Keidanren
Policy & Action

Rebuilding Japan's Electricity System

Electricity Policy to Realize Society 5.0

Keidanren

April 16, 2019

Defining the Issues: The Crises Facing Japan's Electricity System (1)

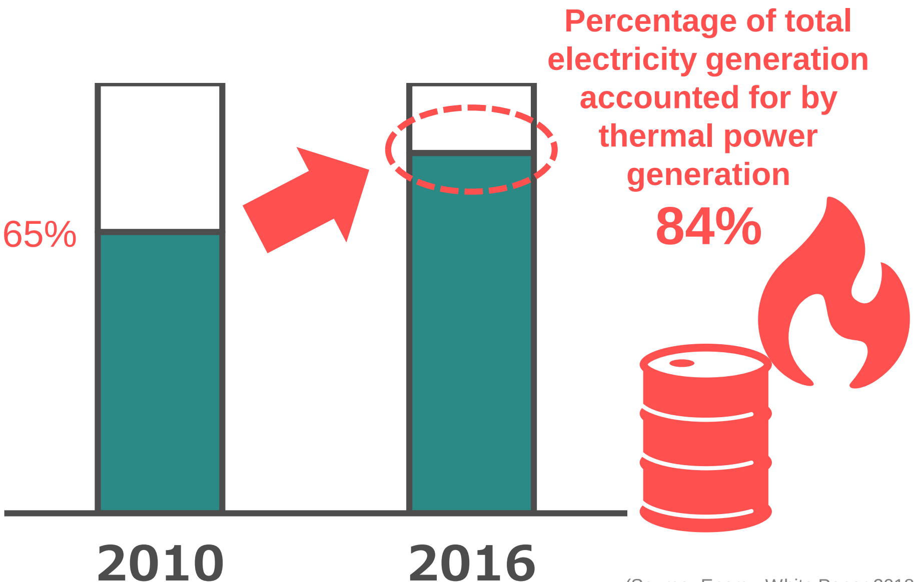
Keidanren Policy & Action

- The electricity system in Japan faces four crises brought about by factors including changes in circumstances following the Great East Japan Earthquake.

Issue 1: Reliance on fossil fuels remains high, attracting criticism from the international community.

Issue 2: Renewable energy, which is expected to be effective in addressing global warming, cannot be expanded due to transmission constraints and other limiting factors.

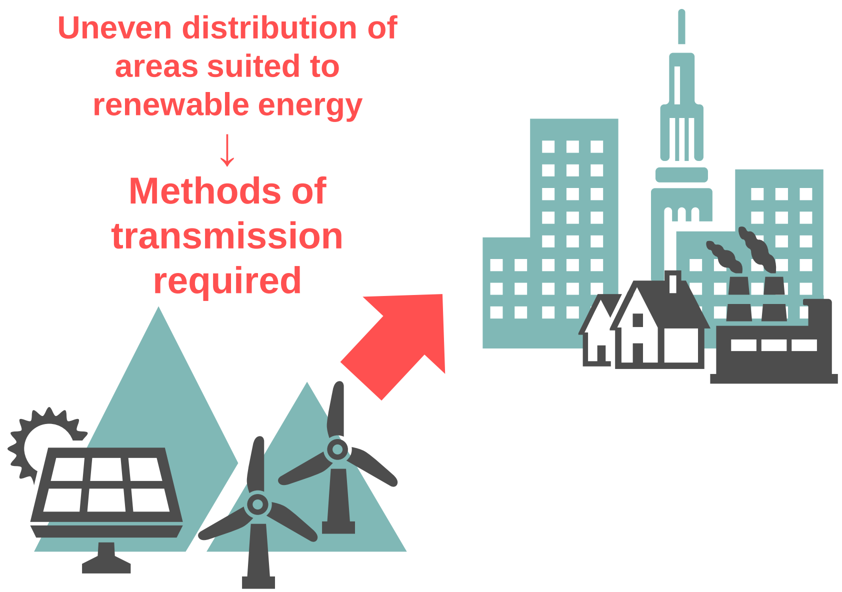
Issue 1 Ending heavy reliance on fossil fuels



(Source: Energy White Paper 2018)

Contrary to global expectations, the proportion of fossil fuels in the energy mix has risen

Issue 2 Expanding introduction of renewable energy



Development of electricity networks is inadequate

Defining the Issues:
The Crisis Facing Japan's Electricity System (2)

Keidanren
Policy & Action

Issue 3: Although nuclear power safety measures have been reinforced, resumption of operations has been slow.

Issue 4: Electricity charges have not fallen to a level comparable with other countries.

▶ There is a risk of being unable to ensure stable supply of electricity in economically efficient and environmentally responsible ways.

Issue 3 Re-starting nuclear power plants

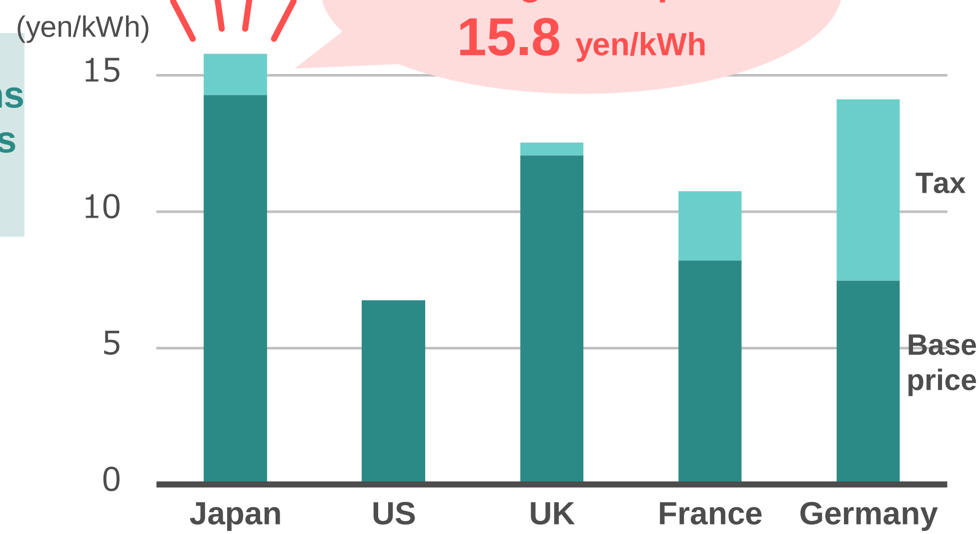
Number of nuclear power plants in operation

