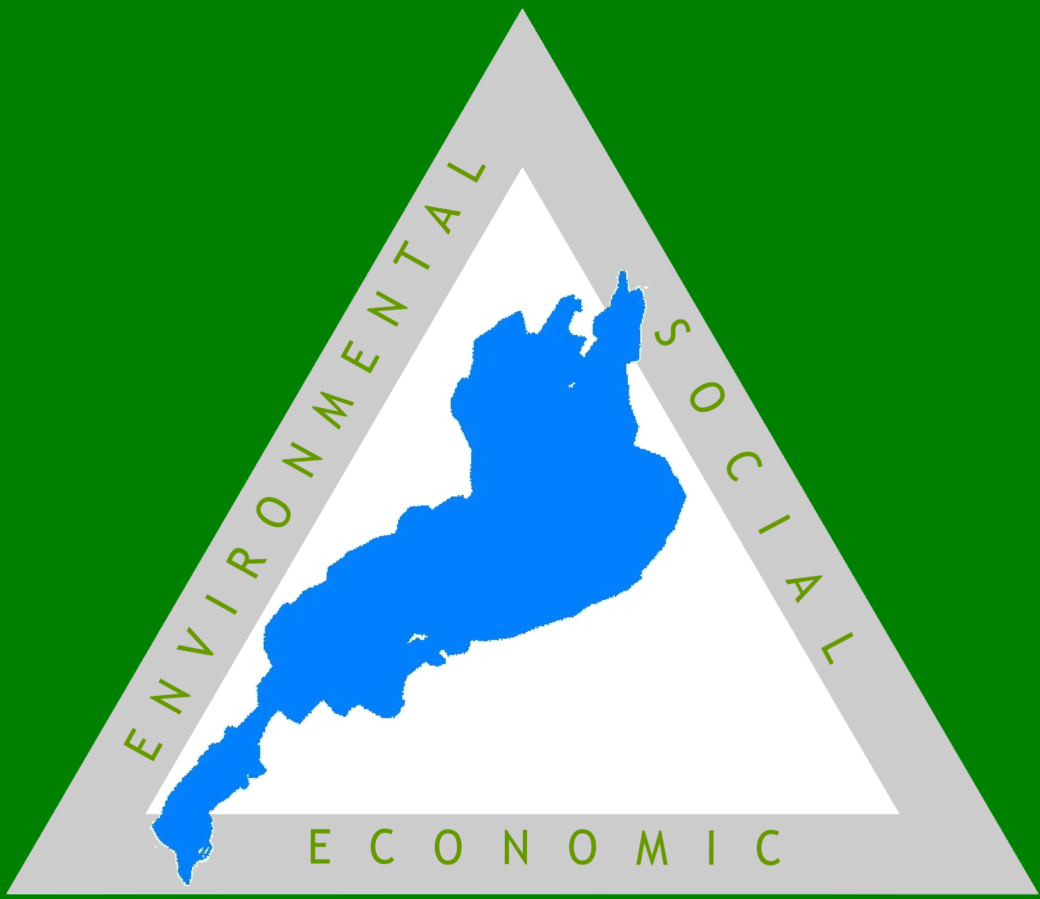
Shiga's scenario towards the realization of a sustainable society



Summary of a quantitative scenario study on the establishment of a sustainable society in Shiga Prefecture

Shiga Prefecture Sustainable Society Research Team

March 2007

To realize sustainable Shiga

Background of the need to shift to the sustainable society

Shiga Prefecture is facing various problems including the issue of water quality in Lake Biwa, our “Mother Lake.” While the proper treatment and disposal of the waste generated in the prefecture is a short term challenge, the course for the establishment of a recycling system based on a long term outlook is also still uncertain. The population growth due to the immigration of young generations and other factors as well as the solid performance of the manufacturing industry are increasing CO_2 emissions, and there is no doubt that they would keep increasing for a long term without tackling them.

We have prepared this booklet to stop such environmental trends. Based on future changes in our population and economy, it boldly illustrates the vision of sustainable Shiga in 2030 and lists the policies and measures necessary for the realization of it. The environmental indicators selected to represent sustainability include GHG (greenhouse gas) emissions and water quality, beauty of lake areas, the area of reed communities in Lake Biwa as well as the amount of landfill waste.

Urgent and decisive actions are needed

Our main conclusions are as follows:

If businesses in Shiga substitute production systems with less environmental impact for the existing ones, people adopt environmentally friendly lifestyle, and local governments, etc. implement decisive environment improvement projects, the following targets, which are set as our environmental targets for 2030, can be achieved:

- The reduction of GHG emissions by half (from the 1990 level);
- Recovery of water quality in Lake Biwa to the level in the decade from 1965;
- Recovery of the area of reed communities to the level in 1955;
- Doubling of the beautiful lake areas (from the 2000 level); and
- Reduction of landfill waste by 75% (from the 2000 level).

To achieve these targets, the design of a system to encourage the relevant parties to take actions and implement necessary projects should start immediately.

We expect that this proposal will help start full scale discussion of how Shiga should be sustainable involving all people of the prefecture. We also hope that our proposal triggers discussions of similar issues among other local autonomies and efforts to create sustainable communities spread to other regions.

March 2007

To compile this booklet, Shiga Prefecture Sustainable Society Research Team (Shiga SD 2030 Research Team), established under the Lake Biwa Environmental Research Institute, has worked for the information collection, estimation, analysis, examination, etc.

Contents

Environmental targets for 2030

To establish a scenario to create a sustainable society, we will firstly examine the environmental conditions that Shiga should achieve in 2030. Among the potential indicators for setting environmental targets, we have selected the establishment of a low carbon economy to tackle global warming (GHG emissions), the environment of Lake Biwa, the symbol of Shiga's local natural environment (water quality, area of reed communities, and beauty of lake areas), and the Establishment of a recycling system (amount of landfill waste). Although they are all important and difficult, it is necessary to meet these three targets at least at the same time in order to realize the "sustainable" environment.

Establishment of a low carbon economy

Global warming is one of the major global environmental challenges that human being face. The impacts expected from global warming include attack of more gigantic typhoons, more heavy rain and flooding events, rise in the sea level, and in some regions, more droughts. It is forecast that these impacts will cause serious damage to food production, cities and buildings, and human health, and the ecosystem will also be affected inevitably. It is believed that global warming is already being apparent due to the greenhouse gases emitted from human activities and has to be addressed immediately.

Kyoto Protocol entered into force in February 2005, which requires Japan to reduce GHG emissions by 6% below the 1990 level in the first commitment period (2008 to 2012). To meet the target, various plans and actions are underway at different levels in Japan. Shiga Prefecture has also established a target of reducing GHG emissions in 2010 by 9% below the 1990 level in the (revised) Global Warming Countermeasures Promotion Plan. However, it is claimed that much more drastic reduction is needed to avoid the risks of global warming. In the international discussion of required reduction levels, consensus is being built that it is necessary to limit the temperature rise to not more than 2^{o}C above the pre-industrial levels to stabilize the climate, as a target for avoiding serious damage. To meet this target, it is needed to reduce global GHG emissions by half from the 1990 level by the mid-21st century. Even the developed countries that have already met high emission standards are required to achieve further drastic emission reductions. Recent research has indicated that Japan has to reduce the emissions in 2050 by 60-80% below the 1990 level as its long term target. As a part of Japan, Shiga Prefecture will be also required to realize similar level of emission reductions. Then, we target to reduce GHG emissions in 2030 by half from the 1990 level. To stabilize the climate, it is necessary to make efforts at the global level over the time scales of decades to centuries. Still, the realization of a low carbon economy in Shiga in 2030 will show a model to the world and steadily contribute to leaving a livable global environment to next generations.

Reduction of GHG emissions by half

Revival of the Lake Biwa environment

The functions of Lake Biwa are various ranging from supply of water resources for Shiga and neighboring prefectures and the maintenance of the diverse ecosystem with many indigenous species to places for recreation and relaxation with beautiful landscape. People in Shiga have lived in harmony with Lake Biwa and enjoyed such blessings of the lake since the ancient times. However, due to recent changes in land use, industrial activities, and lifestyle in the surrounding area, abnormal conditions such as the generation of red tides and water blooms, and decrease of indigenous fish and nesting waterfowl have been becoming routine in the lake, and there is also a concern about the deterioration of the landscape in lake areas because of the transformation of the lakeshores. No sign of improvement has been seen in the declining functions of the lake yet.

We set the rehabilitation of the environment to the level where these original functions can be fully fulfilled by 2030 as the target for the environment of Lake Biwa. Specific goals are as follows:

Reduction of pollutant load flows into the lake by half for the conservation of water quality

Doubling of the area of reed communities for the restoration of the lakeshore ecosystem

Doubling of the beautiful lake areas for the conservation of the landscape

(1) For the supply of water resources, we will seek to restore the water quality to the level before the generation of red tides and water blooms in northern part of the lake (water quality in the decade from 1965: COD 1.7mg/l). This requires the pollutant load flows into Lake Biwa to be reduced by half.

(2) For the maintenance of the diverse ecosystem, habitats and spawning/nesting sites are essential. We will seek to restore reed communities on the lakeshores, which are the most important sources of them, to double the area to the level around the year 1955.

(3) As areas around the lake (lake areas) are an indispensable component of the original landscape of Lake Biwa, we set the doubling of the beautiful lake areas as the target for the conservation of landscape.

Sustainable Shiga will meet these targets are met and improve the various functions of Lake Biwa simultaneously. This means that the drastic improvement of the water quality will result in the elimination of abnormal conditions such as the generation of red tides and water blooms as well as the improved quality of the source of drinking water. People in not only Shiga but also other Kansai regions can enjoy these blessings. The restoration of habitats represented by reed communities in lake areas will diversify indigenous species and nesting waterfowl in the lake and increase their population, which will also lead to the recovery of the original scenery of Lake Biwa symbolized by flourishing fishery and wild geese alighting at Katata. In addition, natural lakeshores and traditional townscape will be revived in lake areas, and the beautiful landscape, which used to be admired as “Ohmi Hakkei (eight most beautiful scenes in the southern part of Lake Biwa),” will be restored as a symbol of the society where nature and human beings really coexist.

Establishment of a recycling system

Reduction of landfill waste by 75%

In the conventional mass consumption society, people have bought foods, clothes, electronic goods, and houses they like and disposed of them as garbage when they are no longer in use. Meanwhile, businesses have generated a large amount of waste in manufacturing processes. Landfill sites have been steadily filled with such waste, and new sites have been sought before old ones are completely filled. But, it will be impossible to continue such practices. While waste is inevitably generated as long as people live, the securing of landfill sites in the land of Shiga with rich nature faces restrictions from various aspects and will be even more difficult in future.

To establish a favorable recycling system in Shiga, it is necessary to reduce waste generation as well as to establish a system to recycle waste as resources in order to extend the life of the existing landfill sites as long as possible. The Waste Disposal Plan of Shiga Prefecture formulated in June 2006 targets the reduction of the amount of landfill municipal waste and industrial waste to a half and a third respectively in 2010 from the 1997 level. Nevertheless, it is desirable to reduce landfill waste close to zero in the long term when the current status of the landfill sites is considered. Here, we set a target of reducing landfill waste in 2030 to a fourth of the 2000 level (or a fifth of the 1997 level) and draw a vision of the recycling system to be achieved based on the target.

Proposal for meeting the environmental targets

In order to meet the "Environmental targets for 2030" mentioned in the preceding chapter, it is necessary to find a path to maintain healthy activities under strict environmental restrictions based on mutual support between "citizen," "businesses," and "local governments, etc." This path will be narrow and tough but it will not be impossible to clear the path with decisive policies. In the following, we propose the efforts and actions required for these three players and policies needed for them.

