### 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.

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

**Macro targets**

<table>
<thead>
<tr>
<th>Decarbonization</th>
<th>Achieve macro targets for GHG reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examples: Reduction estimates</td>
<td>Industrial sector 30% reduction Business sector 51% reduction</td>
</tr>
</tbody>
</table>

**Economic growth and development**

- In the virtuous cycle of growth and distribution, growth creates resource for distribution, and distribution leads to growth in the next phase. Simultaneous pursuit of growth and distribution is the key to realizing the new form of capitalism. (Council for Realizing the New Form of Capitalism)

**Directions**

- Transition of energy supply/demand structure
- Transition of industrial structure

### Section 1 Industrial GX starting from energy

**Toward carbon neutrality by 2050, it is important to closely monitor supply and demand reduction 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 investments are 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 demand 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.
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)

<table>
<thead>
<tr>
<th>Present</th>
<th>Transition</th>
<th>CN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy efficiency improvement</td>
<td>Measures for energy efficiency improvement</td>
<td>CN of grid power (Max. introduction of renewable energy, Restart of nuclear power plants)</td>
</tr>
<tr>
<td>Gas</td>
<td></td>
<td>Co-firing with ammonia, Natural gas</td>
</tr>
<tr>
<td>Coal</td>
<td>Fossil fuels + CCS</td>
<td>Decarbonization</td>
</tr>
<tr>
<td>Oil</td>
<td>Waste (Including co-firing)</td>
<td>Decarbonization</td>
</tr>
<tr>
<td>Nuclear</td>
<td>Hydrogen/ammonia</td>
<td>Hydrogen/ammonia &amp; E-Methane Biomass</td>
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</table>
| Energy transition to carbon neutrality (CN)

Examples of decarbonization efforts

- Example 1 Conversion from coal to waste (large company in the manufacturing industry)

- Example 2 Electrification of heat demand (SME in the food manufacturing industry)

<table>
<thead>
<tr>
<th>E/H</th>
<th>Electric</th>
<th>Heat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>After</td>
<td>After</td>
</tr>
<tr>
<td>Coal</td>
<td>Electricity (Heat)</td>
<td>General garbage</td>
</tr>
<tr>
<td>Boiler facilities (Adapted to waste)</td>
<td>Incinerator</td>
<td>Garbage incineration</td>
</tr>
<tr>
<td>Papermaking facilities</td>
<td>Power generation facility</td>
<td>Paper products</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste (Adapted to waste)</td>
<td>+ 10 to 20 million yen</td>
<td>Manufacturing facilities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Food products</td>
</tr>
<tr>
<td>General garbage (Adapted to waste)</td>
<td>+ several billion yen</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste (Adapted to waste)</td>
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</table>

- Example 1 Conversion from coal to waste (large company in the manufacturing industry)

- Example 2 Electrification of heat demand (SME in the food manufacturing industry)

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.

Houses/buildings, Infrastructure

- Regulations will be strengthened toward securing energy efficiency (ZEH/ZEH standards) of houses/buildings to be built in any new construction.
- 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 conductive to less CO2 emissions will be promoted in public projects.

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.

Automobile

- Range of pathways will be pursued aiming to achieve 100% of new passenger vehicle sales being electrified 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.

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.

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.

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.

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.

CCS

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

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.

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.
Chapter 4: 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.

### 5 pillars

1. **Budgetary measures**
   - Build a framework where the private sector can make investment decisions with predictability by showing support measures with an unprecedented scale and period.
   - New KPIs will be established including factors such as aggressiveness in prior investment, project profitability and environmental burden.

2. **Regulation/systems**
   - Regulatory measures will be established to promote a new market and boost private investment.
   - Project profitability will be improved toward social implementation of expected energy sources.
   - Predictability for investment return will be improved for projects that entail long lead times before seeing returns on investment.

3. **Financial package**
   - Financial systems will be enhanced in the three fields, namely transition, innovation and green. The financial environment will be underpinned by enhanced information disclosure and market credibility.

### Common bases

- Development of Environment toward digitalization
  - The following two measures will be implemented in tandem toward development of an environment for digitalization:
    1. Establishment of social structure with digital implementation
    2. R&D to accelerate digitalization

- Creation of innovation and its implementation
  - R&D will be advanced in new areas where R&D shows little progress.
  - Diversification of players for social implementation by involving start-ups. A framework for creating initial demand will be established. Support will be provided toward international rule-making.
  - Ecosystems in academia will be formed to create excellent seeds.

- Training of working people and researchers, elementary and secondary education
  - Educational opportunities regarding energy and environment will be provided seamlessly in elementary, secondary and higher education with recurrent education also enriched.
  - Support will be provided to joint research by young researchers and companies. Efforts will be made to improve the treatment of researchers employed by companies.

- Decarbonization efforts in local communities and daily living as well as resource circulation
  - Pioneering efforts will be deepened and accelerated. Efforts will be made for human resource investment to promote local community-led transition to decarbonization and decarbonization in local communities.
  - A positive cycle of decarbonization and economic growth will be realized by increasing the demand for products and services with values added that are conducive to decarbonization, through consumers’ preferences.

### 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.

#### GX League Plan

- **Initiative in the GX League**
  1. Discuss and create a vision of a sustainable future toward carbon neutrality by 2050.
  2. Discuss market creation and rule-making in the carbon-neutral era. (e.g., an accreditation system for zero-CO₂ products)
  3. Conduct emissions trading with a goal toward carbon neutrality.

#### Carbon Credit Market

- **Company-derived**
  - Emission reduction credits by GX League companies

- **Project-derived**
  - J-Credit
    - 3CM

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

- **Decarbonization investment**
  - 17 trillion yen /year
  - 150 trillion yen over 10 years

- **Decarbonization of power sources /fuel transition**
  - 5 trillion yen

- **Decarbonization of manufacturing processes**
  - 2 trillion yen

- **End use**
  - 4 trillion yen

- **Infrastructure**
  - 4 trillion yen

- **R&D**
  - 2 trillion yen

- **Development of infrastructure for electrified end use**
  - Reinforcement of power systems
  - Development of infrastructure for electrified vehicles
  - Measures to address digitalization
  - Carbon Recycling
  - Development of manufacturing processes conducive to carbon neutrality
  - Nuclear power
  - Implementation of leading-edge CCS projects

- **Decarbonization of carbon neutrality**
  - Energy efficiency improvement/decarbonization in industrial processes
  - Introduction of industrial heat pumps and co-generation systems
  - Introduction of houses/buildings with high energy efficiency

- **Decarbonization in transportation**
  - Introduction of edge CCS projects
  - Development of infrastructure for electrified vehicles
  - Measures to address digitalization