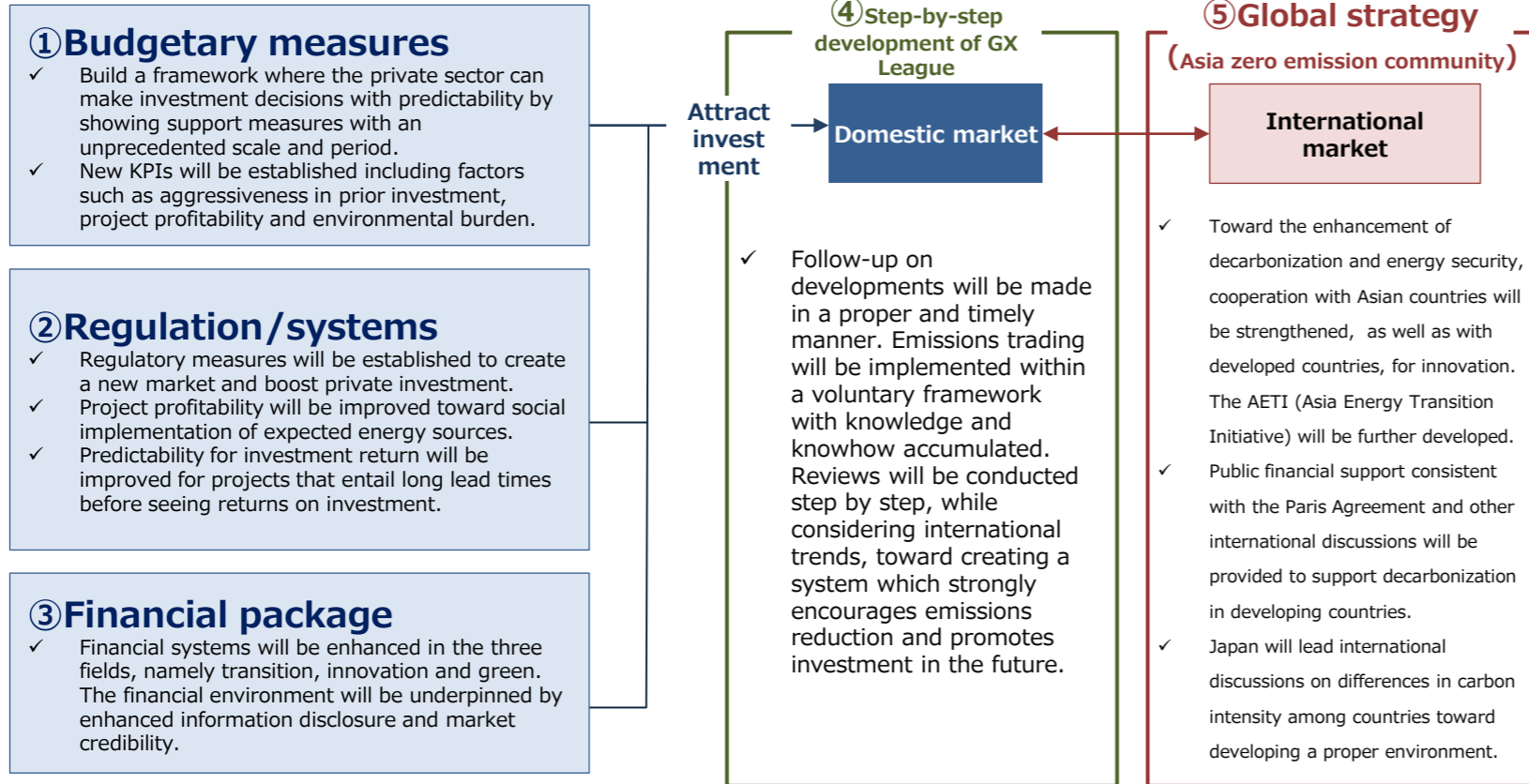


Investment required for decarbonization

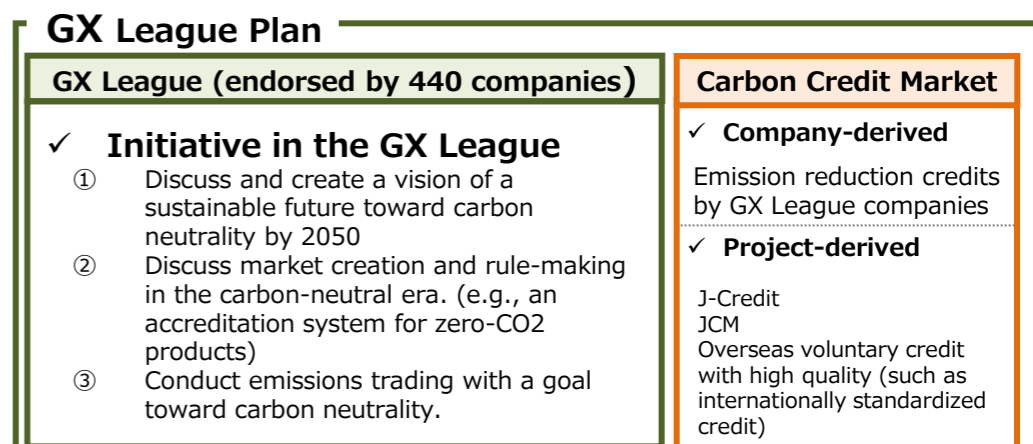
- Investments related to decarbonization in major sectors are calculated on certain assumptions. As a result, investment required to achieve carbon neutrality by 2050 is estimated to be 17 trillion yen in 2030 alone, totaling 150 trillion yen over the coming 10 years.

Decarbonization investment	17 trillion yen /year	➔ 150 trillion yen over 10 years	
			Trillion yen
Decarbonization of power sources /fuel transition	5 trillion yen	✓ Renewable energy ✓ Hydrogen/ammonia ✓ Manufacturing batteries	2.0
			0.3
Decarbonization of manufacturing processes	2 trillion yen	✓ Energy efficiency improvement/decarbonization in manufacturing processes ✓ Introduction of industrial heat pumps and co-generation systems	1.4
			0.5
End use	4 trillion yen	✓ Introduction of houses/buildings with high energy efficiency ✓ Introduction of next-generation automobiles	1.8
			1.8
Infrastructure	4 trillion yen	✓ Reinforcement of power systems ✓ Development of infrastructure for electrified vehicles ✓ Measures to address digitalization	0.5
			0.2
			3.5
R&D	2 trillion yen	✓ Carbon Recycling ✓ Development of manufacturing processes conducive to carbon neutrality ✓ Nuclear power ✓ Implementation of leading-edge CCS projects	0.5
			0.1
			0.1
			0.6

5 pillars



(Reference) Step-by-step development of the GX League



Step-by-step development of the GX League: Possible points of discussion

- How to conduct emissions trading
- How to expand further endorsement, especially by large emitters
- How to establish a more ambitious goal and attract investment toward reducing emissions
- How to create GX markets (such as initial demand) (considering the status of implementation by companies)
- How to expand the trading volume, create and expand carbon absorption/removal credits while properly addressing international discussions regarding carbon pricing and overseas trends in carbon credit.

Common bases



Development of social systems and infrastructure toward realization