Kansai Electric Power
power with heart

Announcement of Kansai Electric Power Group "Zero Carbon Vision 2050"

February 26, 2021
The Kansai Electric Power CO., Inc.

The Kansai Electric Power Group declared “Zero Carbon Vision 2050” on February 26, 2021.
In an effort to create a sustainable society, our group, as a leading company of zero-carbon energy, is aiming for carbon neutrality throughout the entirety of its business activities including power generation by 2050 in order to combat global warming, while striving to increase energy independence to secure energy supply, with priority given to safety.

Three key approaches to achieve “Zero Carbon Vision 2050”

① Zero-carbon emissions on the demand side
With the enlarged role on the demand-side, the Kansai Electric Power Group, as a zero-carbon solution provider, is pleased to provide customers with the best available solution toward zero-carbon emissions along with supporting its implementation across all sectors such as residential, commercial, industry and transportation.

② Zero-carbon emissions on the supply side
With priority given to safety, our group will seek to achieve the best energy mix which can lead to full decarbonization, ensure secure stable supply with an increasing energy self-sufficiency ratio, and enhance economic efficiency.
Based on diversified social requests including promoting distributed energy resources and strengthening resilience, our group is making best efforts to maximize the introduction of renewable energy as a main power source, upgrade the power transmission and distribution system, and maximize nuclear power where power generation output stability and energy density are high with priority given to safety, as well as working to decarbonize thermal power generation which can flexibly adjust output to secure a stable supply despite the large-scale diffusion of renewable energy. Our group will also look to contribute to decarbonization on an international level.

③ Seeking to create a hydrogen- based society
As hydrogen is indispensable for a zero-carbon society, our group, as a key player working toward realizing a hydrogen-based society, will tackle the challenges to produce, transport and supply zero-carbon hydrogen with non-fossil fuels, in addition to using hydrogen for power generation.

Our group will establish a system with the President to mobilize its resources to support decarbonization not only in the economic activities of our customers, but also across society as a whole.
Every effort will be made through active cooperation with various parties, such as customers, business partners, the government, municipalities and research institutes.

Kansai Electric Power
power with heart

The Kansai Electric Power Group Zero Carbon Vision 2050

February 26, 2021

The Kansai Electric Power Co., Inc.

Commitments Toward 2050

In an effort to create a sustainable society, the Kansai Electric Power Group, as **a leading company of zero-carbon energy,** is **aiming for carbon neutrality throughout the entirety of its business activities including power generation by 2050** in order to combat global warming, while striving to increase energy independence to secure energy supply, with priority given to safety.

In addition, our group will mobilize its resources to support **decarbonization not only in the economic activities of our customers, but also across society as a whole**.

These efforts will be made through active cooperation with various parties, such as customers, business partners, the government, municipalities and research institutes.

The Kansai Electric Power Group's vision for the 2050 energy system

With the dramatic progress being made in 3D+D (Decarbonization, Decentralization, Digitalization plus electrification or *Denka* in Japanese), considered from the demand-side perspective, energy utilization will merge into two forms: electricity and hydrogen, and the energy system will be decentralized and diversified accordingly.

Considered from the supply-side perspective, energy suppliers will accelerate decarbonization (zero carbon) and likewise some energy users will also expand their roles as prosumers*1 who supply energy back to the grid.

*1. Prosumer: A consumer who consumes the electricity they generate while selling any surplus on the market.

[Demand side]

- Energy users themselves will own and use distributed resources such as renewable energy including solar power, battery storage, and e-mobility, which in turn diversifies energy consumption and transaction patterns.
- Power systems optimized for local needs become prevalent, such as stand-alone distributed systems (micro-grids, off-grids).
- Energy will be used intensively as electricity or hydrogen.

[Supply side]

- Non-fossil fuel power sources including renewable and nuclear power will be introduced and/or utilized to the maximum through technological development/innovation and advanced operations.
- Fossil fuel use at thermal power plants will transition to zero-carbon fuels (hydrogen, ammonia, etc.) and CCUS*2 technologies will be introduced to thermal power generations.
- Hydrogen will be produced with the utilization of non-fossil fuel energy sources including renewable and nuclear energy.

