

The Kansai Electric Power Group
Zero Carbon Roadmap

March 25, 2022

The Kansai Electric Power Co., Inc.



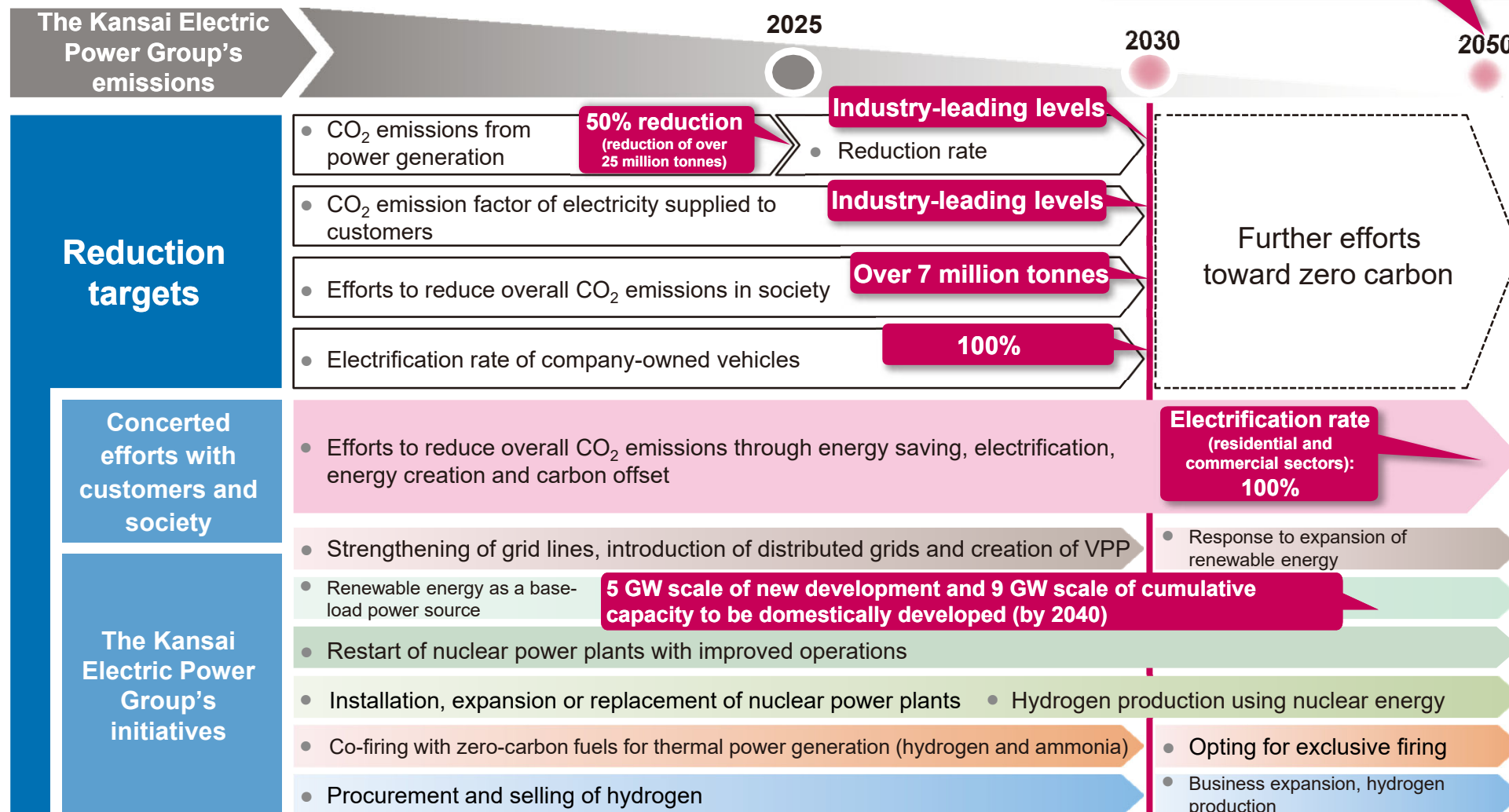
Take action together toward zero carbon.

The Kansai Electric Power Group is committed to helping society achieve zero carbon in addition to making its operations carbon-free. This involves cooperation with all stakeholders, including customers, business partners and municipalities. We, therefore, have developed the Zero Carbon Roadmap with our commitment represented in the slogan “Take action together toward zero carbon.”

Roadmap overview

- The Zero Carbon Roadmap sets the course toward Zero Carbon Vision 2050.*1

Zero CO₂ emissions from business activities*2



*1 The vision's three key approaches (on the demand, supply and hydrogen sides) are divided into two categories: concerted efforts with customers and society, and the Kansai Electric Power Group's initiatives (including on hydrogen).

*2 The roadmap will be revised in response to technological advancement and changes in policies and regulations to ultimately eliminate CO₂ emissions from business activities (including those of affiliates).