Efforts and actions to be taken by the players

Businesses

The manufacturing industry is expected to continuously account for huge part of Shiga's gross product with robust exports to outside the prefecture in 2030, and the environmental impact of the sector will be still large. Thus, its role in meeting the environmental targets is extremely important and the sector is required to make the following efforts to promote the establishment of a more environmentally friendly production system:

・Introduction of high efficiency production equipment: improvement of the total efficiency by 22%;
・Switching of fuel for production: increase in the share of natural gas from 8.6% (2000) to 26.8% (2030);
・Reduction of water pollutant load factor by 50%;
・Increase in the ratio of valuable industrial waste sold by 10%;
・Increase in the ratio of recycled industrial waste: e.g. ratio of recycled waste plastics/rubber from 76% (2004) to 94% (2030);
・More efficient logistics: reduction of transport volume per production by 30%;
・Modal shift: substitution of railway transport for freight for 50% of road transport to distant prefectures; and
・Introduction of biomass fuel to freight vehicles: penetration rate of 10%.

The primary industry (agriculture, forestry, and fishery) is assumed to grow dramatically due to the penetration of "Made in Shiga" brands and demand expansion based on local production for local consumption although its share in Shiga's gross product is small. This sector especially represents a large proportion in terms of the generation of pollutants causing water quality impairments, and for the achievement of the environmental targets, further promotion of environmentally friendly agricultural practices including the following efforts are required:

・Improvement of farming methods: reduction of fertilizer application by all farmers; 100% return of animal waste to farms; and repetitive use of effluent in 50% of rice fields.

Although having occupied a smaller proportion of Shiga's gross product in comparison with the national average in the past, the service industry is presumed to grow dramatically by 2030, and environmental measures in this sector will also play a crucial part in meeting the targets. Specifically, the following efforts should be promoted among others:

・Introduction of high efficiency business equipment: improvement of total efficiency by 40%;
・Use of heat insulating buildings for business: compliance with the heat insulation standard for energy saving buildings in 90% of buildings;
・Use of renewable energy in business buildings: introduction of photovoltaic power generation in 50% of buildings and biomass heating in 10%; and
・Environmentally friendly business activities: 100% implementation of energy saving actions.

Citizen

The number of households in Shiga Prefecture is estimated to keep growing until 2030, which would result in dramatic increases in energy consumption and the generation of water pollutants and waste in households if no countermeasures were taken. It is also expected that more women and elderly people will have driving licenses and CO_2 and other emissions from passenger vehicles will greatly increase. Thus, the following efforts and actions are required among others:

- Introduction of high efficiency equipment: improvement of total efficiency by 40%;
- Use of heat insulating buildings: compliance with the next-generation heat insulation standard in 90% of buildings;
- Use of renewable energy in houses: introduction of photovoltaic power generation in 20% of houses, solar hot water system in 20%, biomass heating in 10%, and passive solar in 10%;
- Penetration of fuel-efficient passenger vehicles: increase in average fuel efficiency by 60% (share of hybrid vehicles: 90%);
- Introduction of biomass fuel for passenger vehicles: penetration rate of 10%; and
- Environmentally friendly actions:
  100% implementation of energy saving actions, increased share of railway transport from 23% (2000) to 36% (2030), increased share of walking and bicycles from 6% (2000) to 16% (2030), 100% implementation of kitchen management, 50% implementation of reuse of bathwater and rainwater, and recycling of municipal waste 500g per day and person.

These environmentally friendly actions will be facilitated by the increases in time for social activities and leisure expected in 2030.

Local governments, etc.

To meet the environmental targets, local governments, etc. will promote the following projects in organic cooperation with relevant agencies:

- Maintenance of forests: proper thinning, etc. in all plantation sites (42% of forest area);
- Formation of compact cities: reduction of average distance of intra-city travel by 25%, and conversion of unused space to green zone 20%;
- Development and maintenance of sewage systems and reception of industrial effluent: 96% coverage of sewage, and reception of 100% of industrial effluent;
- Measures for drainage in urban area: retention and infiltration of 30% of rainwater on building sites, and greening of 20% of roof area;
- Measures for drainage in urban area: cleaning of 50% of road surface and drainage, and permeable paving of 20% of road;
- Urban area effluent purification facilities: purification of 30% of the effluent not covered by the above measures for drainage in urban area;
- Measures for rivers, etc.: direct purification of river water (vegetation purification, contact purification, etc.), and dredging;
- Planting of reeds: increase in the area to 260 ha including existing communities; and
- Development of beautiful lake areas: removal of concrete and wave-dissipating blocks from lakeshores and creation of lakeshores with natural stones and sand.

Policies to promote the efforts and actions

The policies to promote the above-mentioned efforts and actions required for the relevant players include the followings, and it is necessary to start the design of the systems and the analysis of the effects, etc.

- Policies to reduce the environmental impact of business activities:
  Voluntary environmental action plans, environmental conservation agreements with local governments, etc., tax systems to reflect environmental impact, regulations on environmental impact, environmental performance standards, subsidy schemes for advanced efforts, and low interest loans to environmental in vestment
- Policies to reduce the environmental impact of people's activities:
  Enlightenment and education, environmental performance standards, subsidy schemes for advanced efforts, and low interest loans to environmental investment
- Policies to promote environmental projects of local governments, etc.
  Use of tax revenue according to environmental impact, and regulations on land use and construction

Main efforts and actions required for the respective players to achieve different environmental targets

	Realization of a low carbon economy	Rehabilitation of the environment of Lake Biwa	Establishment of a recycling system
Businesses	Introduction of high efficiency production equipment Fuel switching in manufacturing and transportation More efficient logistics and modal shift	Reduction of water pollutant loads per production value	Recycling of waste Development of efficient recycling plants
Citizen	Environmentally friendly houses Penetration of fuel-efficient passenger vehicles Energy saving actions Use of railway, bicycles, and walking	Kitchen management Reuse of bathwater and rainwater	Control of municipal waste generation through the use of rented and leased goods Separation and recycling of domestic waste
Local governments, etc.	Maintenance of forests formation of compact cities Encouragement of modal shift	Development of sewage systems and reception of industrial effluent Measures for drainage in urban Direct purification of river water and dredging Conversion to natural lakeshores	Establishment of a system for the reuse and recycling of municipal waste Establishment of efficient recycling routes

Proposal of the tri-parties beneficial policy model

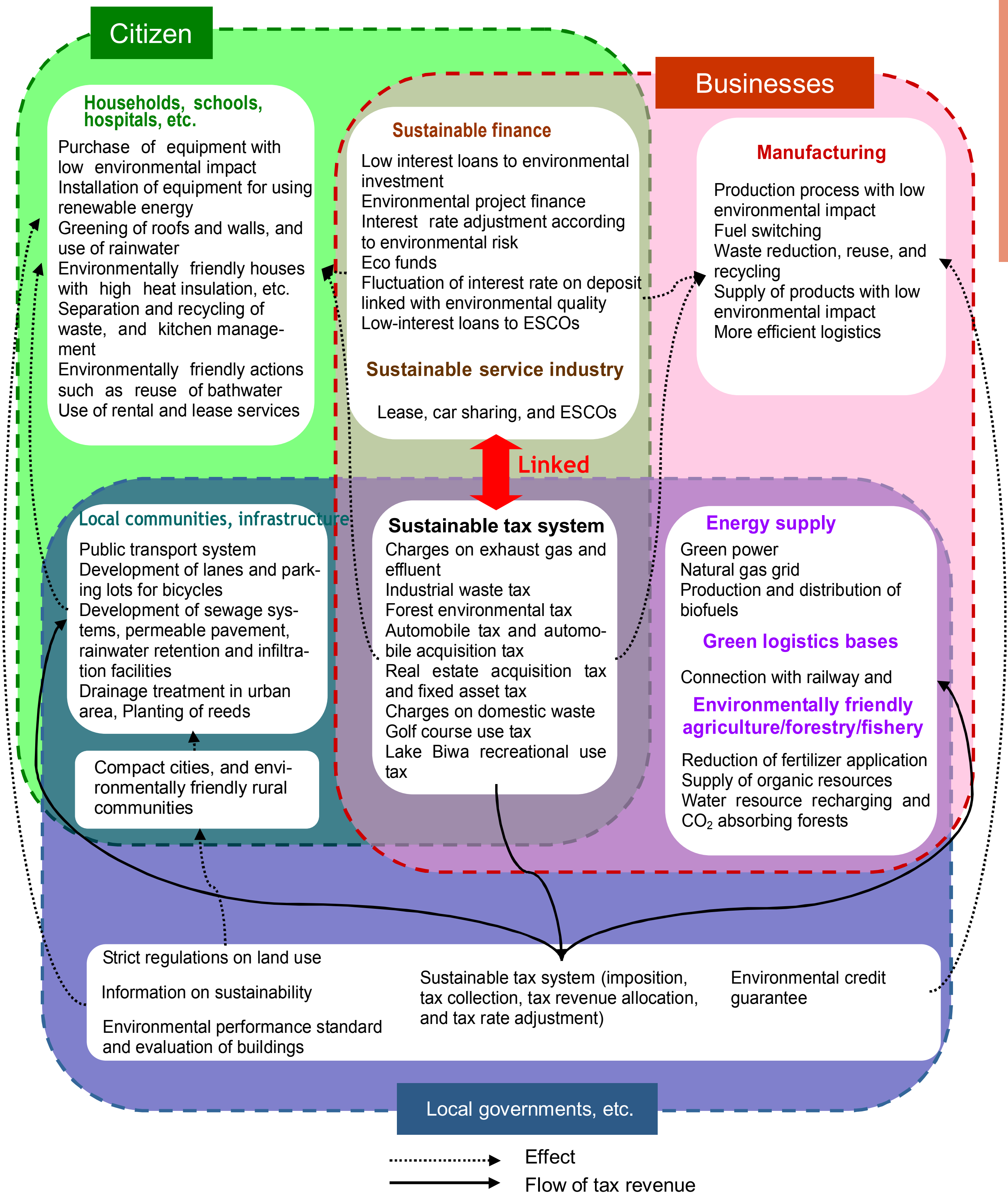
The tri-parties beneficial policy model is a mechanism where the three parties of businesses, citizen, and local governments, etc. share not only environmental benefits but also economic gains, and “sustainable tax system” and “sustainable finance” will play the pivotal roles in the mechanism. They also serve as tools for promotion and control for the parties, and may be used cooperatively to have synergic effects.

The sustainable tax system will involve the greening and expansion of existing taxes such as automobile tax and automobile acquisition tax, industrial waste tax, charges on domestic waste, forest environmental tax, golf course use tax, real estate acquisition tax, and fixed asset tax as well as the establishment of new taxes such as charges on exhaust gas and effluent and Lake Biwa recreational use tax. The tax system will operate these taxes in an integrated manner to encourage relevant parties to change their behavior towards the establishment of a sustainable society and use the tax revenue as sources for the development of sustainable infrastructure. Special depreciation and deduction schemes for environmental investment by companies, etc. will be also operated as part of this tax system.

Sustainable finance consists of low-interest loans to environmental investment, environmental project finance, loan decision and interest rate adjustment based on environmental risk, eco funds, interest rate on term deposit linked with environmental quality, and loans to domestic ESCOs (energy service companies). Some of them are already in operation or under consideration at financial institutions in Shiga ahead of other prefectures in Japan, and they will contribute to the further enhancement of environmental investment by companies and environmental awareness among people in the prefecture. The environmental credit guarantee program for small and medium-sized enterprises by public agencies is another important policy to support this financial scheme.

Although not included in the figure, the emissions trading system with the proper allocation of emission allowances to individual entities in the prefecture is also an effective and efficient program and should be continuously considered as the third pillar of the tri-parties beneficial system package.