2010	54
2018	9
2030 (target)	Around 30

Resumption of operations still delayed even 8 years after the earthquake

Issue 4 Reducing electricity charges

Industrial electricity charge in Japan 15.8 yen/kWh



Electricity charges in Japan are relatively high

Note: Base price/tax breakdown not available for US (Source: Energy White Paper 2018)

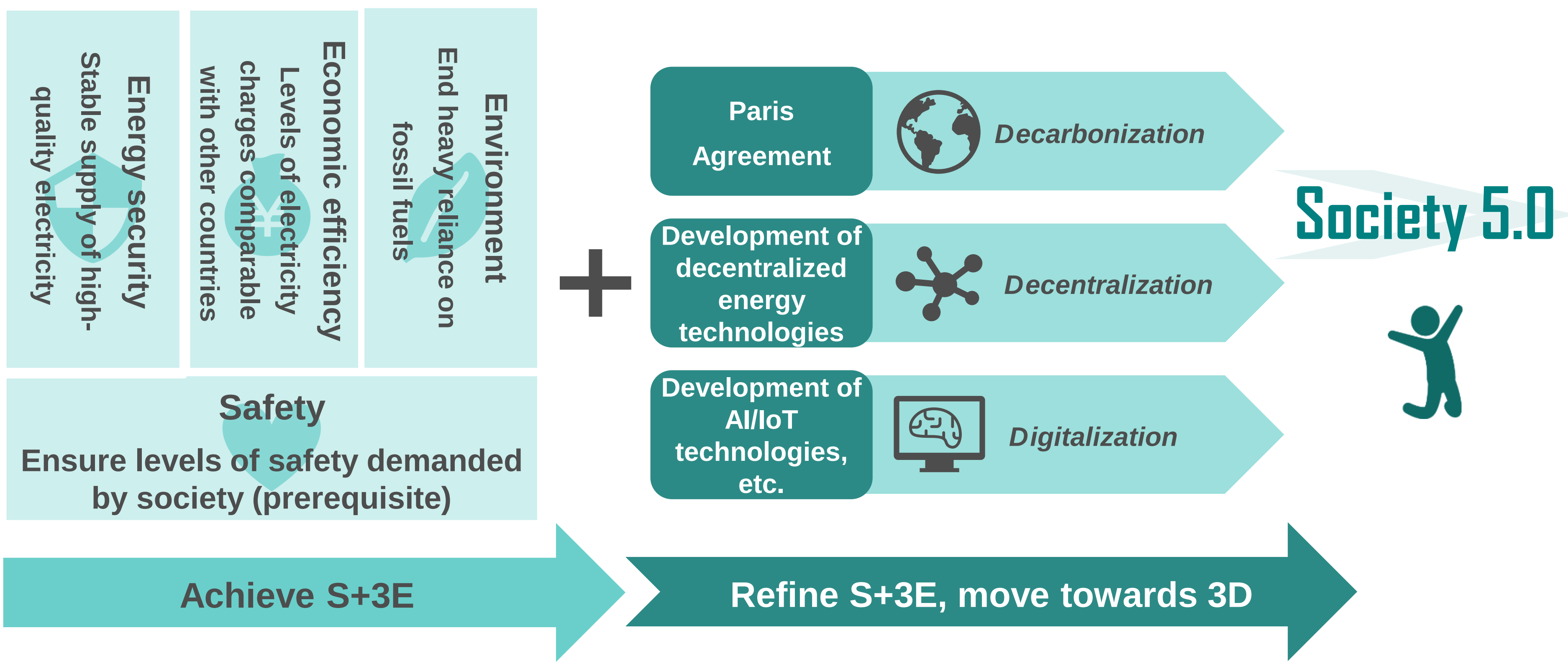
Keidanren Policy & Action

Direction of the Electricity System

- The broad principle for energy policy is balancing energy security, economic efficiency, and environment on the premise of ensured safety (S+3E).
- In addition, electricity systems around the world are moving towards decarbonization, decentralization, and digitalization (3D), a direction shared by Society 5.0.
- There is a need to encourage investment in electricity and forge ahead with development, enhancement, and deployment of technology.

Basis of energy policy: S+3E

Direction of electricity systems around the world: 3D



Current Situation in Japan: Sluggish Electricity Investment

- Japan currently faces sluggish investment in electricity. There are concerns that failure to address this will hamper S+3E and impede resolution of a wide range of important issues.
- Breaking this impasse will require the creation of a virtuous cycle of electricity investment.

Sluggish electricity investment

Uncertain future for electricity industry

- Liberalization of power generation and retailing
- Delayed re-start of nuclear power generation
- Large-scale introduction of solar power under the feed-in tariffs scheme
- Concern over falling electricity demand

3D initiatives will be difficult under current circumstances.
In addition, S+3E will be hampered.

▶ **Impact on a wide range of key policy issues and, by extension, daily lives and business activities.**

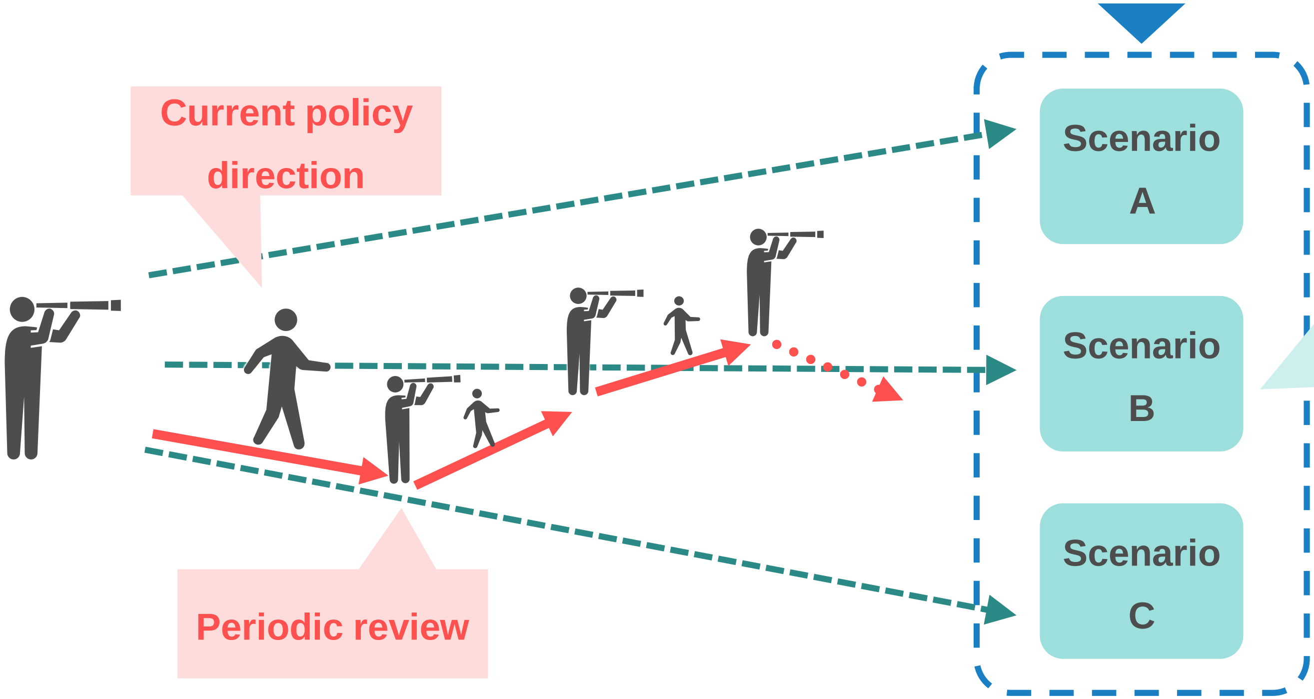
No expansion in nuclear power and renewable energy ↓ Impedes climate change countermeasures	Inferior quality of electricity supply and rise in electricity charges ↓ Harms industrial competitiveness	Increase in aging infrastructure and excessive delay in decentralization ↓ Hinders reinforcement of resilience	Failure to stimulate the energy value chain and excessive delay in decentralization ↓ Hampers regional revitalization