*2. CCUS: Technologies of Carbon Dioxide Capture, Utilization and Storage

The Kansai Electric Power Group's vision for the 2050 energy system

Demand side

Electricity and hydrogen

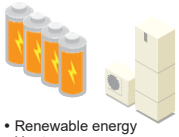
Residential and commercial sectors are fully electrified.
Industrial and transportation sectors are further electrified, with zero-carbon hydrogen used to meet heat demand, etc.

Prosumers*1

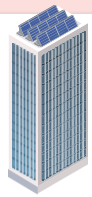
A growing number of energy users turn into prosumers by owning and using distributed renewable energy sources (solar energy, etc.).

Residential and commercial sectors

Fully electrified



- Renewable energy
- Heat pump
- Storage batteries



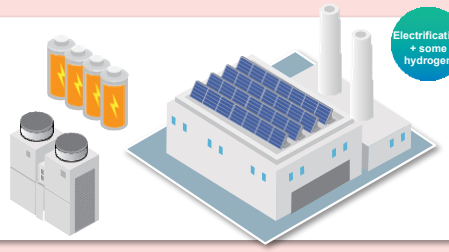
Total electric conversion office buildings, etc.

Total electric conversion condominiums, etc.

Industrial sector

Electrification + some hydrogen

- Renewable energy
- Heat pump
- Storage batteries

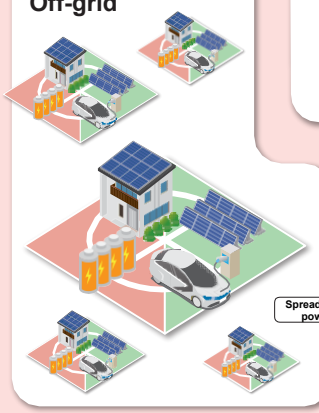


Transportation sector

Electrification + some hydrogen

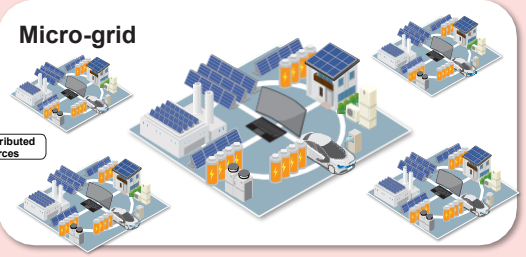
- Electric vehicles
- Fuel-cell vehicles, etc.

Off-grid



Spread of distributed power sources

Micro-grid



Electricity

Hydrogen

Market and businesses

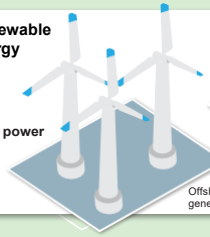
Supply side

Electricity

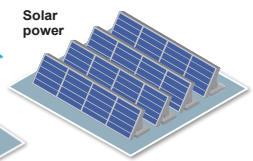
Introduction and use of non-fossil power sources to the fullest degree and use of zero-carbon fuels used for thermal power generation

Renewable energy

Introduction to the fullest degree

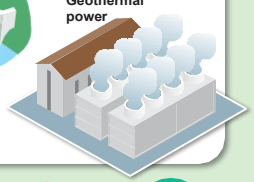


- Wind power
- Offshore wind power generation, etc.



- Solar power

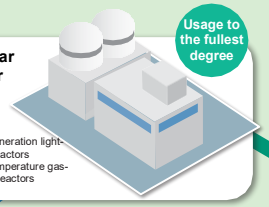
- Hydropower



- Geothermal power

Nuclear power

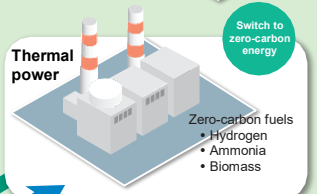
Usage to the fullest degree



- Next-generation light-water reactors
- High-temperature gas-cooled reactors
- SMR*2

Thermal power

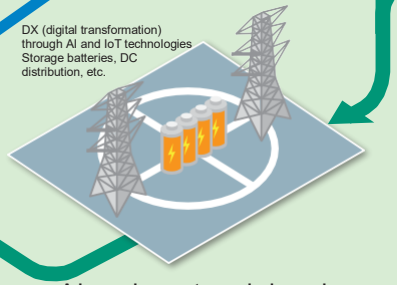
Switch to zero-carbon energy



Zero-carbon fuels
- Hydrogen
- Ammonia
- Biomass

Electricity

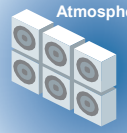
DX (digital transformation) through AI and IoT technologies Storage batteries, DC distribution, etc.