Tri-parties beneficial policy model



Shiga's socioeconomic assumption in 2030

Dominant social trends in 2030

Shiga's socioeconomic vision in 2030 can be characterized by the following three major trends:
(1) Return of the population to the current level and progress of aging;
(2) Mature economic growth and dramatic increase in the role of the tertiary industry; and
(3) Increase in the proportion of women and elderly people in employment.
However, these changes are expected to differ naturally between different regions in the prefecture. Based on the overview of the whole prefecture as well as rough division of characteristics between cities and rural villages, the future vision can be described as follows:

Powerful cities and industries maintaining intra-prefectural and inter-prefectural connections

The urban population continues to increase due to the settlement of young people and moves from other prefectures. The service industry greatly grows and provides jobs. Among the industry, real estate, transportation, communications, tourism, and rental sectors as well as finance, which support investment and financing for these areas, play pivotal roles. While many residents of cities live in mid-to-high-rise housing in function-intensive cities, they will participate in local traditional activities in Shiga, and communities and lifestyles integrating both old and new generations will be formed. Daily shopping and amusement do not depend on large suburban shopping malls but people use shopping avenues around railway stations and in downtown areas, which helps urban centers regain vitality. As even elderly people have employment offers and many women have jobs, service sectors such as housekeeping, child care, education, adult education, healthcare, welfare, and nursing care play major parts in the local economy and society, and it is also important for local communities to supplement these functions. Such communities have another crucial function of providing places for cultural leisure activities for people in both urban and rural areas.

Beautiful rural villages maintaining nature and landscape

Despite the dramatic decrease in population size and aging, the primary industry greatly grows in a large-scale and multi-functional style, supported by the entry of corporations. The sector contributes to the supply of foods and woods (Shiga brand products) to the market in the prefecture as well as the recharge of water resources, maintenance and enhancement of carbon sinks, supply of biomass energy, and the promotion of eco-tourism. Furthermore, village development in harmony with nature progresses as a model for the sustainable society, and the vil-

Specific assumptions

Population	1.38 million in 2030 (estimated by Shiga Prefecture in 2006; similar level to the population in 2005)
No. of households	520,000 households in 2030 (same as above; 470,000 households in 2005)
National economy	Per capita GDP: approximately 0.9% of annual growth
Public fixed capital formation	Investment in infrastructure development, etc. After basic infrastructure development has been completed, new development is dramatically reduced and capital investment is placed mainly on maintenance and management. Total investment is lower than the current level.
Breakdown of private consumption expenditure	Breakdown of the goods and services consumed mainly in households. With longer-life products, the value of purchased goods remains unchanged. It is assumed that the shares of spending for the primary industry and personal services (education, healthcare and insurance, accommodation, etc.) increase.
Employment rate	Through the development of the welfare environment to facilitate the employment of elderly people and women, the employment rate of elderly males rises by 20% and the rate of women by 10 to 30%.
Time budget	The working hours of male workers are reduced by 1.5 hours per day. It is assumed that both men and women increase time for participating in social activities.
Breakdown of exports	The breakdown of goods and services delivered from Shiga to outside the prefecture. The exports of products in the manufacturing industry are assumed to remain unchanged in monetary terms.
Import ratio	The ratio of the goods and services produced outside Shiga Prefecture in the demands for goods and services in the prefecture. The import ratio of goods in the primary industry declines, but imports of other goods and services increase.
Input coefficient	The input of raw materials needed for the production of one unit in a certain industry. It is assumed that this figure declines due to paperless operations based on the use of IT, less input of metal and cement and increase of wood products in public projects, and reduced consumption of fuel and electricity as a result of energy saving.
Labor productivity	To maintain an annual economic growth of 0.9% while the population is decreasing, it is necessary to secure high labor productivity. Labor productivity per person-hour rises by 2.7% per annum in the manufacturing industry and by 1.6% in the service industry.

The amount of environmental impact is closely related with the social and economic conditions of that time. Therefore, we have estimated various aspects of Shiga such as demands for goods based on certain assumptions on the direction of social development until 2030. As the future situation including changes in population and economic growth is uncertain, what we present here is only assumption.

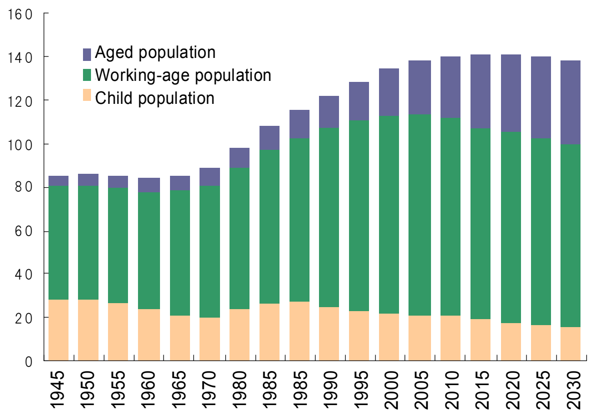
lages serve as sources of leisure, welfare, nursing care, and education by use of blessings of nature through exchanges with people in urban area.

Population and number of households

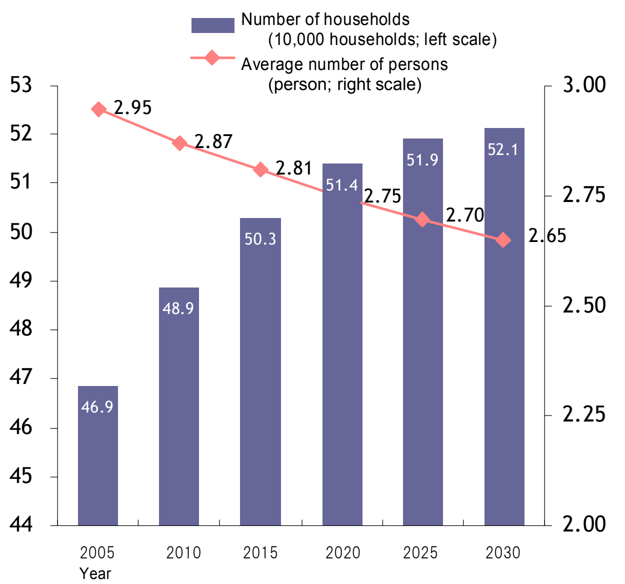
According to the figures of the population estimated by Shiga Prefecture in 2006, the total population is expected to take a downward turn around 2017 and fall to 1.38 million in 2030 (similar to the level in 2005). It is forecast that, while the population will continue to grow in Otsu and urban areas in southern Shiga, the other parts will have population decline. In the population composition, because of the low birthrate and aging, the ratio of working-age population (15 to 65 years old) will decline from 67% (2005) to 60% (2030) and the group of 65 years or older will increase the ratio from 18% to 28%. The percentage of elderly population will be especially high in northern and western Shiga. The number of households is estimated to grow from 470,000 in 2005 to 520,000 in 2030 due to the increase of single-person households.

Age pyramid in Shiga Prefecture

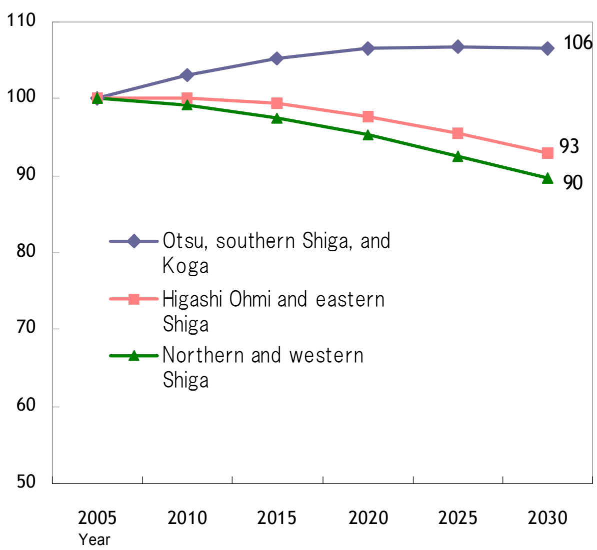
Population of three age groups by year



Number of households and average number of persons per household



Population index in different regions of the prefecture (Year 2005=100)



Macro economy

The estimate performed by our research team based on a macroeconomic model shows that the (real) gross product in Shiga Prefecture in 2030 will be approximately 7,677 billion yen, 30% higher than the results in 2002. Shiga's economy depends heavily on exports because of the structure, and this estimate also draws the picture as a mature economy in consideration of an assumption on the economic growth of Japan as a whole (annual per capita GDP growth of approximately 0.9%).

Industrial structure

We have conducted an input-output analysis based on final demands in the macro economy and estimated the industrial structure in Shiga Prefecture. While the secondary industry in the prefecture is characteristically large in scale, it will decrease the production slightly and also lose the share from 62.3% (2000) to 48.2% (2030). On the other hand, the share of the tertiary industry will grow dramatically from 36.9% (2000) to 47.6% (2030). The share of the primary industry is forecast to increase from 0.8% (2000) to approximately 4.2% (2030).

Macroeconomic indicators (billion yen)

	2002	2030	2030/	Average growth rate
Real GDP of Shiga Prefecture	5884	7677	1.30	0.95%
Per capita (10,000 yen)	433	556	1.28	0.90%
Real private consumption expenditure	2541	3145	1.24	0.76%
Real housing investment	245	285	1.16	0.53%
Real exports	6004	8132	1.35	1.09%
Real imports	5183	7162	1.38	1.16%
Real private capital investment	782	1098	1.40	1.22%
Real public consumption	877	1617	1.84	2.21%
Real public fixed capital formation	433	339	0.78	-0.87%

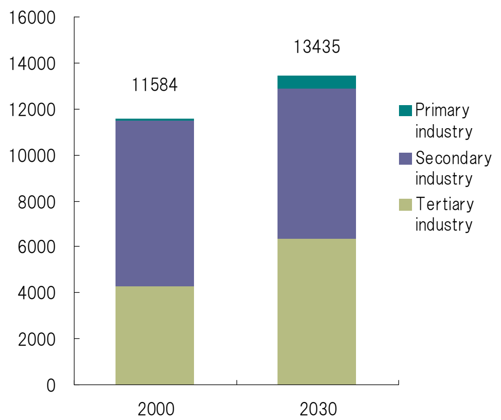
As the share of the manufacturing industry is large in the industrial structure of Shiga Prefecture, the exports account for a high proportion of the final demands. Therefore, the industry largely depends on the economic trend of Japan as a whole. Based on the assumption that per capita GDP in Japan will grow by 0.87% until 2030, we have estimated that annual per capita GDP growth will be 0.90% in Shiga.

Furthermore, we have estimated production by industry in further detail with an input-output analysis. Based on assumptions that the service sector grows and the food self-sufficiency ratio in the prefecture increases (about 50% in monetary terms including intermediate input) because of local production for local consumption, etc. at the same time, we have estimated that the shares of the primary and tertiary industries will grow and that of the secondary industry will decline in the production in 2030.