etc.

Specifying the Vision for the Future Electricity System

Keidanren Policy & Action

- To secure electricity investment, it is necessary to present a vision and enhance predictability.
- In drawing up its 6th Strategic Energy Plan, the government needs to present electricity system scenarios beyond 2030.
- At the same time, it should examine the social impact of achieving these scenarios.



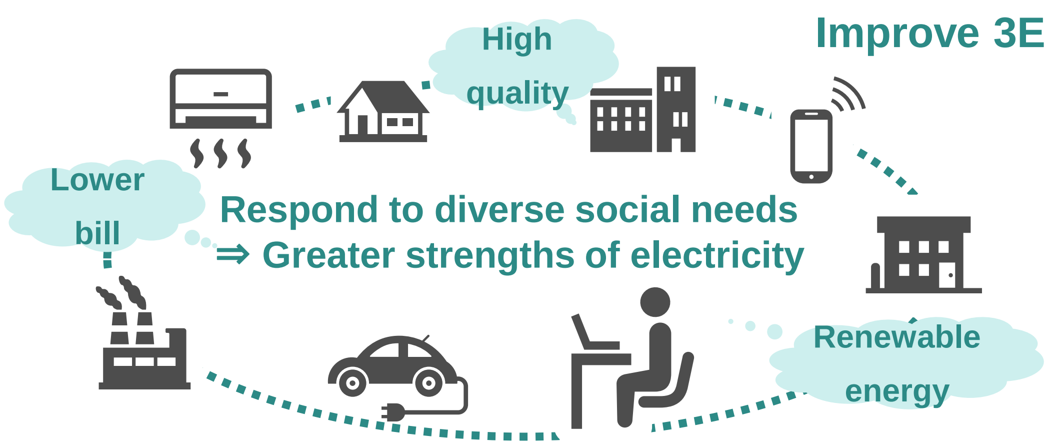
- Specific scenarios encompassing electricity sources, networks, demand, public burden, etc.
- Strive for best mix combining a range of options

Securing Base Demand for Electricity

- The importance of improving 3E through energy-saving efforts is obvious.
- To stimulate electricity investment, it is also important to expand the amount of economic activity and make the electricity business more attractive.
- By utilizing the strength of electricity and responding to diverse demand-side needs, electricity is expected to be used in forms optimal for society.

Volume of energy demand = **Energy efficiency**: Continually improve energy intensity under public and private sectors collaboration × **Amount of economic activity**: Promote industry and nurture seeds of new economic growth

Improve 3E

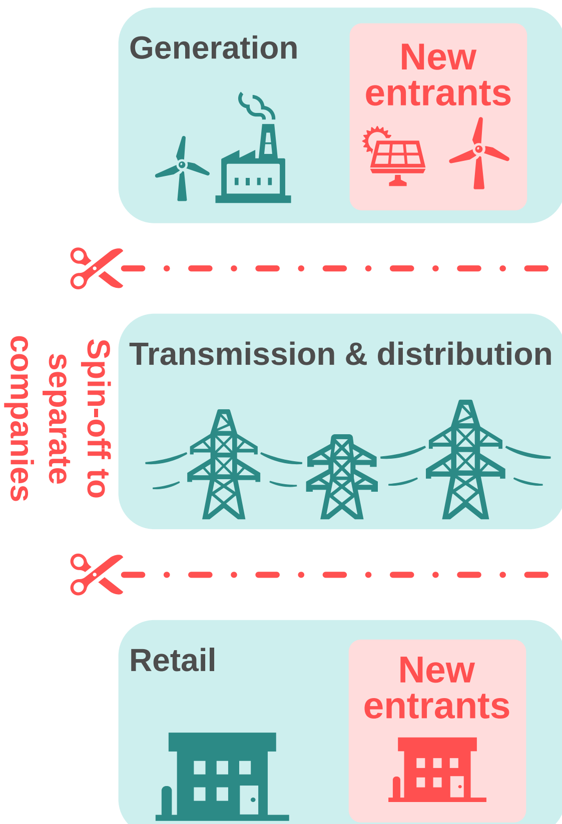


Secure base demand for electricity

Keidanren Policy & Action

Ensuring Stable Supply

- Electricity system reforms are creating a structure that ensures stable supply of electricity by dividing roles into generation, transmission & distribution, and retail, including new entrants.
- In order to ensure stable supply, the government should examine additional measures beyond establishment of wholesale markets.



Provide supply capacity and adjustment capabilities

Coordinate balance between supply and demand

Procure supply capacity corresponding to subscriber volume

Ensure stable supply through division of roles

- Will generators maintain electricity sources with declining utilization rates?

  ↓

  Additional mechanisms should be examined to ensure adjustment capabilities and supply capacity

- Will diverse players fulfil appropriate roles?