CCUS*3

CO_2

Underground storage
- Economical utilization



Atmosphere

DACCS*4

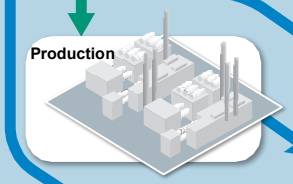
Advanced power transmission and distribution power system

(Upgrading of power system control technology and cross-regional operation of electric power networks)

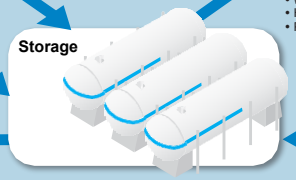
Hydrogen

Zero-carbon hydrogen production using electricity and heat produced from non-fossil power sources

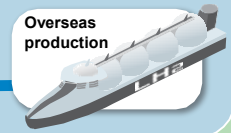
- Water electrolysis
- High-temperature steam electrolysis
- Production through thermochemical decomposition



Production



Storage



Overseas production

Hydrogen

Development of resilient power transmission and distribution facilities supporting electric utilization (demand side) and electric supply (supply side)

*1. Prosumer: A consumer who consumes the electricity they generate while selling any surplus on the market.

*2. SMR: Small Modular Reactor
*3. CCUS: Technologies of Carbon Dioxide Capture, Utilization and Storage

*4. DACCS: Technologies that capture CO_2 directly from the atmosphere and store underground

The Kansai Electric Power Group Zero Carbon Vision 2050 Three key approaches

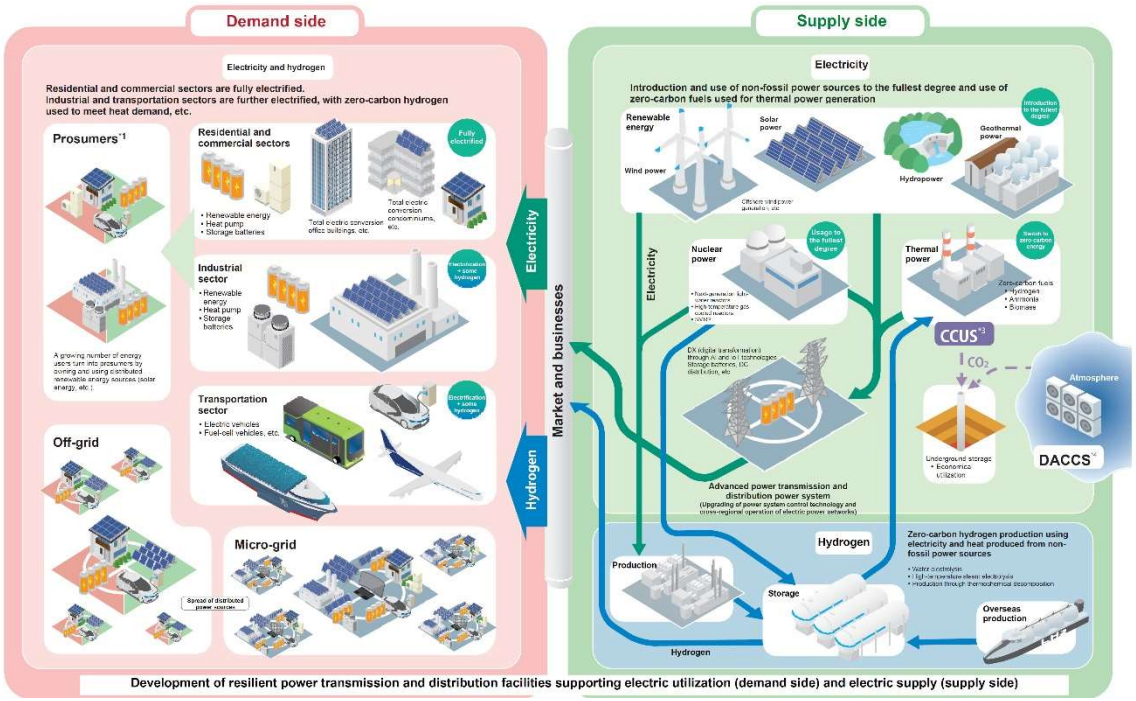
In order to achieve a zero-carbon society with an eye on 2050, as **a leading company in zero-carbon energy**, the Kansai Electric Power Group is committed to implementing the following three approaches, mobilizing its resources and cooperating with customers, business partners, the government, municipalities and research institutes, etc.