Production by industry

	Production (billion yen)		Share in the total production	
	2000	2030	2000	2030
Primary industry	95	564	0.8%	4.2%
Agriculture and forestry	90	531	0.8%	4.0%
Fishery	6	33	0.0%	0.2%
Secondary industry	7220	6470	62.3%	48.2%
Mining	22	10	0.2%	0.1%
Construction	938	985	8.1%	7.3%
Manufacturing	6260	5475	54.0%	40.7%
Tertiary industry	4269	6401	36.9%	47.6%
Utilities (electricity, gas, heat, and water)	102	116	0.9%	0.9%
Transportation and communications	532	1002	4.6%	7.5%
Wholesale/retail and restaurants	541	637	4.7%	4.7%
Finance and insurance	314	593	2.7%	4.4%
Real estate	657	708	5.7%	5.3%
Service	1739	2612	15.0%	19.4%
Public duties	335	658	2.9%	4.9%
Unclassifiable	50	74	0.4%	0.5%
Total	11584	13435		

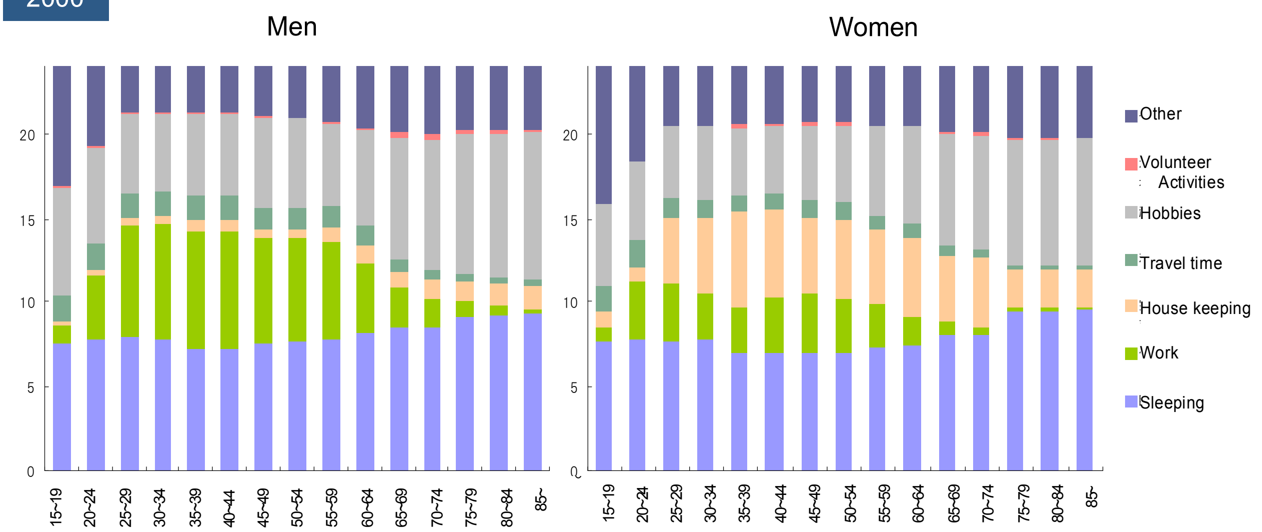
Production by industry (billion yen)



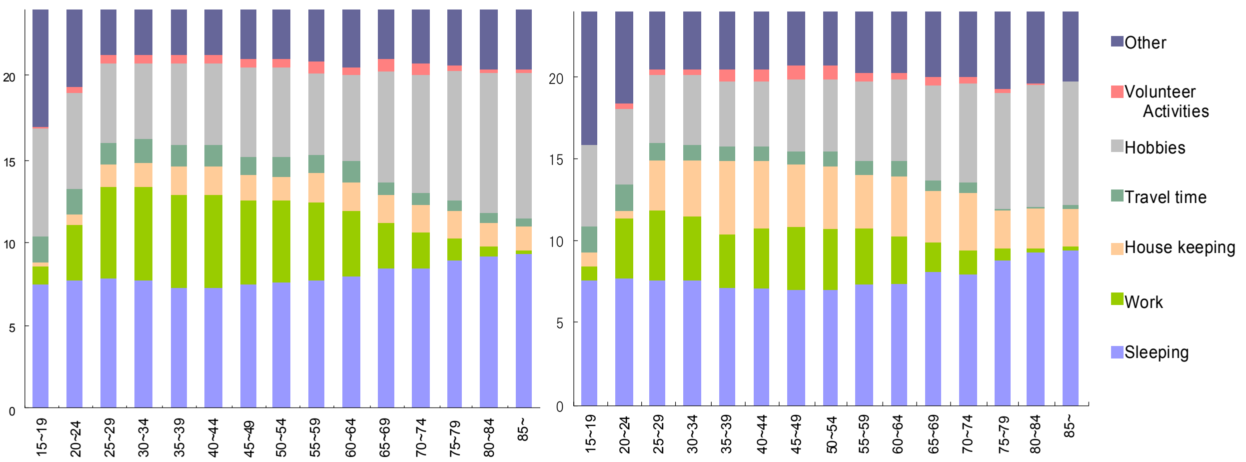
Time budget

It is estimated that men will spend less time working (from 7.0 hours to 5.6 hours among the group of 30 to 44 years old) and more time doing housekeeping (from 0.8 hours to 1.7 hours among the group of 35 to 39 years old) while women will spend more time working (from 2.9 hours to 3.6 hours among the group of 30 to 44 years old) and less time doing housekeeping (from 5.8 hours to 4.4 hours among the group of 35 to 39 years old). In the society as a whole, it is expected to spend more time for leisure and local activities with the increase in elderly population as one of the reasons.

2000



2030



The graphs above show how people in Shiga spend 24 hours by gender and age group. The figures in 2000 are based on the Survey of Time Use and Leisure Activities conducted by national government of Japan, and those in 2030 are estimates in this research. The lime green areas represent working hours, which reflect the increases in the labor participation rate of women and elderly people. The time for voluntary activities and social participation activities, presented in bisque color, will increase by around 30 minutes per day on average, which is equivalent to participating in 8-hour activities for about 24 days in a year.

Scenario towards a sustainable society

Realization of a low carbon economy

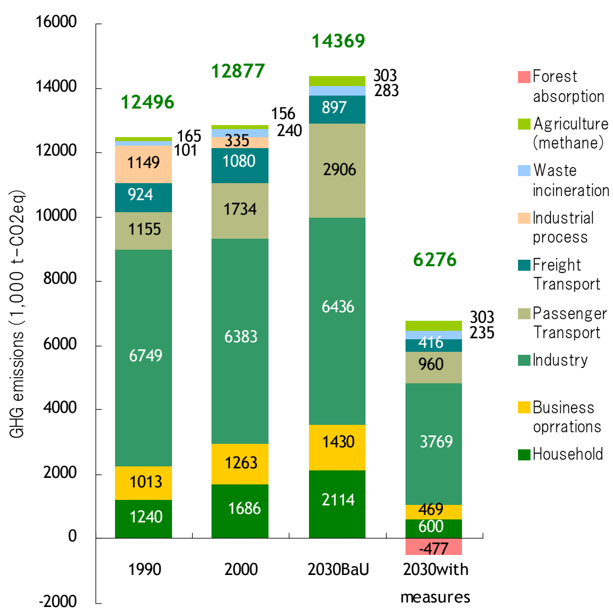
Current status and trends of GHG emissions

Our target is to reduce GHG emissions by 50% below the 1990 level. CO_2 emissions from energy use, the dominant source of greenhouse gases in Shiga Prefecture, were 11.1 million tons of CO_2 in 1990 and increased by 10% to 12.1 million tons of CO_2 in 2000. Without measures taken for emission control, the emissions are estimated to grow to 13.8 million tons of CO_2 in 2030, equivalent to approximately 20% higher than the 1990 level. Among the whole GHG emissions, the share of CO_2 emissions from industrial processes will decline due to changes in the industrial structure of Shiga.

Changes in amount of activities

This research has classified energy consuming sectors into the five categories of households, business operations (such as shops and offices), industry (meaning factories and similar sites here), passenger transport, and freight transport. The indicator to quantitatively represent each activity level is referred to as amount of activities, and this analysis presents the amount of activities of households in the number of households, business operations in the floor area of business buildings, industry in the production of the primary and secondary industries, and both passenger and freight transport in transport volume (person-km and ton-km, re-

GHG emissions by sector



The figure above shows GHG emissions in 1990, 2000, and 2030 with and without measures. BaU stands for “Business as Usual” and represents the case where no additional measures were taken to reduce CO_2 emissions.

It is clear that the industrial sector accounts for a large proportion in any cases. This is because of the major presence of the secondary industry in Shiga’s industrial structure. The fact indicates that the dramatic reduction of total emissions will require measures in the industrial sector.

Main measures

Environmentally friendly actions	Use of public transport, increased use of bicycles, cooler business clothes in summer and warmer clothes in winter, hot bathing before the bathwater getting cold, environmentally friendly way of cooking, and other energy saving actions
Renewable energy	Photovoltaic power generation, use of solar heat, biomass fuel for automobiles, biomass fuel for heating, passive solar heating, and wind power generation
Structural reform of transport	Reduction of travel distance by the establishment of compact cities, improvement of logistics efficiency, and modal shift of freight transport
Technical innovation (improvement of energy efficiency)	High efficiency industrial boilers, high efficiency industrial furnaces, high efficiency air conditioners, heat pump heating/hot water supply, high efficiency gas stoves, hybrid bicycles, and improvement of heat insulation capacity of buildings
Fuel shift	Shift from oil to natural gas
Reduction of emissions per power generation	Changes in the composition of power sources in Japan as a whole (decrease in coal-fired power, maintenance of nuclear power generation, and increase in natural gas)

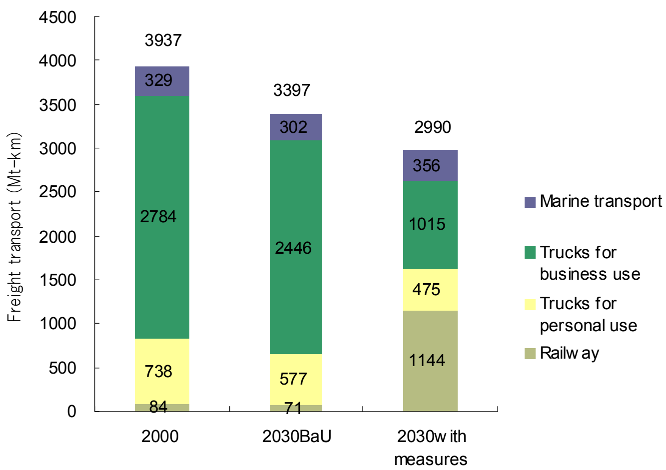
The table above lists major measures to be introduced in the scenario. Measures for the reduction of CO_2 emissions are roughly classified into the fundamental reduction of energy-consuming actions (corresponding to “environmentally friendly actions” and “structural reform of transport”), use of more energy efficient equipment (“improvement of energy efficiency”), shifting of energy sources to those with less CO_2 emissions (“renewable energy” and “fuel shifting”), and changes in the composition of power sources in Japan as a whole. The dramatic reduction of emissions by tens of percent will require the introduction of these measures in various stages of energy use.

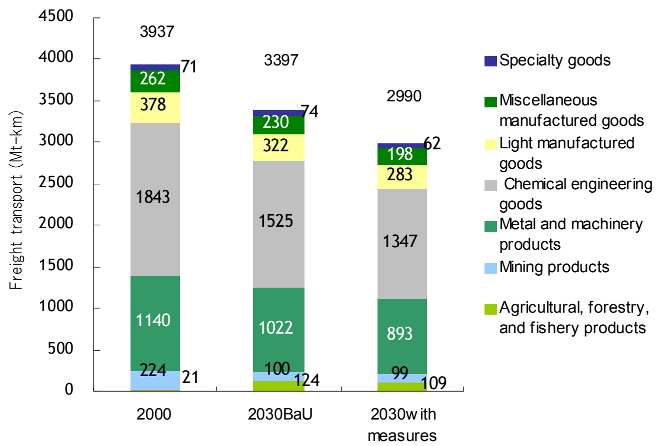
spectively). When the amount of activities of each sector in 2030 is compared with the level in 2000, as indicated in "Shiga's socioeconomic scenario in 2030," the number of households is expected to increase by 19% and the figure in the industry sector will decline by 4% due to changes in the industrial structure. In business operations, the floor area will grow by 13% owing to an increase in production in the tertiary industry. Passenger transport is estimated to grow by 53% because of changes in the population composition and the increase in the ratio of licensed drivers while freight transport will decline by 14%. All sectors except freight transport will increase or maintain the amount of activities, which serves as a factor to increase energy consumption and CO_2 emissions.