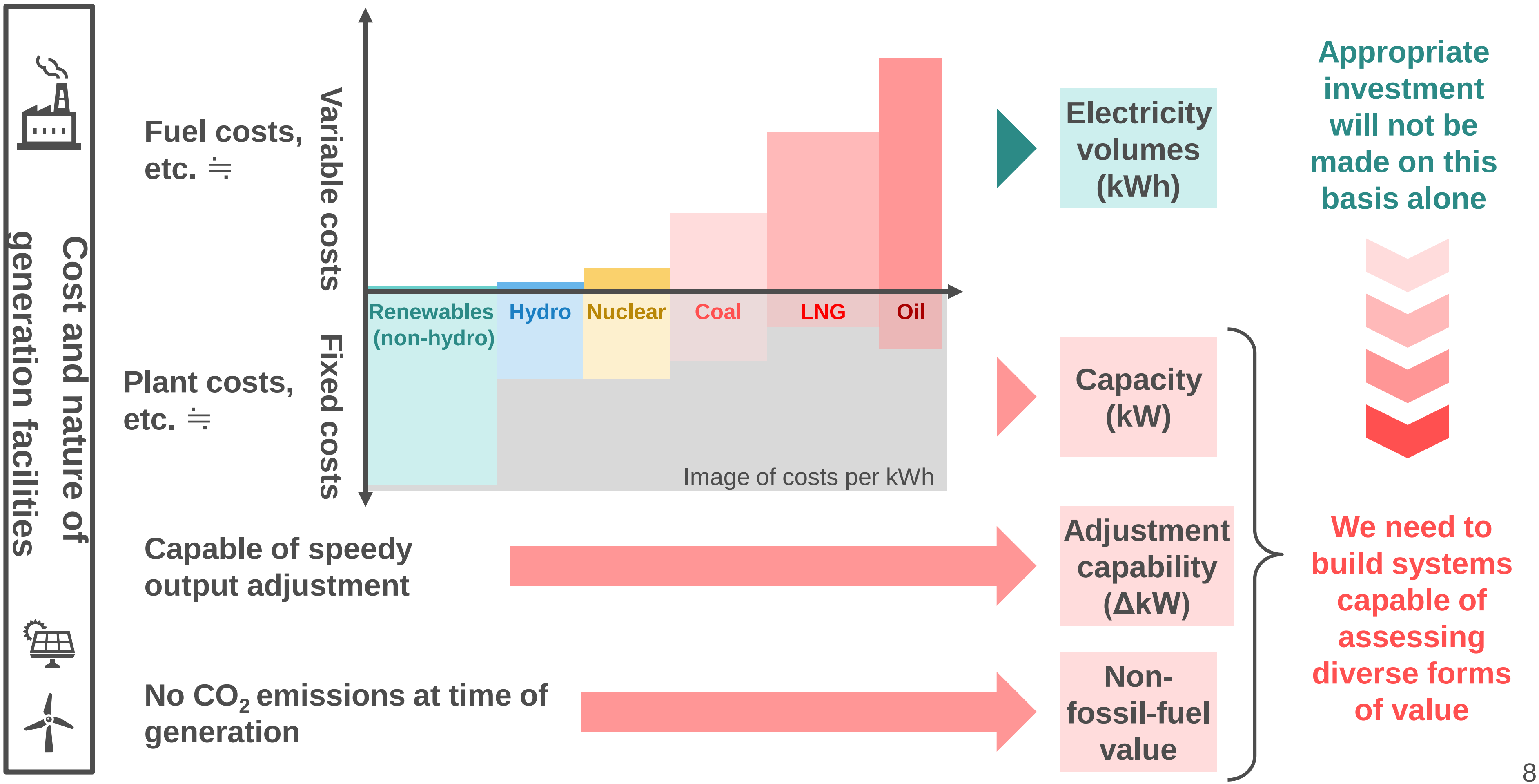
  ↓

  A grid code* should be developed, together with compliance mechanisms

*A grid code specifies technical requirements for connection to a transmission and distribution network to ensure stable supply (remote control capability, output adjustment capability, etc.)

Diverse Value of Power Generation

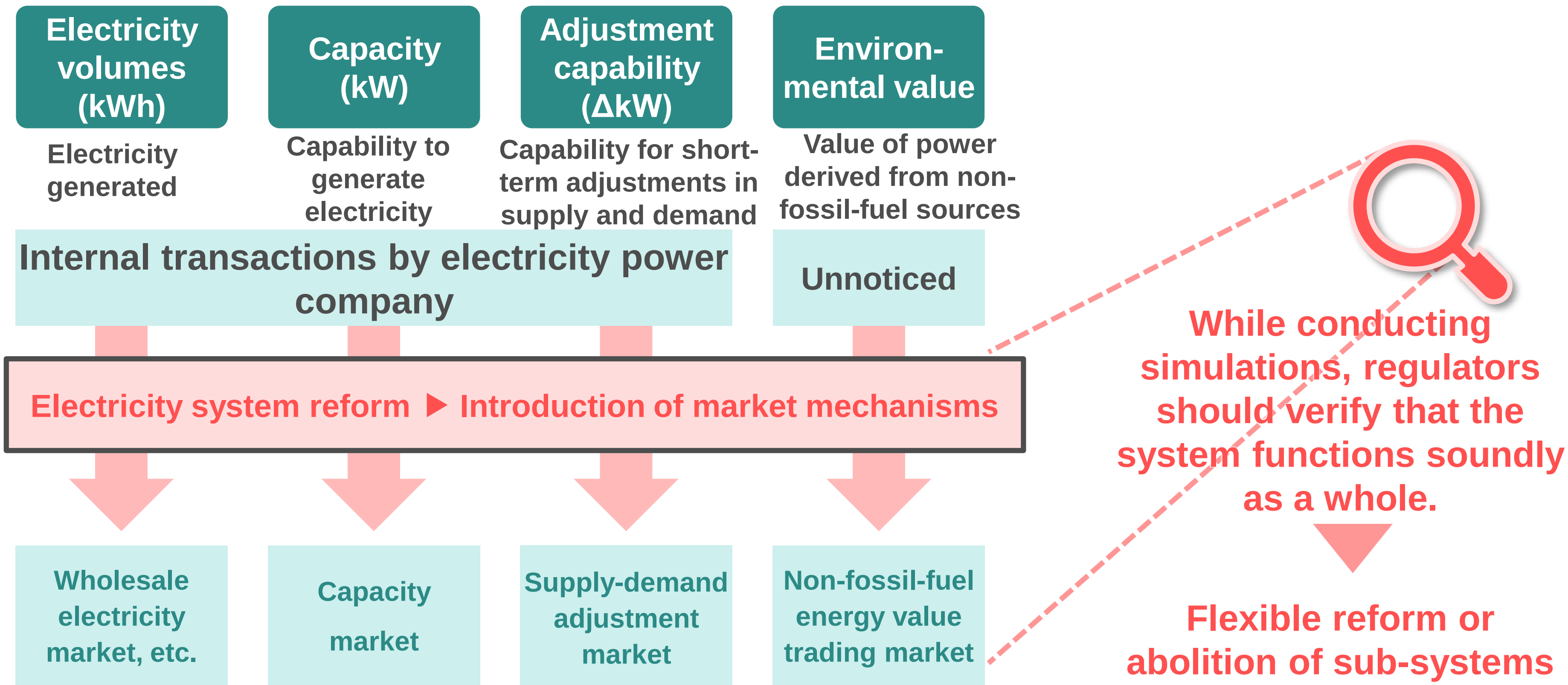
- Generation facilities provide value in terms of more than just electricity volumes (kWh).
- Mechanisms for assessing such value are required in order to encourage smooth investment in electricity generation.