Reduction targets toward fiscal 2030

- Toward fiscal 2030, steadily **reduce CO₂ emissions from the power generation by the Kansai Electric Power Group.**
- Based on the above, **help customers and society reduce CO₂ emissions.**
- Accordingly, strengthen the resilience of power grid networks while modernizing them in the transmission and distribution business.

Contribution to customers and society

Decrease the CO₂ emission factor of electricity supplied to customers to industry-leading levels.

Provide services to help customers and society reduce CO₂ emissions by over 7 million tonnes (equivalent to about 30% of reductions expected in the Kansai area).

The Kansai Electric Power Group's initiatives

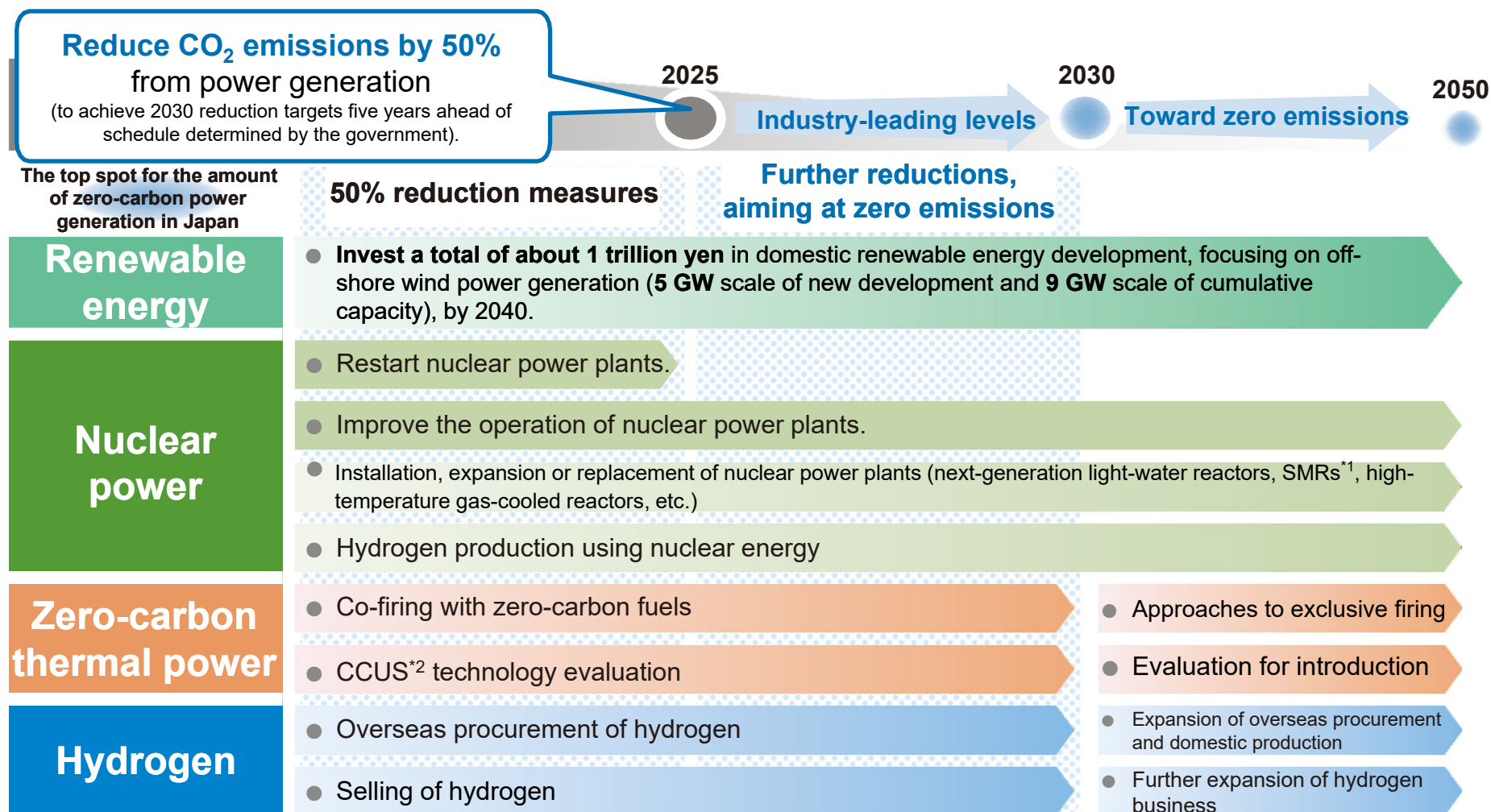
Reduce CO₂ emissions from power generation by 50% by fiscal 2025 (reduction of over 25 million tonnes from fiscal 2013 levels) and maintain industry-leading reduction levels.

Totally electrify* over 5,000 vehicles owned by the Group.

*Including electric vehicles (EVs), plug-in hybrid vehicles (PHVs) and fuel cell vehicles (FCVs) but excluding special-purpose vehicles

The Kansai Electric Power Group's initiatives

- Take various initiatives to achieve zero carbon, focusing on **renewable energy**, **nuclear power**, **zero-carbon thermal power** and **hydrogen**.
- Operate nuclear power plants in a safe, stable manner and **reduce** CO₂ emissions from power generation **by 50%** by fiscal 2025 (**reduction of over 25 million tonnes**). Achieve further reductions for fiscal 2030 with a focus on nuclear and renewable energy while maintaining industry-leading reduction levels.