Wide ranging measures

Based on the above estimate of amount of activities, we have determined the combination of measures to reduce GHG emissions by 50% in 2030 below the 1990 level. The measures are applicable to various stages on energy use. Even if the high energy efficiency technologies available in 2030 are introduced to the maximum extent possible and changes in CO_2 emissions associated with the different composition of power sources at the national level are taken into consideration, it will be still impossible to reach the target of 50% reduction. Nevertheless, with the addition of measures at the local level including drastic changes in transport structure, the practice of environmentally friendly actions by almost all people, and substantial introduction of renewable energy, it will be feasible to reduce GHG emissions by 50% (66% below the 2030 BaU level).

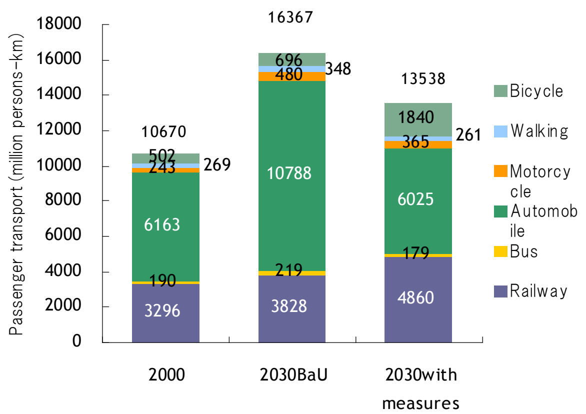
Freight transport





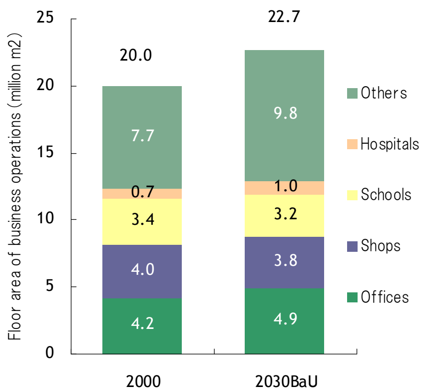
Estimated freight transport is shown by mean of transport (upper graph) and by type of cargos (lower graph). While trucks for business use are prevailing in 2000, railway occupies a higher proportion in the estimate for 2030 with measures. By item, the graph shows the increase in the share of agricultural, forestry, and fishery products.

Passenger transport



Passenger transport is estimated to increase by 53% in the 2030 BaU scenario over the 2000 level due to changes in the population composition and higher ratio of licensed drivers. In the 2030 scenario with measures, the establishment of compact cities will shorten the travel distance, which will be only 26% higher than the 2000 level. The ratio of automobiles will decline and that of railway and bicycles rise as a result of changes in means of transport.

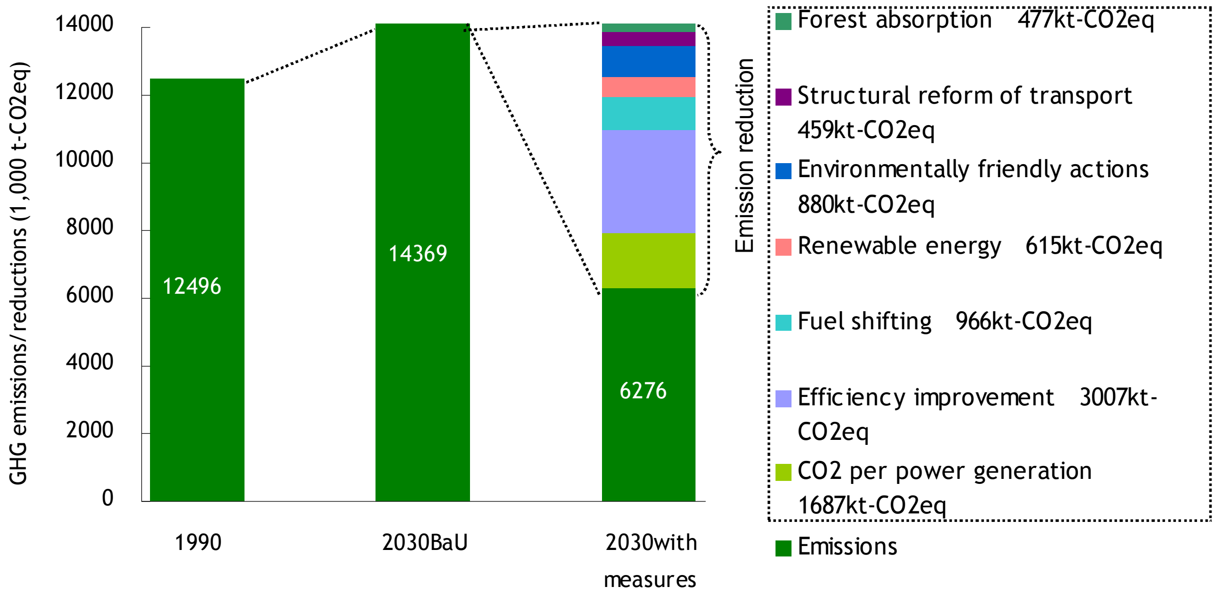
Floor area of business operations



The amount of activities of the business operation sector is based on floor area. It will increase on the whole due to production growth in the tertiary industry. While the floor area of hospitals will increase owing to the impact of aging, that of schools will decrease because of low birthrate.

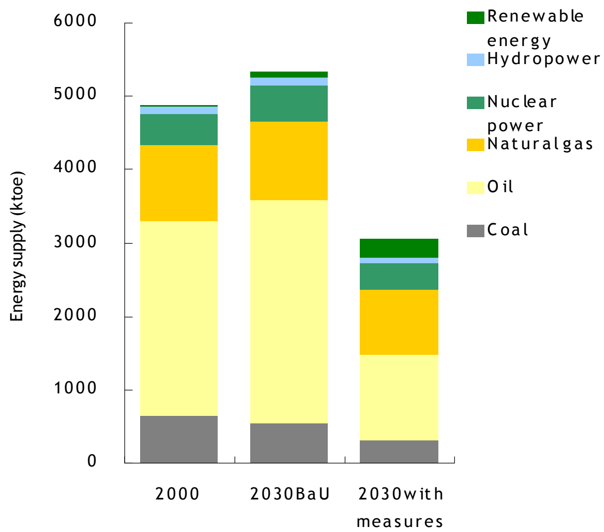
Contribution of each measure

The figure below shows CO_2 emission reductions by different types of measures. Efficiency improvement of equipment accounts for the largest proportion, 37% of the total reductions, followed by changes in the composition of power sources in Japan as a whole (21%). Among the categories of measures, those especially necessary for local governments to take are the structural reform of transport, environmentally friendly actions, penetration of renewable energy, and forest absorption. The shares of them in reductions are 6%, 11%, 8%, and 6% respectively and 30% in total. To realize a low carbon economy, Shiga Prefecture has to have original policies for encouraging businesses and citizen to take these measures.



Supply of primary energy

	Coal	Oil	Natural gas	Nuclear power	Hydro-power	Renew-able energy	Total
Supply (ktoe)							
2000	650	2643	1050	405	109	25	4883
2030BaU	542	3043	1056	498	120	85	5344
2030(with measures)	319	1160	886	361	87	231	3044
Ratio							
2000	13%	54%	22%	8%	2%	1%	100%
2030BaU	10%	57%	20%	9%	2%	2%	100%
2030(with measures)	10%	38%	29%	12%	3%	8%	100%



In the supply of primary energy in whole Shiga, oil represents the largest share of 54% in 2000. This is because of demands for oil in the industry sector and prevailing demands for automobiles in traffic. Without measures taken, it is estimated that the supply of primary energy would increase by 9.4% in 2030 from the 2000 level. If measures were taken, on the other hand, the supply would decline by approximately 37% below the 2000 level. Renewable energy will represent 8% while the share of oil declining to 38%.

It is estimated that CO2 emissions from energy can be reduced by 44% in total through the reduction of final energy demands by approximately 32% as a result of various measures as well as shift to less carbon intensive energy sources such as renewable energy and natural gas.

List of measures

Sector	Measure	Status to be achieved by 2030	What should be done now to achieve the status	Reduction
Household	Energy efficiency of equipment	Improvement of efficiency by 30% in total	Improvement rate of approximately 0.8% per annum; Selection of more energy efficient products at the time of replacement	551
	HEMS (home energy management system)	Penetration at 90% of houses	Start of penetration	60
	Heat insulation level in houses	Achievement of the next-generation heat insulation level in 90% of houses	Selection of high heat insulation level at the time of newly building, remodeling, and changing houses	55
	Biomass heating	Penetration at 10% of households	Selection of biomass at the time of replacement of heating appliance	39
	Passive solar heating	Penetration at 10% of households	Installation at the time of newly building and remodeling houses	39
	Energy saving actions	Penetration at almost all households	Start of penetration, and education	156
	Photovoltaic power	Penetration at 20% of households	Continuous expansion	54
	Solar water heater	Penetration at 20% of households	Continuous expansion	99
	Other			89
	Total in households			1144
Business	Energy efficiency of equipment	Improvement of efficiency by 36% in total	Improvement rate of 1% per annum; Promotion of investment in energy saving	443
	BEMS (business energy management system)	Introduction to 90% of buildings		47
	Heat insulation level in business buildings	90% of energy saving buildings in all buildings	Selection of high heat insulation level at the time of new construction	31
	Biomass heating	Penetration rate of 10%	Start of penetration	19
	Energy saving actions	Penetration at almost all business establishments	Start of penetration, and education	43
	Photovoltaic power	Installation at 15% of buildings	Expanded penetration	12
	Other			79
	Total in businesses			674
Industry	Energy efficiency of equipment	Improvement of efficiency by 28% in total	Selection of more energy efficient products at the time of renewal of facilities	846
	Fuel shift		Selection of less carbon intensive fuel at the time of renewal of facilities	883
	Natural gas	2000 8.6%→25.9%		
	Oil	2000 55.5%→39.4%		
	Coal	2000 4.9%→0.9%		
	Electric Power	2000 30.9%→33.7%		
	Total in industry			1729
Passenger transport	Compact city	Reduction of average distance of intra-city travel by 25%	Prevention of extension of urban area, and vitalization of urban centers	215
	Improvement of fuel efficiency of automobiles	Improvement of average fuel efficiency of passenger cars by 60% (penetration of hybrid cars at 90%)	Selection of cars with high fuel efficiency at the time of the purchase of a new car	788
	Public transport, bicycles, and walking	Share of railway:36% (31% in 2000) Shares of bicycles and walking: 16% in total	Development of public transport (improvement of convenience) Development of sidewalks, bicycle roads, signals, etc.	633 633
	Biomass fuel	Penetration rate of 10%	Start of introduction in some parts	193
	Others			36
	Total in passenger transport			1865
Freight transport	Enhancement of logistics efficiency	Reduction of transport per production by 30%	Development of distribution centers, etc.	51
	Modal shift	Substitution of railway transport for freight for 50% of road transport to distant prefectures	Development of railway for freight transport	194
		Substitution of lake transport for 10% of the transport within the prefecture	Planning and development of the idea	
	Biomass fuel	Penetration rate of 10%	Start of introduction	75
	Others			150
	Total in freight			470
Others	Reduction of CO2 emissions per power generation			1687
	Forest development	Management of all artificial forests in Shiga Prefecture	Establishment and execution of the maintenance plan; and financing for the maintenance of forests	477
	Recycling of waste	Improvement of the recycling rate of plastic by 36%	Promotion of separated collection and reuse	48
Total				8094

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Revival of the Lake Biwa environment

Various functions of the Lake Biwa environment

Lake Biwa has various functions for not only human beings but also other creatures. Some measures to improve such functions of Lake Biwa have synergic effect with each other, while some have trade-off relations. For example, planting on lakeshores to improve water quality also contributes to the conservation of the ecosystem. On the other hand, depending on the way of planting and management, it can have negative impact on landscape. Therefore, a strategy based on comprehensive assessment is required.