Keidanren Policy & Action

Design and Verification of Wholesale Markets

- The government envisions subdividing the value of power generation and transacting each form of value on a separate new market.
- Various concerns exist over the design and operation of such new markets, and careful consideration is required.
- It will also be important to verify that each market and the system as a whole function soundly.



These markets need to be designed and operated while focusing on their contribution to both stimulating competition and addressing questions of common good.

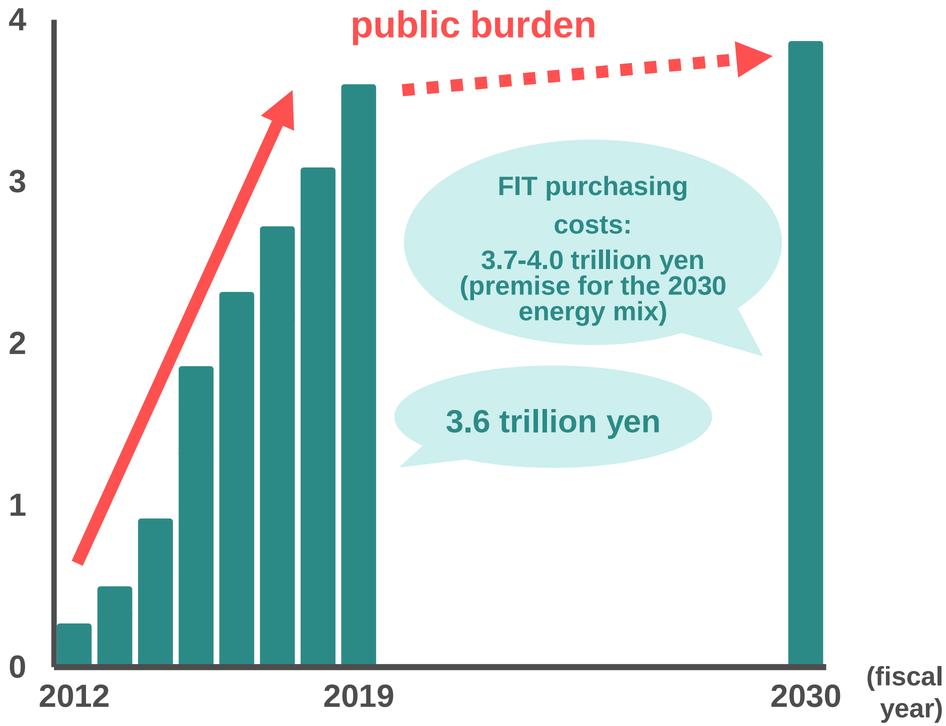
Keidanren Policy & Action

Turning Renewables into a Major Energy Source

- An appropriate business environment needs to be created with a view to turning renewables into a major energy source.
- The feed-in tariff (FIT)[1] scheme imposes a growing public burden, and urgently requires sweeping revision.
- One option is to use a feed-in premium (FIP)[2] scheme for portions of electricity generation that continue to require public subsidies.

1. FIT is a system of purchasing renewable energy at fixed prices.
2. FIP is a system of adding a certain level of premium to regular revenue from selling electricity at market prices.

Sweeping revision of the FIT scheme is essential to curb the public burden



Support should be examined based on the characteristics of each energy source

Solar and wind power	Move to subsidy-free market pricing of electricity as swiftly as possible
Hydro and geothermal power	Examine support for development and other measures to further expand introduction in the post-FIT era
Biomass power	Examine subsidies as part of agriculture and forestry policy and waste disposal policy

Keidanren
Policy & Action

Continuing Use of Nuclear Power

- Ensuring world-class safety levels is a prerequisite for utilization of nuclear power.
- Nuclear power is an essential source of energy for Japan and the world as a whole to secure stable future energy supply and pursue decarbonization.
- As well as swiftly and steadily working to restart existing nuclear plants, the government should include replacement and new facilities in its policies. A stable business environment and technology development are also crucial.

Creation of a stable business environment	Use of existing power plants	Future use of nuclear power
■ Foster public trust ■ Improve the environment for back-end operations ■ Review damage compensation systems (Ensure both swift, certain aid for victims and predictability for business)	■ Restart operations swiftly and steadily ■ Streamline regulations and speed up inspections ■ Conduct technical investigation of operational lifespan (treatment of plant downtime, extension of lifespan to more than 60 years)	■ Include replacement and new facilities in policies ■ Develop technologies for new types of reactor, etc.

Energy Storage Technology Development and Deployment

- Energy storage technologies are rapidly growing in importance with the expansion of variable renewable energy (VRE) sources.
- The government should promote development of technologies for storage batteries, hydrogen, etc., present a road map for reducing costs, and propose approaches for practical implementation throughout society.
- Energy storage technologies are deeply intertwined with industrial policy, especially for the transport sector. Measures should be put in place from a broad range of perspectives.

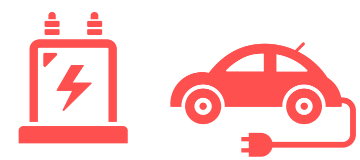
Stable supply of electricity is achieved by matching supply and demand

Issues with VRE sources

Surplus generation capacity at times of low demand

Frequent changes in output due to weather conditions, etc.