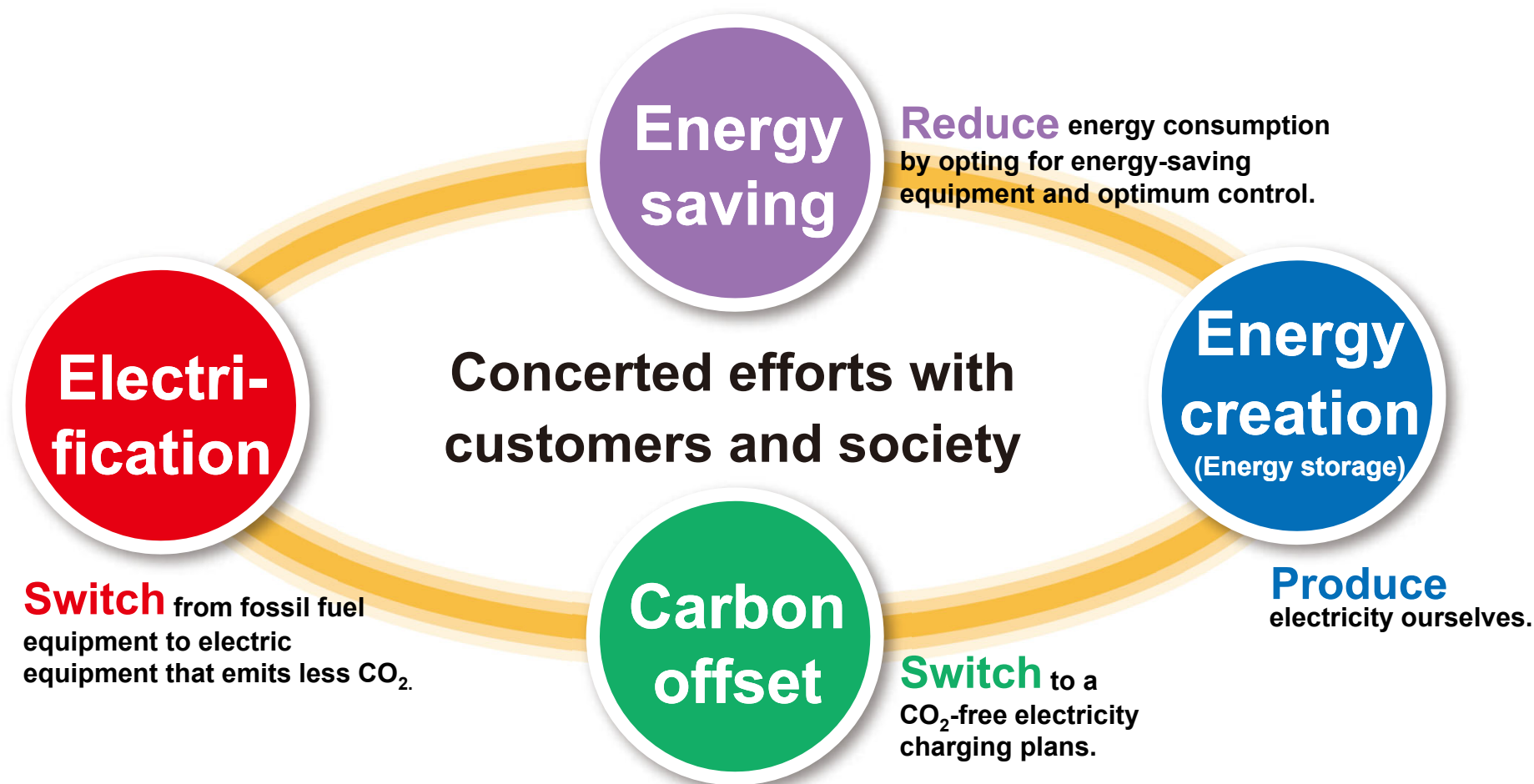


*1 SMR: Small Modular Reactors

*2 CCUS: Carbon dioxide Capture, Utilization and Storage, where CO₂ is recovered from exhaust gases for utilization or storage underground.