[1] Zero-carbon emissions on the demand side

[2] Zero-carbon emissions on the supply side

[3] Seeking to create a hydrogen-based society

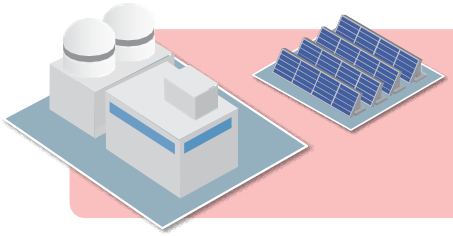
The Kansai Electric Power Group's vision for the 2050 energy system



Zero carbon emissions on the demand side

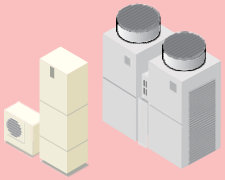
With the enlarged role on the demand-side, the Kansai Electric Power Group, as **a zero-carbon solution provider**, is pleased to provide customers with **the best available solution toward zero-carbon emissions along with supporting its implementation** across all sectors such as residential, commercial, industry and transportation.

Approaches toward 2050



Renewal of service menu leading to decarbonization

System solutions combining distributed renewable energy and battery storage



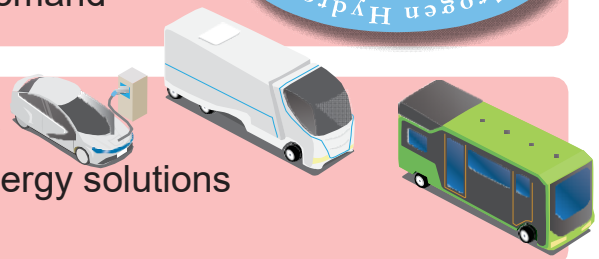
Electrification of energy consuming equipment in all sectors (through use of heat pump technology, etc.)

* The residential and commercial sectors will be fully electrified.

Promoting the use of hydrogen, etc., targeting customers who need to meet heat demand

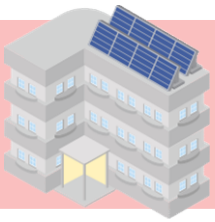
Advanced energy management, leveraging AI-IoT-technology-based DX, storage batteries, etc.

Promoting e-mobility and integration of energy solutions with MaaS[*5]



Promotion of smart cities contributing to zero-carbon

Mobilization of the Kansai Electric Power Group's resources in the fields of energy, telecommunications, real estates, etc.



*5. MaaS (Mobility as a Service): Comprehensive web-search and online reservation/payment services leveraging optimized combinations of public transportation and other mobility means, tailor-made to individual needs.

Zero-carbon emissions on the supply side

With priority given to safety, our group will seek to achieve the best energy mix which can lead to full decarbonization, ensure secure stable supply with an increasing energy self-sufficiency ratio, and enhance economic efficiency. Based on diversified social requests including promoting distributed energy resources and strengthening resilience, our group is making best efforts to **maximize the introduction of renewable energy as a main power source, upgrade the power transmission and distribution system, and maximize nuclear power where power generation output stability and energy density are high with priority given to safety,** as well as working to **decarbonize thermal power generation** which can flexibly adjust output to secure a stable supply despite the large-scale diffusion of renewable energy. Our group will also look to contribute to decarbonization on an international level.