Resolve with energy storage technologies



Deeply intertwined with industrial policy beyond the electricity industry, e.g. transport industry

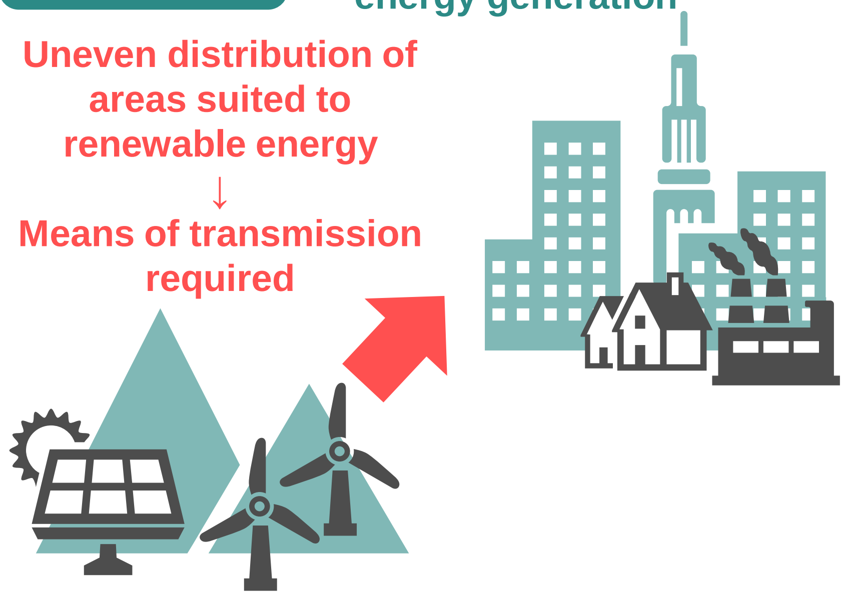
Measures should be put in place from a broad range of perspectives

Need for Next-Generation Electricity Networks

- Next-generation electricity networks will enable higher levels of S+3E and pursuit of 3D.
- Existing networks need to be progressively upgraded in the aim of moving ahead to the next generation.

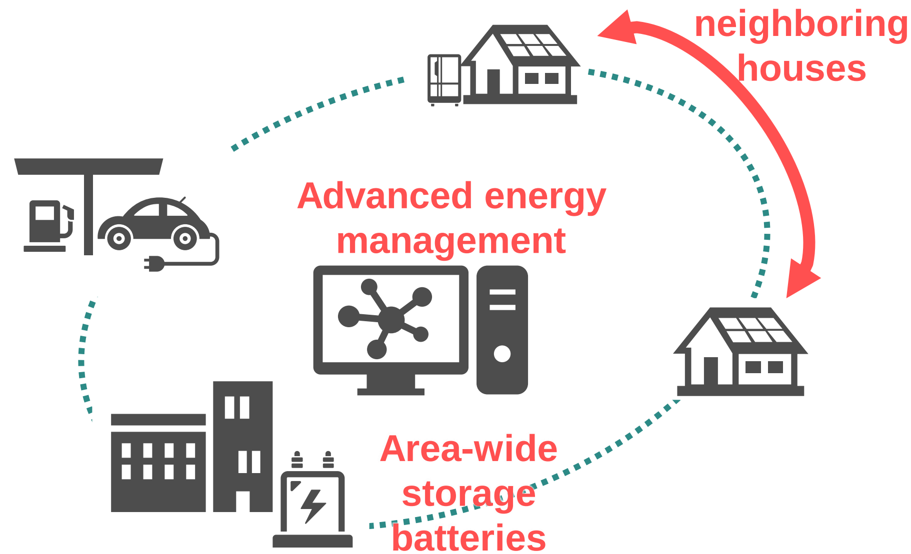
Transmission networks

Adapt to expansion of large-scale renewable energy generation



Distribution networks

Expand use of decentralized resources



Optimize transmission routes and expand capacity where necessary

Utilize digital technologies for demand forecasting, monitoring, and control driven by AI, IoT, etc.

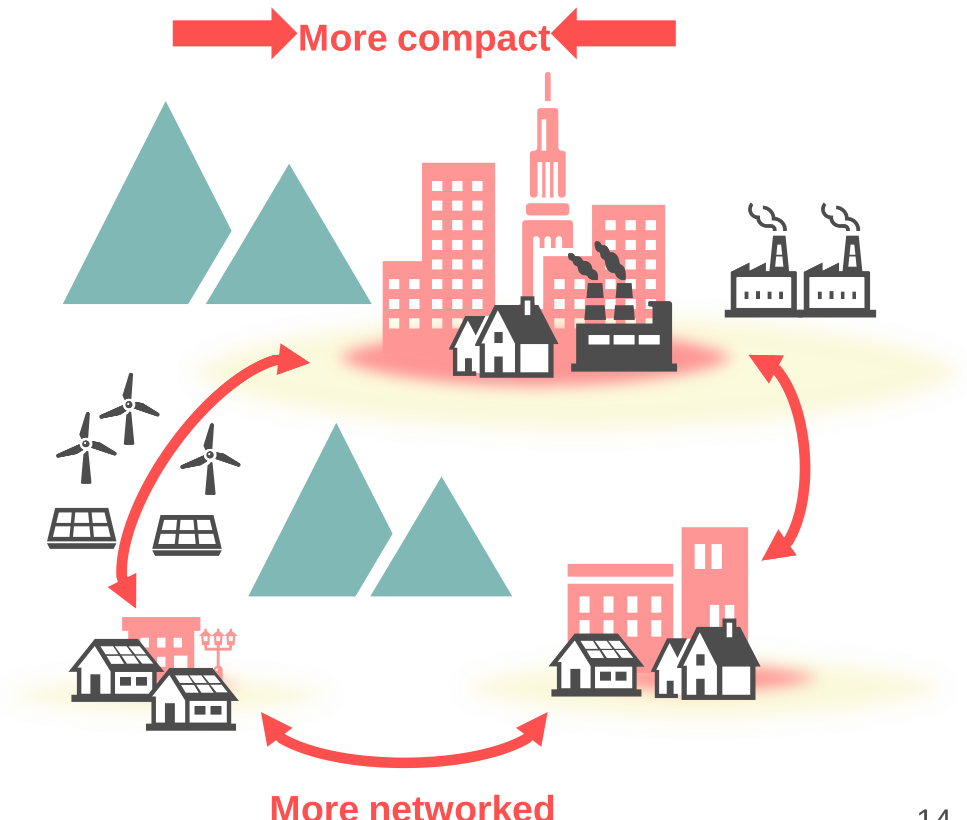
Upgrading Networks with a Balance between Social Benefit and Public Burden

Keidanren Policy & Action

- The cost required is the biggest issue in building next-generation electricity networks.
- Maximum use should first be made of existing facilities (e.g. Japanese version “Connect & Manage” scheme).
- Building networks will require data-based cost-benefit analysis.
- More compact and networked social infrastructure will also be vital.