Concerted efforts with customers and society

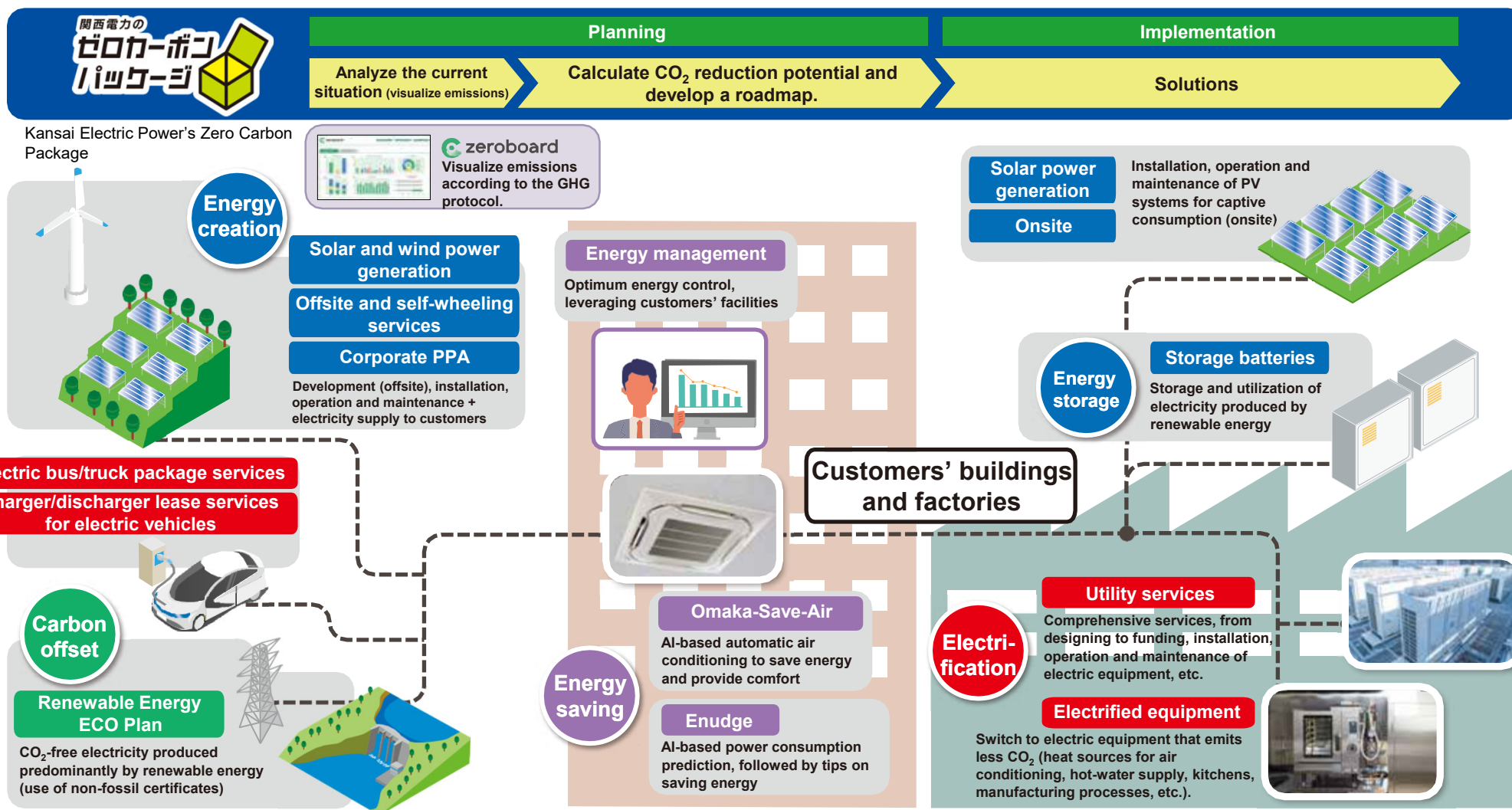
The Kansai Electric Power Group is committed to making concerted efforts with customers and society, focusing on **energy saving**, **electrification**, **energy creation (energy storage)** and **carbon offset**, for a reduction of **over 7 million tonnes** of CO₂ emissions by fiscal 2030.