We have focused on the three functions of supply of water resources, maintenance of the lakeshore ecosystem, and provision of recreational sites with beautiful landscape, which are important in the examination of Lake Biwa, and set respective targets for the functions: “restoration of water quality,” “conservation and rehabilitation of the lakeshore ecosystem,” and “conservation and rehabilitation of beautiful lake areas.”

Restoration of water quality

Current water quality

The water quality of Lake Biwa has shown no sign of improvement despite of the many efforts made to conserve it, and the level of contamination still exceeds the environmental standards except the phosphorus level in the northern part. While red tides, which were observed in 1977 for the first time and have occurred almost every year since then, are on a declining trend, water blooms appear every year due to the advanced eutrophication of the lake water.

Scenario to meet the target

In 2000, the amounts of inflow loads of COD (chemical oxygen demand), TN (total nitrogen), and TP (total phosphorus) in Lake Biwa were estimated to be 16.2, 6.7, and 0.38 ktons/year respectively. Through a wide range of measures to improve the water quality, it is expected that the inflow loads of COD, TN, and TP from pollutant sources can be reduced to 7.7, 3.3, and 0.09 ktons/year respectively.

Measures to meet the target

Measures in households (reduction of COD by 88%, TN by 50%, and TP by 92%)

The amount of discharge will be greatly reduced through efforts in households such as kitchen management and reuse of rainwater and bathwater. The sewerage coverage will be increased to 96%. Efficient facilities to collect phosphorus from sewage sledge and generate biogas will be constructed.

Measures in the industry (reduction of COD by 60%, TN by 47%, and TP by 74%)

The manufacturing industry will substantially reduce the generation of loads from the sources through thorough improvement of production process efficiency and recycling rate. All effluent will be directed to the sewage system for treatment. All livestock waste will be returned to farms to reduce the application of chemical fertilizers to farms and the amounts of nitrogen and phosphorus emissions.

Measures related to rain falling on the lake surface (reduction of COD by 15% and TN by 15%)

Actions such as local production for local consumption and introduction of IT will reduce the movements of people and goods. With the sidewalks, bicycle roads, and the new public transport system developed to reduce dependence on cars, people will use cars less. This will reduce NOx emissions from automobiles. In addition, greening of wastelands and roads to prevent pollutants from rolling on the ground and regulations on exhaust gas from automobiles and factories will improve the air quality and reduce organic matters and nitrogen falling on the lake surface.

Measures related to non-point sources (reduction of COD by 44%, TN by 71%, and TP by 85%)

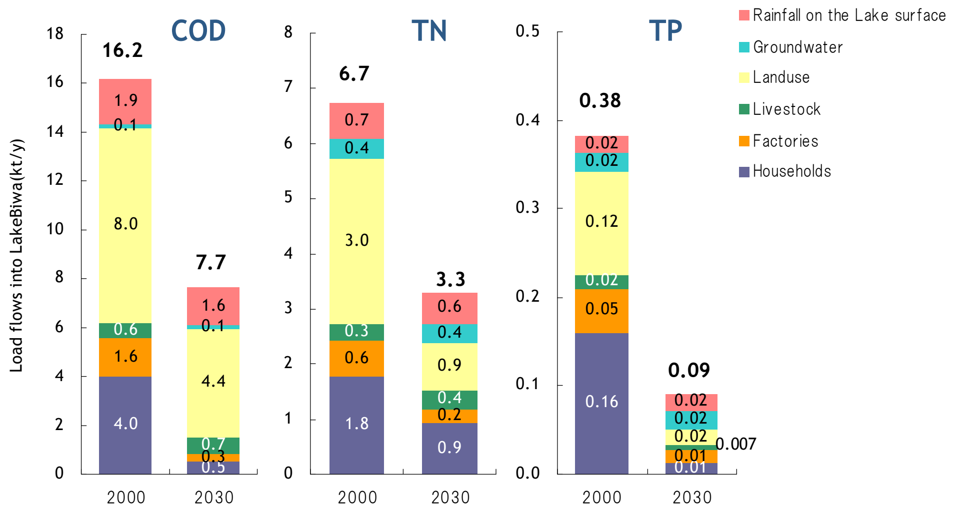
Buildings will install rainwater retention facilities to reduce initial discharge of loads from urban area at the time of rainfall. Greening of wastelands and development of green belts along roads will enhance underground infiltration of rainwater and reduce the discharge of pollutant loads. In particular, pollutant loads will dramatically decrease with the pavement of roads with permeable materials to promote underground infiltration of rainwater, regular cleaning of the surface and drainage channels, and installation of equipment to collect and purify effluent from the surface. The establishment of compact cities will limit the conversion of forests and farms to housing/industrial sites and consequently maintain the area of agricultural and forest land. With environmentally friendly agricultural practices in farms such as the reduction of fertilizer application and repetitive use of drain water as well as through management of forests including proper thinning, the discharge of pollutant loads from farms and forests will be dramatically reduced.

Measures related to rivers include the renovation of all rivers with natural materials to use the functions inherent to nature such as purification by vegetation for the reduction of pollutant loads.

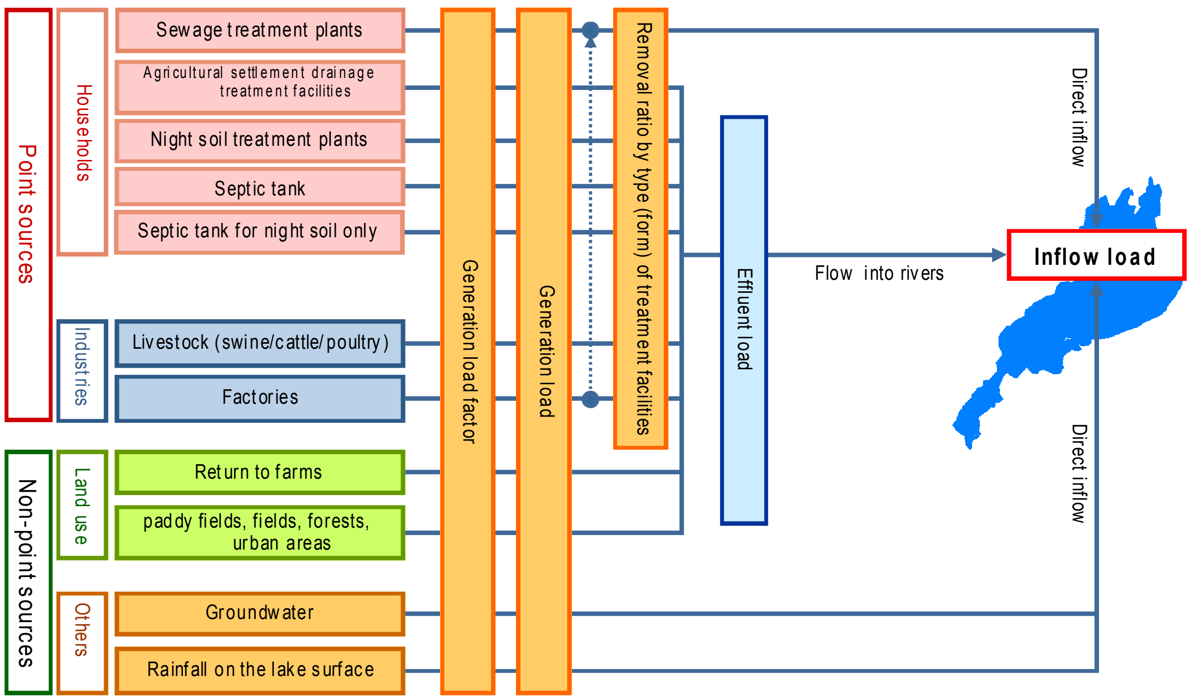
Measures in the lake

The population of reeds and other vegetation will be restored on the lakeshores, and dredging will be also implemented in some parts to reduce elution from the lake bottom.

Load flows into Lake Biwa



Method to calculate load flows



The estimated load flows into Lake Biwa are shown in the figure. Firstly, we set 2000 as the reference year, and the values on load activities causing the generation of pollutants (population covered by each type of sewage treatment facilities, industry, land use, natural conditions, etc.) were developed and sorted based on GIS (geographical information system) and various environmental information on the basin. In the calculation of effluent loads from point sources of pollution, the value on each pollution source was multiplied by the generation load factor to determine the generation load in the basin, and then estimated in consideration of the removal rate in each treatment process. Meanwhile, the amount of effluent loads from non-point source of pollution (except groundwater) was determined by multiplying the value on different load activities by generation load factor. Finally, the amount of load flows into Lake Biwa was estimated on the assumption that effluent loads flow into Lake Biwa via rivers and in consideration of the percentage of river water reaching the lake. However, loads from sewage treatment plants, rainwater on the lake surface, and groundwater were assumed to flow directly into Lake Biwa.

List of measures to reduce inflow loads

Section	Measure	Status to be achieved by 2030	Reductions by measure (ton/year) COD	TN	TP
Household	Sewerage coverage	Sewerage coverage of 96% in the Lake Biwa catchment area	1903	499	91
	Kitchen management	Penetration at all households	1502	337	43
	Use of soil trench system and reuse of treated effluent in agricultural settlement	Application rate of 100%	64	45	13
	Reuse of rainwater and bathwater	Penetration rate of 50%	313	72	8
Industry	Connection to sewer system for treatment	Connection of all unconnected effluent (85% of all effluent) to sewer system for treatment	715	175	28
Dairy farming	Use of animal waste on farms	Application rate of 100%	18	6	9
Land use	Compact city	Diversion of 20% of building sites, wastelands, and roads to green space	249	43	3
	Urban area				
	Rainwater retention and infiltration facilities in buildings	Among building sites (55% of whole urban area), application rate of 30%	231	30	2
	Greening of roof area	Among building sites (55% of whole urban area), application rate of 20%	58	12	1
	Cleaning of roads	Among roads (6% of whole urban area), application rate of 50%	16	3	0
	Cleaning of drainage channels	Among roads (6% of whole urban area), application rate of 50%	16	3	0
	Pavement with permeable materials	Among roads (6% of whole urban area), application rate of 20%	6	1	0
	Development of green belts (securing of green space)	Among wasteland and other sites and roads (45% of whole urban area), application rate of 20%	79	26	1
	Urban area effluent purification facilities	Among effluent from wasteland and other sites and roads (45% of whole urban area), application rate of 30% except the effluent treated in the other measures	156	25	2
	Farm				
	Reduction of fertilizer application	Application rate of 100%	0	276	22
	Repetitive use of drain water (including cyclic irrigation and irrigation shared between different rice fields)	Among rice fields, application rate of 50%	599	108	5
	Purification of water quality by use of fallow rice fields	Among fallow rice fields (2% of whole rice field area), application rate of 50%	12	2	0
	Forest				
	Proper management including proper thinning	Application rate of 42%	505	230	4
Rivers, etc.	Direct purification of river water (reservoirs, vegetation purification, contact purification, etc.)	Among effluent from land use, application rate of 50%	494	162	7
	Improvement of sediments (dredging in rivers and attached lakes)	Among effluent from land use, application rate of 50%	0	629	23
	River development with natural materials	Application rate of 100%	987	324	15
Rain falling on the lake surface	Improvement of the air quality	Reduction of travels by car and penetration of low-emissions vehicles → Rate of reduction of the atmospheric concentration level by the improvement of the air quality	373	199	0
Others	In the lake				
	Vegetation (reed) purification	Reduction by planting of reeds over an area of 260 ha (COD 75, TN 55, and TP 4.8 (tons/year))	75	55	5
	Dredging	Reduction by the measure (COD 20, TN 27, and TP 1.8 (tons/year))	20	27	2
	Water weed mowing	Reduction by the measure (COD 30, TN 20, and TP 0.5 (tons/year))	30	20	1
	Reduction of the generation load factor				
	Industry	Application rate of 70% in terms of production value	385	169	15
	Dairy faming	Application rate of 70% in terms of number of animals	367	190	6