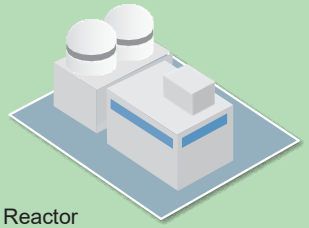
Approaches toward 2050

<Renewable energy and power transmission and distribution system>

- Promotion of renewable energy sources to the fullest degree such as offshore wind power at home and abroad
- Usage of hydropower to the fullest degree and maximization of the power generation output through renovation and development of power generation facilities
- Upgrading power system control technology through AI-IoT-based DX, cross-regional operation of electric power networks and introduction of distributed grids (see Appendix [1])

<Nuclear power>

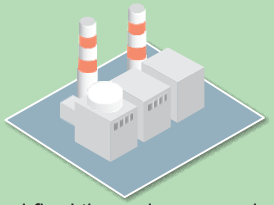
- Advanced operational protocols introduced to improve the operation rate, with priority given to safety
- Installation, expansion or replacement of facilities, with options including next-generation light-water reactors, high-temperature gas-cooled reactors and SMRs*6
- Hydrogen production using nuclear energy



*6. SMR: Small Modular Reactor

<Thermal power>

- Shift to power generation using zero-carbon fuels (hydrogen, ammonia, etc.)
- Introduction of CCUS technologies
- Establishment of a “zero-carbon technology hub” to exploit hydrogen as a fuel through the integration and combination of approaches mentioned above (see Appendix [2])



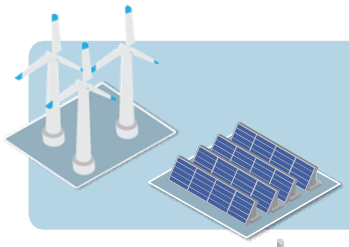
Plans for new coal-fired thermal power projects will not be drawn up unless plans comply with national policies and contribute to decarbonization in host countries)

Seeking to create a hydrogen-based society

As hydrogen is indispensable for a zero-carbon society, our group, as a key player working toward realizing a hydrogen-based society, will tackle **the challenges to produce, transport and supply zero-carbon hydrogen with non-fossil fuels, in addition to using hydrogen for power generation.**

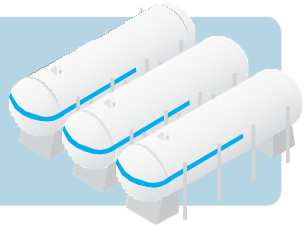
Approaches toward 2050

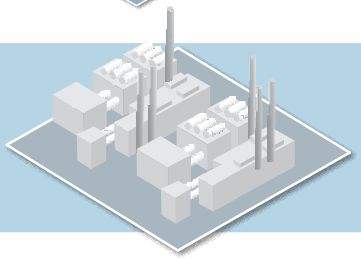
Our group will seek to exploit all possibilities for hydrogen and actively conduct the relevant R&D, demonstrations and evaluations.



Hydrogen production using electricity produced from renewable and nuclear energy

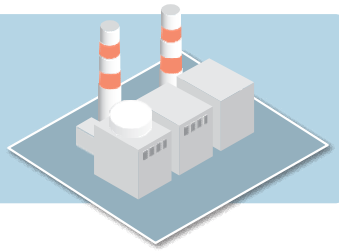
Supply of hydrogen, etc. to customers who need to meet heat demand