Concerted efforts with customers and society

Commercial and industrial sectors

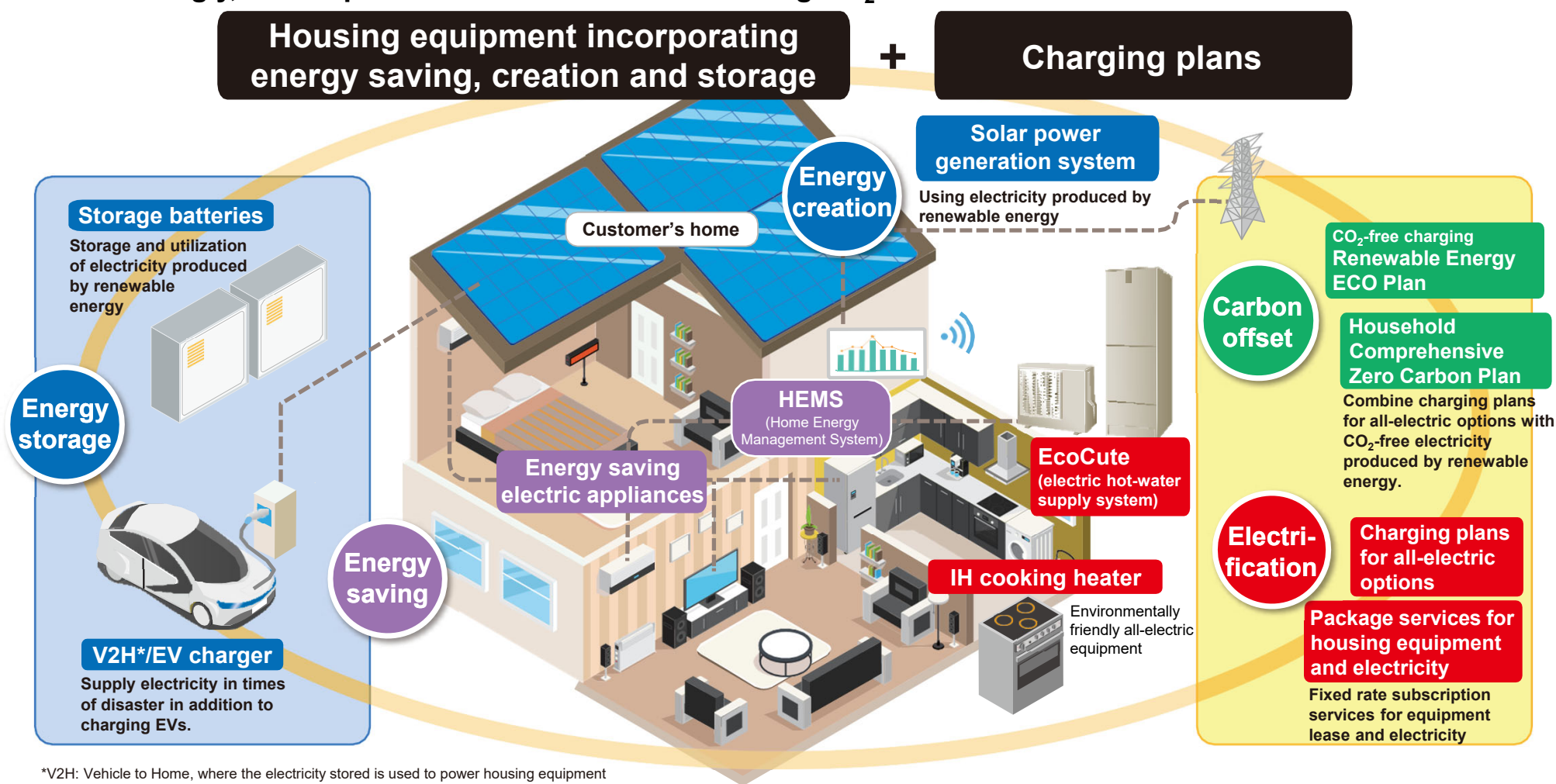
- We offer a variety of services from planning to implementation of zero carbon measures (Zero Carbon Package), with solutions customized according to customers' needs, to jointly reduce overall CO₂ emissions from the commercial and industrial sectors.



Concerted efforts with customers and society

Residential sector

- With focus on electrification through promotion of charging plans for housing equipment incorporating energy saving, creation and storage and for all-electric homes, we offer solutions such as flat-rate package options for housing equipment and electric bills, and the Household Comprehensive Zero Carbon Plan, which combines CO₂-free electricity charging plans.
- Accordingly, we cooperate with customers in reducing CO₂ emissions from the residential sector.



*V2H: Vehicle to Home, where the electricity stored is used to power housing equipment in addition to charging EVs.

Concerted efforts with customers and society

Transportation sector

- We offer one-package services (charging services coupled with EV introduction, energy management, etc.) to jointly reduce overall CO₂ emissions from the transportation sector.
- We help introduce electric vessels and flying vehicles to electrify land, sea and air mobility, thereby contributing to achieving a zero-carbon society.

Air

Flying vehicles (air mobility)

Cooperate with flying vehicle developers and manufacturers while providing solutions for charging facilities in synch with fuselage development.



Electri-
fication

Charger/discharger lease services for electric vehicles

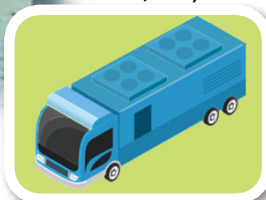
Integrate lease, energy management and car sharing services to electrify company-owned cars and promote BCP².



Land

Electric bus/truck package services

Promote electrification by providing package services (vehicles, chargers/dischargers, energy management, power source facilities, etc.)



EXPO 2025

Activities toward Expo 2025 Osaka, Kansai^{*1}

Electric vessels (electric propulsion vessels)

Cooperate with companies developing electric propulsion vessels and wireless charging systems to promote electrification of vessels.