Conservation and restoration of the lakeshore ecosystem

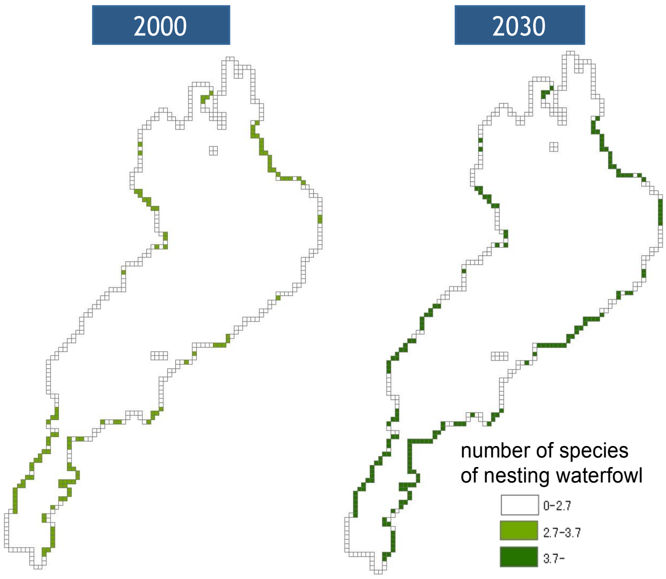
Current status of the lakeshore ecosystem

Lake Biwa is one of the oldest lakes in the world and a reservoir of species with more than 2,000 species of fauna and flora including dozens of indigenous species. However, it is reported that two thirds of the indigenous species in Lake Biwa have been endangered recently. The identified possible causes include deteriorated water quality, hypoxic bottom water in the northern part, destruction of the aquatic terrestrial transition zone providing habitats for many fauna and flora species, separation of migratory corridors for aquatic creatures between Lake Biwa and attached lakes, rivers, water courses, and rice fields, alteration of lakeshores, and the increase in foreign species. Among them, the decrease in the area of reed communities, which has shrunk to half in comparison with the level around the year 1955, has significant impact because they are important as habitats and spawning/nesting sites for fish and waterfowl.

Scenario to meet the target

The current area of reed communities on the shores of Lake Biwa is approximately 130 ha. The target is to restore them and double the area to approximately 260 ha, the level in 1955. This will also double the area of habitats for waterfowl from the current level and increase the number of species and individuals of nesting waterfowl (figure on the right). The following methods will be adopted to conserve and develop reed communities according to local conditions:

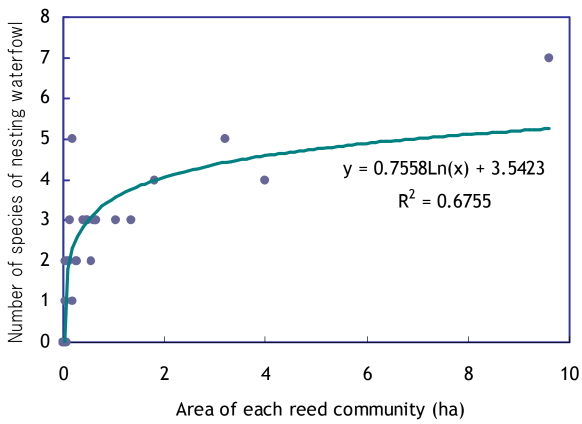
- Existing large-scale reed communities with many species of waterfowl will be managed to prevent the area from decreasing.
- In the small communities with no or only few nesting birds, projects will be implemented to increase the area of the communities by about 45 ha.
- In the areas with no reed communities, reeds will be newly planted mainly on lakeshores covered by sand or natural stones to develop approximately 85 ha of communities.



Reed communities and waterfowl

Reed communities in the lake areas are part of the original landscape representing the unique scenery of Lake Biwa, and also provide habitats for fish and waterfowl. For example, nearly half of the indigenous fish species in Lake Biwa has relations with reed communities. It is considered that reed communities need to have a certain area for the breeding of various bird species including waterfowl, which play crucial roles in the wetland ecosystem as predators.

Thus, we have focused on the area of reed communities on the lakeshores as a requirement for the maintenance of the ecosystem. While reed communities are scattered on the lakeshores in Lake Biwa, it is thought that the expansion of the community size



Source: Prepared based on Sugawa (1996)

Conservation and restoration of beautiful lake surrounding areas

Current status of the landscape around the lake

The areas around Lake Biwa (lake surrounding areas) have been part of the beautiful landscape and used by people in various ways. But they have been losing sandy shores and reed communities due to the reclamation of attached lakes and lakeshore development. While Lake Biwa has a shoreline of 235 km, the ratio of natural lakeshores declined from approximately 49% in the 1970s to about 41% in the 1990s.

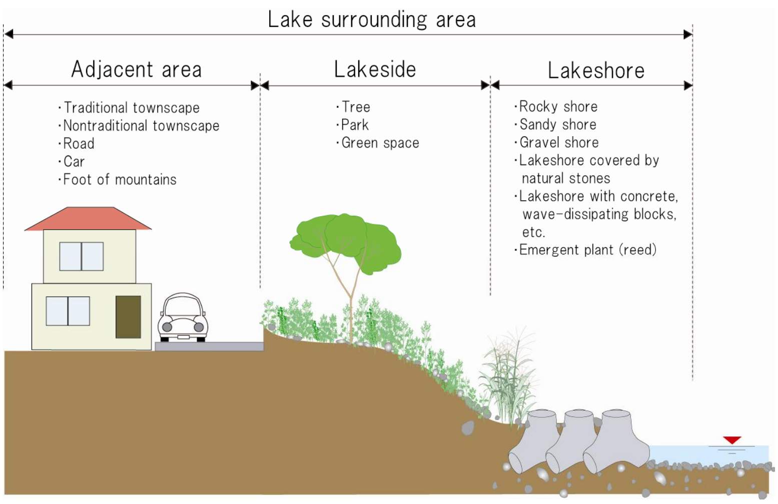
According to the results of a questionnaire survey conducted on landscape, natural components of landscape are preferred to artificial ones in most cases, and "beautiful lake surrounding areas" represent approximately 32% in the current landscape (the figure on the left of the next page).

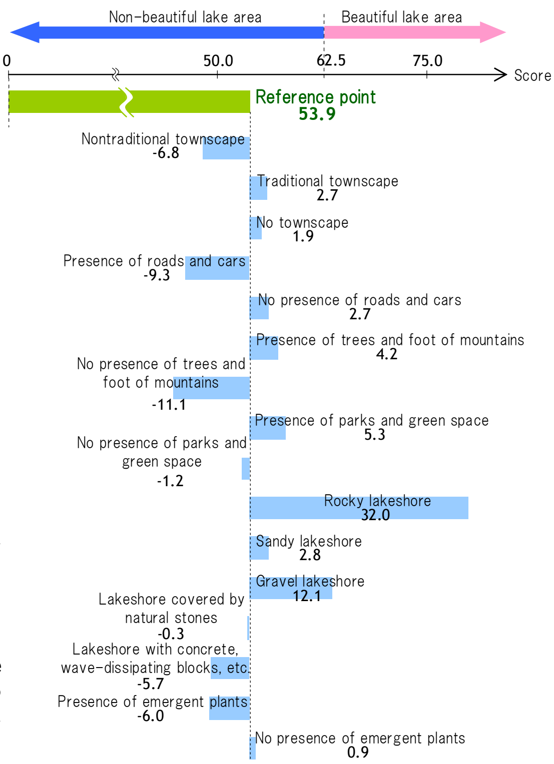
"Scale" to measure the beauty of landscape

While many aspects of the beauty of landscape are subjective, a certain "scale" to measure the beauty of landscape is required for assessing the aspects as objectively as possible and setting targets for the future. For this purpose, we conducted a questionnaire survey on photos taken in various locations on the shores of Lake Biwa, and prepared a "scale" of from 0 to 100 to correlate the beauty of the landscape around the lake[*1] with components of the landscape (figure at the lower left).

Based on the results of the analysis of the questionnaire, the impact of each component of the landscape on the assessment score is shown in the figure at the lower right with the average score(53.9) of all photos as the reference point. It is clear that artificial components have negative impact while natural factors have positive impact. However, "emergent plants" have been judged as negative factors in this landscape assessment.

The current landscape around the lake was assessed. The contour of Lake Biwa was divided into 500-meter meshes (405 meshes in total), and the components of landscape included in each mesh under the current situation (year 2000) were identified. Then, each mesh was graded based on the "scale" mentioned above, and the results were obtained as shown in the figure on the left of the next page. When a mesh with the score of 62.5 or more is defined to be a "beautiful lake surrounding area"[*2], such meshes represent approximately 32% (130 meshes in total).



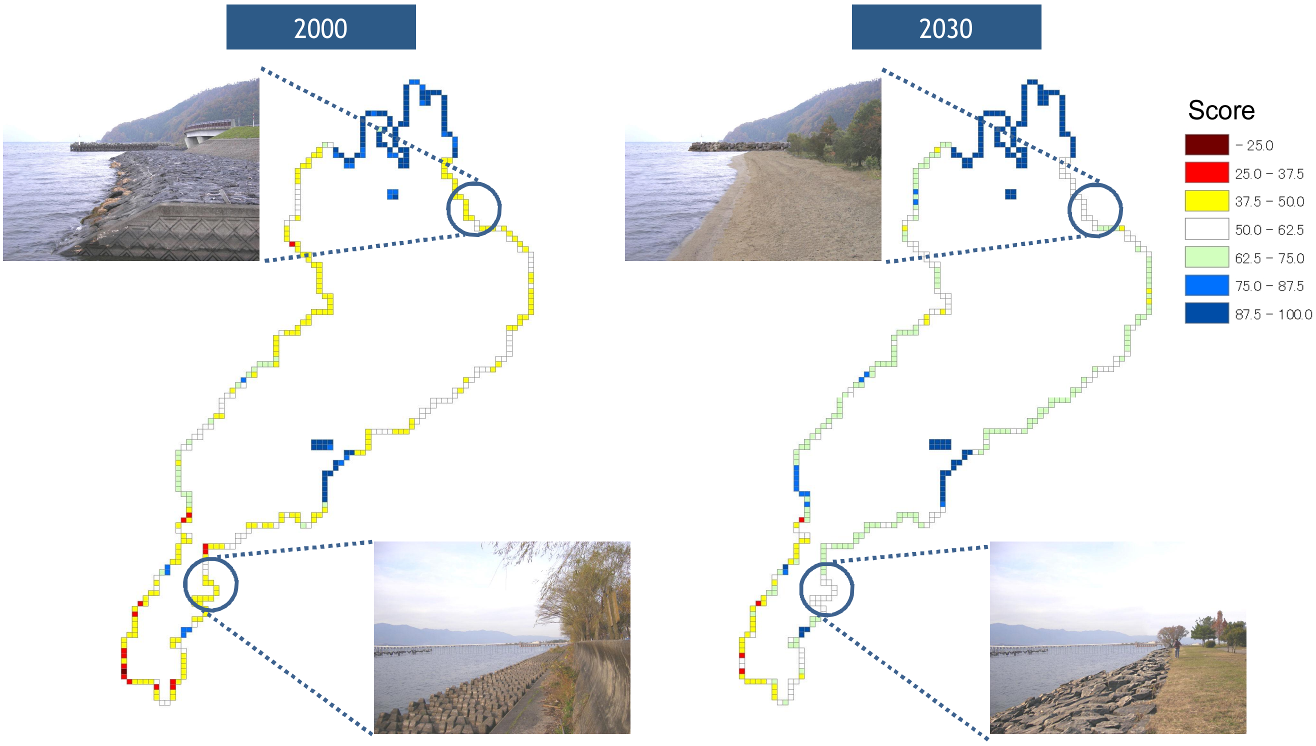


*1: Respondents of the questionnaire rated the beauty of the components on a scale of five levels (not beautiful; not very beautiful; no opinion; rather beautiful; and beautiful). A score of 0, 25, 50, 75, or 100 was given to the respective levels of the scale, and the average score of each photo was calculated with 100 being highest.