Hydrogen production using heat source of nuclear energy

Use of hydrogen as a fuel for thermal power



Establishment of a hydrogen supply chain as an energy supplier

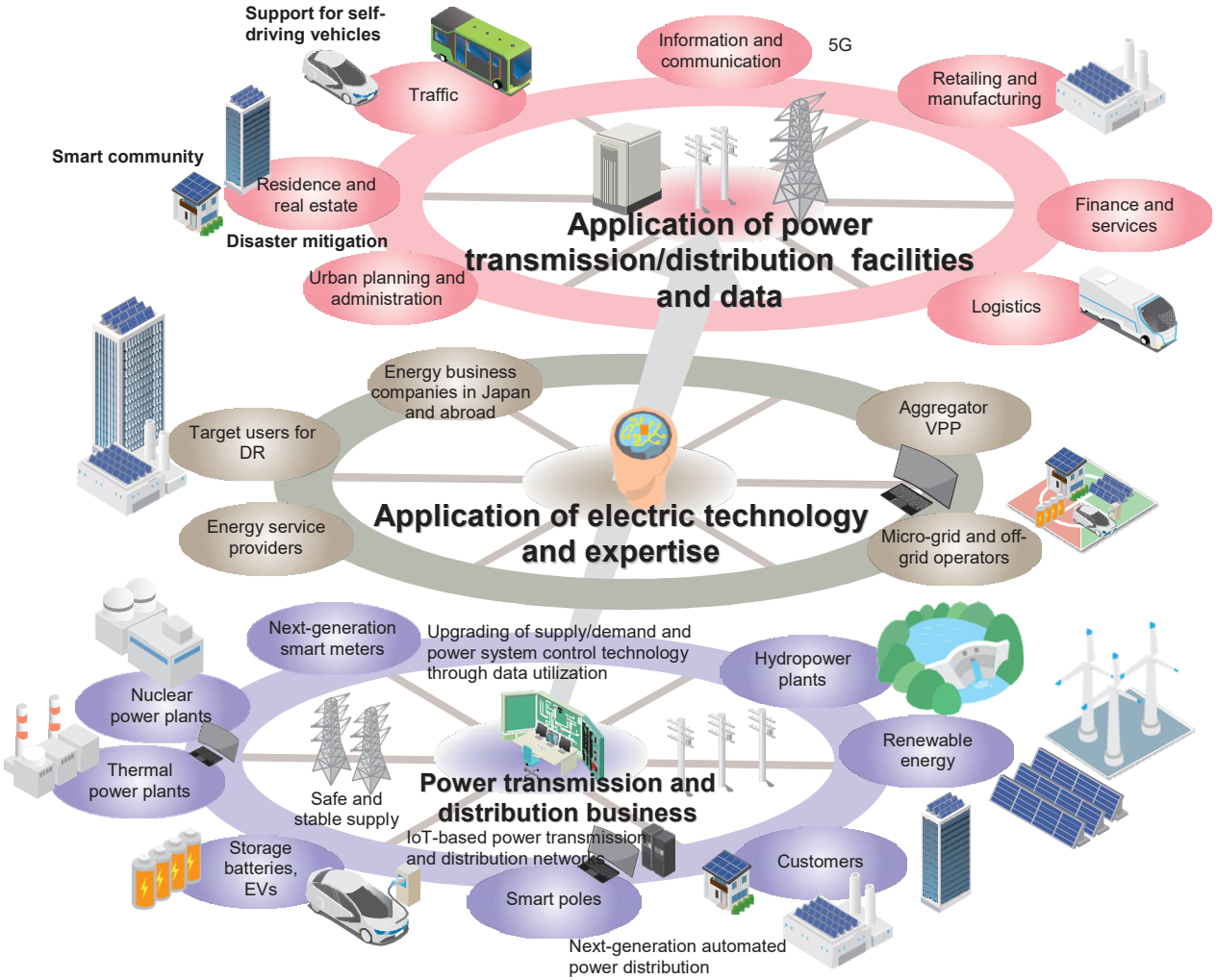
(See Appendix [3])

Appendix

Power transmission and distribution business for a zero-carbon society

Appendix [1]

In addition to supplying electricity safely and stably, the proprietary technologies, expertise and resources of the power transmission and distribution business will be leveraged and efforts will be stepped up both on the demand side and on the supply side, thereby contributing to creating a zero-carbon society.



Usage of zero-carbon energy to the fullest degree through the integration of various resources via electric power networks

Upgrading of power system control technology

- Development of VPP using storage batteries and EVs
- Promotion of DX using data obtained from next-generation smart meters

etc.

Cross-regional operation of electric power networks

- Renovation and strengthening of grid lines and bulk power systems to leverage renewable energy sources, whose ideal locations are unevenly distributed

etc.

Introduction of distributed grids

- Introduction of off-grids and micro-grids for local power generation and local consumption

etc.