Overseas cost-benefit analysis (Example from ENTSO-E in Europe)

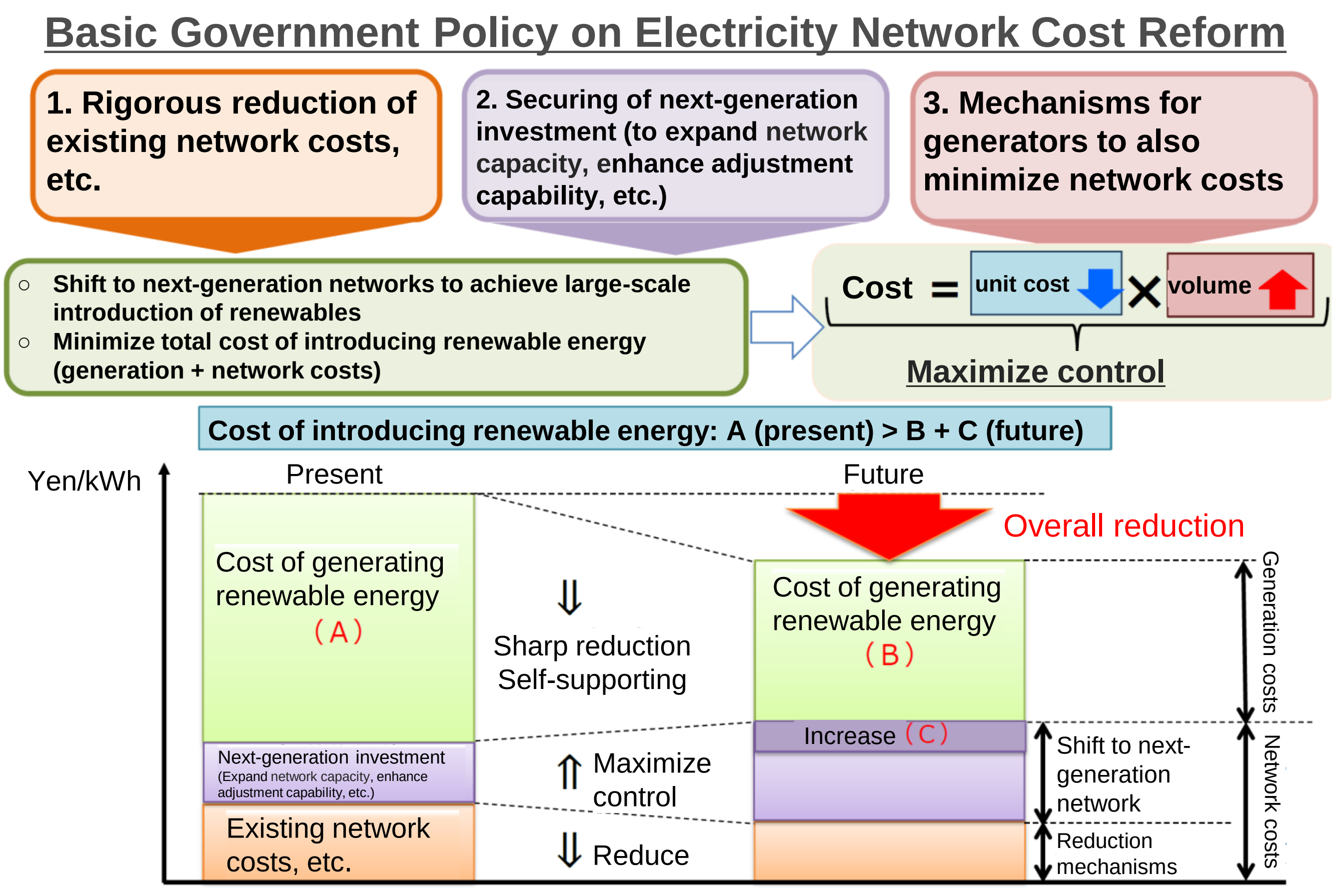
Costs	■ Project costs
Benefits	■ Contribution to stable supply ● Better balance between supply and demand ● Better network stability ■ Social and economic welfare ● Control of CO_2 emissions ● Reduction of fuel costs ■ Lower transmission losses



Keidanren Policy & Action

(For Reference) Government Policy on Network Costs

- From the perspective of building next-generation networks and expanding renewables while controlling public burden, government policy calls for reduction of total unit costs (renewable energy generation costs + network costs) below current levels.



Note: It will also be necessary to reduce the amount of network investment required through a Japanese version “Connect ＆ Manage” scheme, etc.

(Source: Interim Report of Subcommittee on Mass Introduction of Renewable Energy and Next-Generation Electricity Networks)

Keidanren Policy & Action

Wheeling Charge Systems

- Under current circumstances, medium- to long-term investment incentives hold little attraction for transmission and distribution businesses.
- Effective mechanisms to incentivize investment should be built into wheeling charge systems on the assumption of rigorously reducing existing network costs and maximizing the effectiveness of investment.

- Grid power demand not predicted to expand
- Rigid auditing and ex-post-facto assessment

Situation not conducive to investment decisions

Other (taxes, etc.)

Depreciation expenses

Repair costs

Personnel costs

Current wheeling charges

No incentives to invest built into charging systems

Example of wheeling charge system that has introduced investment incentives (UK RIIO model)