Sea

Further efforts

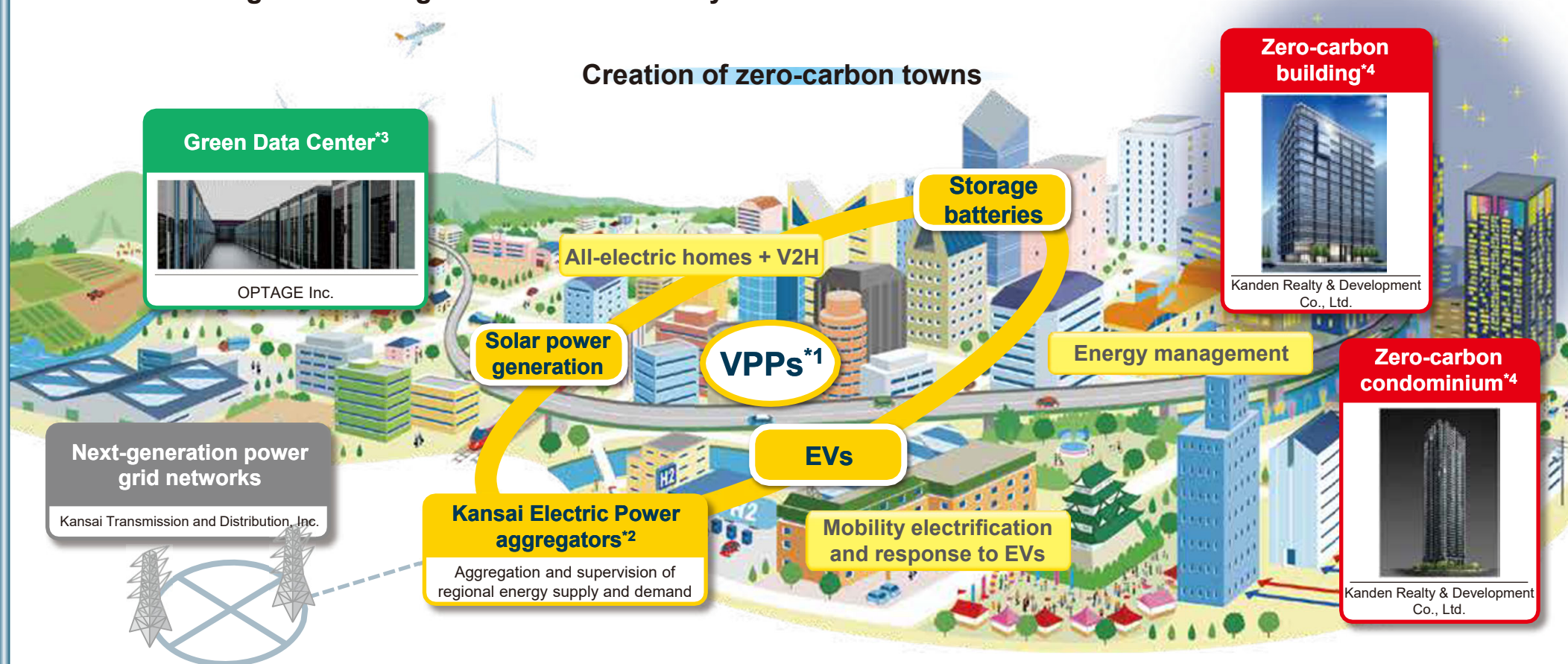
^{*1} Versatile, eco-friendly land/air/sea mobility provides seamless and comfortable transportation inside and outside the Expo venues.

^{*2} BCP: Business Continuity Planning

Concerted efforts with customers and society

Community sector

- Taking into account various community challenges (regional economic revitalization, resilience improvements, etc.), we cooperate with stakeholders such as municipalities and developers and provide wide-ranging services incorporating the Group's various solutions and new technologies, thereby contributing to achieving a zero-carbon society.



*1 VPP (Virtual Power Plant): A system to integrate and control distributed energy sources for electricity supply/demand management, designed to simulate the function of a power plant.

*2 Aggregators: Business operators who aggregate power demand from single or multiple customers to create Virtual Power Plants (VPPs).

*3 Green data center: An energy-efficient, eco-friendly data center that uses renewable energy and incorporates high-efficiency equipment and air-conditioning systems.

*4 Zero-carbon buildings and condominiums: Energy-efficient, all-electric buildings and condominiums (ZEB oriented/ZEH-M oriented or greater) powered by decarbonized energy sources to achieve zero carbon.

Reference:

The Kansai Electric Power Group's initiatives

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Renewable energy

- The Kansai Electric Power Group, as a leading company in zero-carbon energy, is committed to proactively developing renewable energy based on its improved development promotion system, focusing on offshore wind power generation, which has great development potential.
- Through investment of a total 1 trillion yen in domestic projects, we aim to develop 5 GW scale of new development and to achieve 9 GW scale of cumulative capacity by 2040.

Toward the goal

Accelerate development of renewable energy by leveraging our technological prowess in power generation, as well as knowledge and know-how originating from domestic and overseas offshore wind power projects, while enhancing cooperation with other companies.

5 GW scale of new development
9 GW scale of cumulative capacity

to be domestically developed by 2040

Accelerate
development
toward 2050

- Development efforts made so far

We have developed and own one of the largest domestic hydropower plants and are developing various renewable energy resources (leveraging expertise gained from overseas projects to develop and promote domestic projects).