* DR (Demand Response): A technology where energy owners or third parties on the demand side control their energy supply to change electricity demand patterns.
* 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.
* Smart pole: A multifunctional pole capable of collecting and communicating information, with functions such as ICT (Information and Communication Technology) incorporated.

Zero-carbon technology hub

Efforts are underway to review hydrogen exploitation models and to contribute to developing CO_2 separation and capture technology, leveraging thermal power plants in operation. Cooperating with business partners, the government, municipalities and research institutes, etc., the Kansai Electric Power Group is committed to establishing a zero-carbon technology hub tasked with implementing R&D, demonstration and commercialization programs, the objective of which is to develop and capitalize on zero-carbon technologies.

Hydrogen utilization technology hub

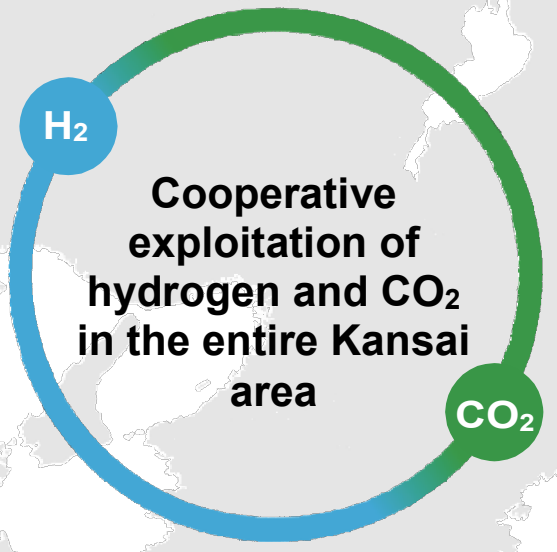
- **Hydrogen energy carrier supply chains from abroad**
- **Hydrogen production (from renewable and nuclear energy, etc.)**
- **Hydrogen power generation**
- **Supply of hydrogen, etc. to customers**
- **Production of CO_2-derived fuels**

etc.

Hydrogen production

Carbon recycling (CO_2-derived fuels)

Hydrogen power generation



Carbon recycling technology hub

- **CO_2 separation, capture, liquefaction and transportation**
- **Production of CO_2-derived valuables**

etc.

CO_2 separation, capture and liquefaction

Carbon recycling (CO_2-derived valuables, etc.)

* Hydrogen energy carrier: Substances functioning as a carrier for efficient storage and transportation of hydrogen

Approaches to establish hydrogen supply chains

Supply to customers

- Industrial sector
  (For customers who need to meet heat demand)
- Transportation sector

For use as a fuel for thermal power generation
(Zero-carbon fuel for thermal power generation)

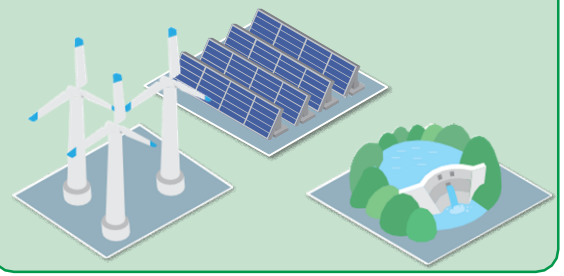
H_2
< Zero carbon>

- Water electrolysis

H_2O — Electricity

- Solar power generation
- Wind power generation
- Hydropower generation

etc.



Hydrogen derived from renewable energy

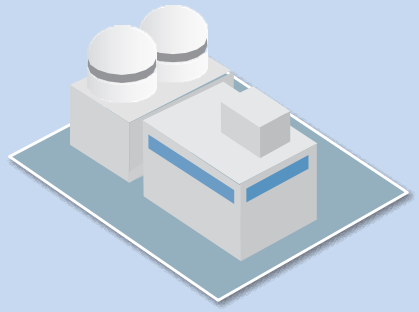
H_2O

- Water electrolysis
- High-temperature steam electrolysis
- Thermochemical decomposition

Electricity

Heat

- **Nuclear power generation**
  (High-temperature gas-cooled reactors, etc.)



Hydrogen derived from nuclear energy

Supply and use	Transportation	Production