Total transmission and distribution business revenue

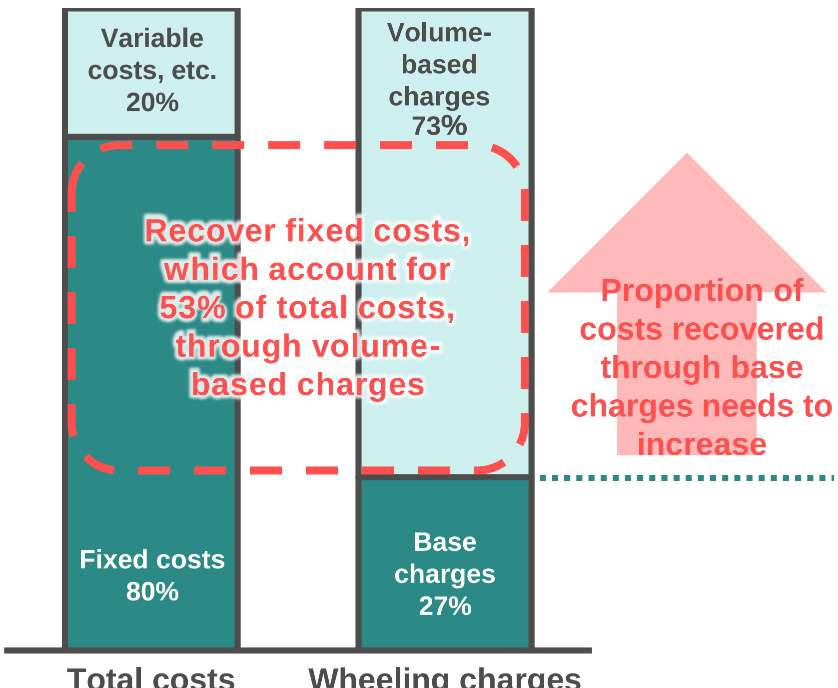
Adjustment for uncertainty	**Ensuring predictability** Adjustment according to changes in customer numbers, etc.
Investment in innovation	**Innovation** Funds for investment in new technology development
Performance incentive	**Stability and environmental responsibility** Remunerated according to achievement of targets
Basic revenue	**Economic efficiency** Regulatory authority adjusts amount based on overall costs, etc.

Keidanren Policy & Action

Burden of Funding Next-Generation Resources

- In the current situation, fixed costs of transmission and distribution infrastructure are largely recovered through volume-based user charges. Taking into account factors such as the shift towards decentralization, the proportion of wheeling charges recovered through base charges should be increased.
- Assuming appropriate consideration is given to governance, etc., it is not impossible to envision applying funding other than wheeling charges (e.g., FIT levies) to network construction. In doing so, it would be essential to compare potential outcomes with the scenario of funding next-generation networks solely through wheeling charges.

Risk that decline in grid power demand could impede recovery of investment in networks



(Prepared based on the interim report of the Working Group to Examine the Cost Burden of Maintaining and Operating the Transmission and Distribution Network)

Scenario where FIT levies are applied to development of next-generation networks that support a shift to renewables as a major electricity source

FIT scheme reforms and sound governance are prerequisites

Re-examine the way to share levy burden	Strictly adhere to upper limits which is the premise for the energy mix
Clarify gradual abatement of levies	Avoid unassessed sources of funding (through examination of charges, etc.)

Need to conduct careful comparison with scenario where next-generation networks are funded solely through wheeling charges

Finance

- In addition to means of recovering investment, financing measures also need to be examined.
- Certain provisions should be put in place to ensure uninterrupted financing of electricity infrastructure, especially adjustable electricity sources and transmission and distribution networks, which offer a high degree of public benefit.
  - For example, measures such as two-step loans* utilizing the Fiscal and Investment Loan Program (FILP) should be considered.
- Creation of an environment that attracts domestic and international capital, including ESG investment, will also be vital.

Electricity investment with a high degree of public benefit

	Investment in adjustable electricity sources	Investment in electricity networks
Recovery of investment (Under government consideration)	Capacity market, supply-demand adjustment market, etc.	Wheeling charge system, etc.
Financing (Needs to be examined)	Uncertainty of raising funds through financial markets ⇒ Need for stable, long-term financing methods	

*Two-step loans: Financing by a designated financial institution that has received long-term funds at low interest from the Japan Finance Corporation, which is able to take advantage of FILP.

Conclusion

Keidanren
Policy & Action

- No form of infrastructure can continue in use forever.
- In the current situation, electricity investment required for the future is being postponed, and constraining the present burden is bound to result in a future bill.
- The government needs to design appropriate systems and continually verify and revise them. The business community will actively participate in discussions to this end.

- The proposals presented in this document set out the direction that should be taken for the government to pursue higher levels of S+3E and accelerate 3D as part of this process.
- There is potential to revolutionize business models for the electricity sector and related industries in the future. Japan needs to develop an image of future electricity systems under multiple scenarios, envision the corresponding change of society, and examine measures required to achieve its goals.

- We hope that the entire country will work together to ensure strong and sound development of Japan's economy and society as a whole and bring Society 5.0 to fruition.

(For Reference) Key Courses of Action to Resolve Issues Set Out in This Proposal

Develop a specific vision for the electricity system

- In compiling the 6th Strategic Energy Plan, present multiple scenarios setting out specifics of electricity sources, networks, demand, public burden, etc. to develop a vision for the electricity system in beyond 2030. At the same time, conduct quantitative discussion in advisory councils and other public forums.
- Develop specific system plans and related policies based on a framework for periodic review of long-term scenarios.
- During the period until scenarios are drawn up, examine ways of creating an environment to develop crucial infrastructure for the future.

Ensure electricity demand

- Engage in public- and private-sector efforts to constantly improve energy intensity through energy-saving initiatives.
- To secure base demand by leveraging the attractions of electricity, respond to diverse demand-side needs (internationally competitive levels of electricity charges, value provided by high-quality, affordable renewable energy, etc.).

Secure investment in electricity generation

- Clarify allocation of responsibilities and authority in wholesale markets.
- Design and operate systems considering concerns over wholesale markets.
- Build mechanisms to control electricity volumes required for adjustment capability and appropriately allocate the burden of necessary costs.
- Formulate a future-proof grid code and establish mechanisms for ensuring compliance with it.
- Verify that the entire system functions soundly once wholesale markets have started operation, and review as required.
- Create a suitable business environment for renewable energy.
  - Solar and wind power: Achieve market sale of electricity independent of government subsidies as swiftly as possible.
  - Hydro and geothermal power: Examine measures to further expand introduction in the post-FIT era.
- Create a business environment conducive to nuclear energy (back-end operations, compensation systems, safety inspections and regulation, etc.) and promote technology development.
- Promote development of energy storage technologies such as storage batteries and hydrogen while maintaining an industrial policy perspective.

Secure investment in transmission and distribution

- Examine mechanisms to ensure system stability in an era of widespread introduction of variable renewable energy sources.
- Examine rules for data usage and handling of personal and business information.
- Build cost-effective next-generation networks based on cost-benefit analysis.
- Examine electricity supply according to need, without being bound by uniform national supply models.
- Reform wheeling charge systems (build in mechanisms to incentivize investment and raise proportion of costs recovered through base charges).

Secure finance

- Examine measures to deal with the impact of electricity system reforms on financing (e.g. prepare a two-step loan framework utilizing FILP as a means of raising funds for adjustable sources of electricity and transmission and distribution networks, including a safety-net role).