Domestic



Biomass: Kanda Biomass Power Plant



Offshore Wind: Port of Akita and Port of Noshiro Project (Source: Akita Offshore Wind Corporation)

Overseas



Offshore Wind: Triton Knoll Project



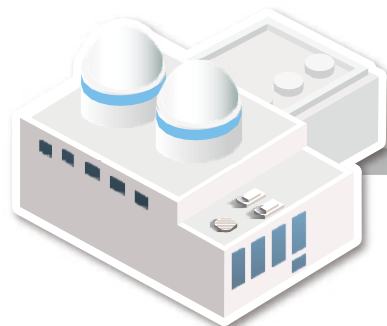
Hydropower: Nam Ngiep 1

The Kansai Electric Power Group's initiatives

Nuclear power

- Giving top priority to safety, the Kansai Electric Power Group will leverage nuclear energy as much as possible.
- Efforts are underway to improve the operation of nuclear power plants and develop and promote next-generation options such as light-water reactors, with replacement in mind, while extracting the full potential of nuclear power for hydrogen production.

Extracting the full potential of nuclear power



Approach 1

Improving the operation of nuclear power plants

- Referencing measures at nuclear power plants overseas, discuss our initiatives to improve the operation rate (flexible operation period, optimization of the timing, period of inspections, and more).

Approach 2

Installation, expansion and replacement

- Work with plant manufacturers to design next-generation light-water reactors that outperform existing reactors in safety and cost efficiency.
- Gather knowledge on next-generation reactors being developed at home and abroad (such as SMRs and high-temperature gas-cooled reactors with great potential) to study technical feasibility.

Approach 3

Hydrogen production using nuclear energy

- Extract the full potential of nuclear energy, which constantly produces a massive amount of zero-carbon electricity, to use the electricity and heat it produces for hydrogen production in the future.

The Kansai Electric Power Group's initiatives

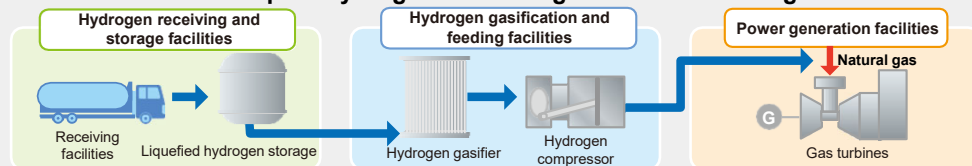
Zero-carbon thermal power

- As for LNG thermal power generation, we will study co-firing with zero-carbon fuels for realization in around 2030 by modifying and replacing existing plants, targeting exclusive firing by 2050.
- As for coal-fired thermal power generation, we will study co-firing with zero-carbon fuels for realization in around 2030, and proceed to evaluate CCUS technology for future introduction.

Demonstration of power generation by co-firing and exclusive firing of hydrogen at our existing thermal power plant

Using our existing thermal power plant (gas turbine power generation facilities), we will establish operational techniques for hydrogen power generation (including operation, maintenance and safety measures) to realize power generation by co-firing and exclusive firing of hydrogen (adopted by NEDO's Green Innovation Fund Project).

■ Process flow from receipt of hydrogen to co-firing and exclusive firing



■ Schedule and implementation flow



Contribution to realizing CCUS

- Cooperation in the demonstration project of CO₂ Capture System using solid sorbents^{*1}
 - An agreement was signed with Kawasaki Heavy Industries, Ltd. to manage a part of construction work for demonstration plant of CO₂ capture system with low energy consumption which is under construction at Maizuru Power Station as part of the NEDO project.
 - The commissioning run will start in fiscal 2022, to be followed by demonstration from fiscal 2023.
- Cooperation in the technology development and demonstration of ship transportation of liquified CO₂^{*2}
 - An agreement was signed with Japan CCS Co., Ltd. to assist construction of a liquified CO₂ shipping base which will be constructed at Maizuru Power Station as part of the NEDO project.

^{*1} "Applied research on coal combustion waste gas and advanced carbon dioxide solid absorption materials"

^{*2} "CCUS research and development/demonstration project / Large-scale CCS demonstration project in Tomakomai / Demonstration test related to CO₂ transport"



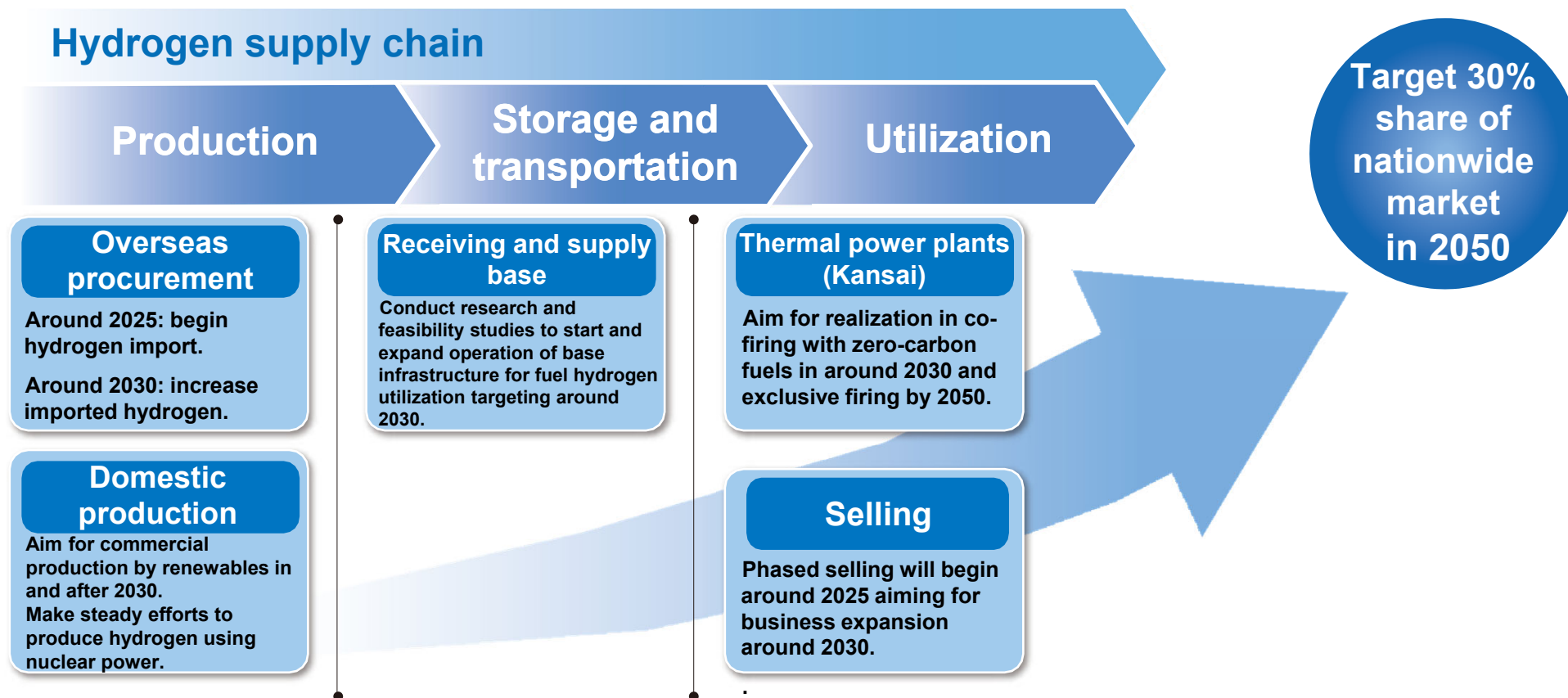
Perspective drawing of demonstration plant

The Kansai Electric Power Group's initiatives

Hydrogen

- In terms of procurement of zero-carbon fuels, we are making efforts to prepare for establishment of fuel hydrogen supply chain including participation in feasibility studies and demonstration projects extensively.
- We plan to begin procurement of hydrogen from overseas mainly for demonstration projects around 2025 in a gradual manner. With regard to the large-scale and commercial procurement of cost competitive hydrogen, we are targeting the year of 2030.
- We will provide the above mentioned hydrogen to the thermal power plants with zero carbon target and make efforts to produce hydrogen as well as start selling our procured hydrogen to our transport and industrial customers step by step around 2025 and aim for expanding our hydrogen business in and after 2030.

Hydrogen supply chain



The Kansai Electric Power Group's initiatives

Transmission and distribution business

- While power plants and electricity users are connected through power grid networks, which are essential in realizing zero carbon, we will expand and upgrade our facilities to ensure stable electricity supply in line with the wheeling pricing system to be introduced in fiscal 2023, which aims to use renewable energy as a main power source and improve the resilience of infrastructure.
- We are committed to reducing our environmental load by upgrading grid lines and trunk power systems, expanding cross-regional grid networks and decarbonizing every operation of the power transmission and distribution business, all designed to leverage renewable energy.
- We will develop a next-generation electric power network to establish a zero carbon foundation by introducing distributed grid systems and upgrading power system control technology through development of VPPs using storage batteries and EVs.

Stable supply

Connect power plants with various power grid users, including customers, while ensuring stable electricity supply.

To be implemented continuously

- Expand and upgrade power facilities steadily.
- Connect newly developed renewable energy sources to power grids promptly and steadily.
- Publicize welcome zones^{*1}.

Environmental load reduction

Leverage eco-friendly electricity

Before 2030

- Upgrade and strengthen grid lines and trunk power systems.
- Expand cross-regional grid networks.

After 2030

- Further upgrade trunk power systems.
- Decarbonize every operation in the power transmission and distribution business^{*2}

Next-generation services

Provide electricity and valuable services in a free and convenient manner.

Before 2030

- Develop VPPs, using storage batteries and EVs, and upgrade services using electricity data.
- Use distributed grids.

After 2030

- Advanced grid operations, making the most of renewable energy.
- Leverage a database that combines other industries' data.

^{*1} Welcome zones: Places where electricity is supplied in a relatively quick and cost-effective manner, located in six prefectures in the Kansai area.

^{*2} Power transmission and distribution business: Managed by Kansai Transmission and Distribution Inc.