*2: Because the score was 62.5 or more when a component was judged to be "rather beautiful" or "beautiful" (mean value of 50 (score for no opinion) and 75 (rather beautiful)), the score of 62.5 or more was set as the condition for being a "beautiful lake surrounding area."

Scenario to meet the target

Setting the doubling of "beautiful lake surrounding areas" by 2030 as the target, we have discussed the scenario to meet it. With efforts such as conversion to landscape-conscious townscape, transformation of artificial lakeshores to semi-natural lakeshores, and the development of parks, approximately 65% of the lake areas, double of the current ratio of about 32%, will be "beautiful." While "beautiful lake surrounding areas" are currently concentrated to the northern part, such areas will spread over the whole region as a result of the scenario with the improvement of the landscape in the populated area around the southern part of the lake as well.



Measures to improve the landscape

The measures to improve the beauty of the landscape around the lake*3 are shown in the table below. As a result of these measures, the scores of lake areas will rise as in the figure above, and the number of meshes representing "beautiful lake surrounding areas" will increase to 263.

Components of landscape		Measures and Status to be achieved by 2030
Surrounding	Townscape	Renovate half of the nontraditional townscape based on traditional construction methods in consideration of the landscape around the lake.
	Transport	Reduce roads and cars adjacent to the lake by half.
	Land use	Plant trees on 75% of the lake surrounding areas where there is currently no foot of a mountain or tree.
Lakeshore	Form of lakeshore	Replace lakeshores covered by concrete, wave-dissipating blocks, etc. with lakeshores covered by natural stones or sand.
Lakeside	Parks and green space	In the meshes where lakeshores covered by natural stones or sand have been created as in the scenario mentioned above, develop parks and green space on the lakeside.

*3 As emergent plants have a function to purify water and also serve as habitats and spawning sites, approximately 260 ha of reed communities including existing ones will be planted on lakeshores covered by natural stones or sand (comparable to the level in 1955).

Establishment of a recycling system

Municipal waste

In 2030, people will have very different styles of working and consumption from now, and rentals and leases on an as-needed basis will be preferred to purchase of goods in the mainstream lifestyle. People will have more leisure time and spend it for activities such as waste collection in a group and waste separation at home. We have estimated the amount of landfill waste based on such conditions on waste generation. It is assumed in the estimate that citizens will seek the establishment of a sound material-cycle society through active involvement in waste reduction and recycling activities and the conditions for the treatment facilities will remain status quo.

When the population changes in Shiga Prefecture and the decrease in generation factor as a result of the use of rentals and leases are taken into consideration in the calculation of waste generation, it is possible to reach the target of reducing landfill waste by 75% in 2030 through the maintenance of recycling, intermediate treatment, and landfill facilities at the current level as well as increased cooperation of the public for waste recycling. Specifically, waste generation will be reduced to 450,000 tons through the reduction in consumption, and the emission will be further reduced by 100,000 tons through group separation and collection efforts among communities. Under these conditions, we have made assumptions including the establishment of a reuse- and recycling-oriented society, public efforts to increase direct recycling, and improved efficiency of recycling facilities.

Measures on municipal waste

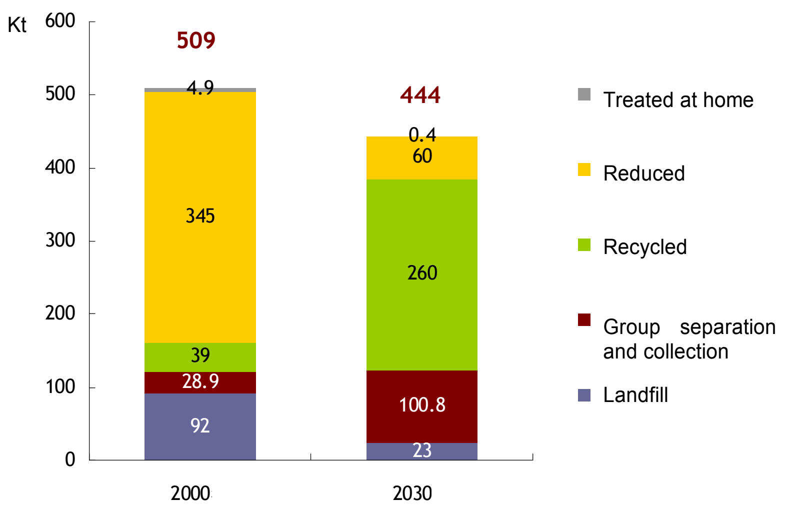
Citizen

- Making efforts to reduce useless consumption and decrease waste generation to 880g (emission level:700g) per person and day
- Use of rented or leased consumer durables
- Recycling of 500g per person and day through spending leisure time for waste separation

Businesses and local governments, etc.

- Financial support for rental and lease businesses
- Sales of only recyclable goods, establishment of recycling routes, and development of efficient recycling plants
- Improvement of recycling efficiency in composting and recycling facilities by 5%
- Reduction of waste delivered to other intermediate treatment facilities by 5%

Generation and landfill of municipal waste



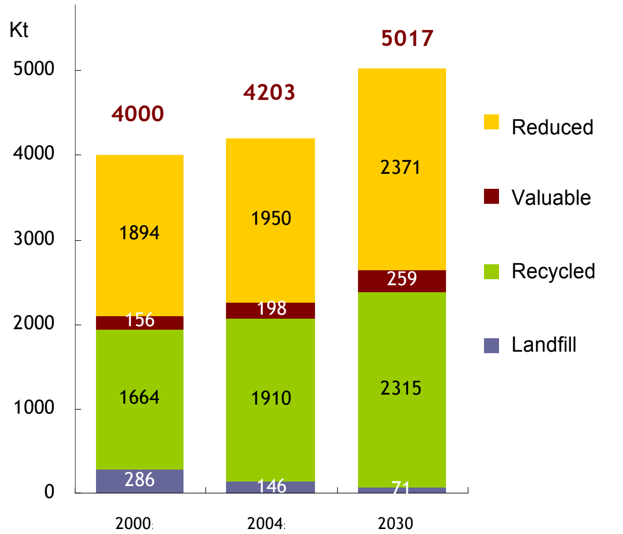
Industrial waste

We calculated the generation of industrial waste by type according to the estimated production by sector in 2030. Then, the amount of recycling and reduction was achieved based on the assumed reduction of industrial waste by type and expected progress and penetration of treatment technologies.

Landfill waste can be reduced by approximately 75% from 286,000 tons in 2000 to 70,500 tons in 2030. Valuable waste refers to the amount of the waste sold as raw materials, and it is necessary to increase the ratio of valuable waste by around 10% with measures including the establishment of the network of such trades between manufacturers in and outside Shiga Prefecture in order to reduce landfill waste.

Organic waste from sewage and other sectors can be greatly reduced in volume by dehydration, but the ratio of recyclable part in such waste is small. Potential recycling technologies include composting and methane fermentation process. The landfill of waste plastics and debris, which is generated in construction, manufacturing, and other industries in a large volume, as well as waste glass and pottery can be reduced through the promotion of recycling. For this purpose, it is important to separate waste in the sites where it is generated. While the recycling rate[*1] of industrial waste is higher than that of domestic waste, for the further reduction of landfill, businesses are required to make additional efforts including the improvement of resource efficiency in production.

Generation and landfill of industrial waste



*1: Recycling rate: the ratio of industrial waste in the input of recycling process, defined as (recycling + reduction) / generation.

List of measures on industrial waste

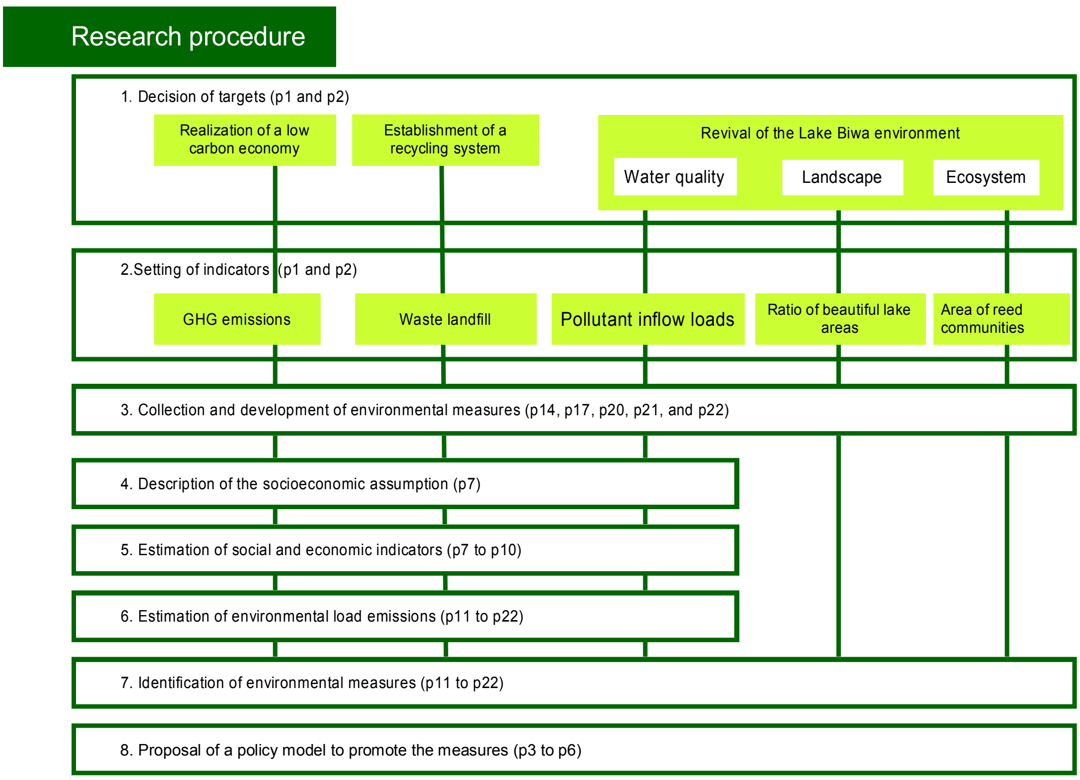
Type of industrial waste	Examples of the measures	Recycling rate (2030) without measures	Recycling rate (2030) with measures	Landfill reduction effect*2 (1,000 tons)
Ash	Use in soil conditioners (coal ash), sewage treatment agents, and snow melting agents	17.6%	50.0%	2.1
Organic sludge	Composting, anaerobic digestion, methane gasification, and carbonization	99.7%	99.7%	0.0
Inorganic sludge	Use in subgrade materials, backfill materials, soft soil conditioners, water-retentive soil, and glass materials	96.9%	98.0%	13.1
Waste oil	Reuse of lubricating oil and use as fuel, recovery of solvent and paint, and use of cooking oil as fuel	98.5%	99.0%	0.4
Waste acid	Recovery of semiconductor etchants, and reuse of waste acid	99.2%	99.5%	0.1
Waste alkali	Reuse of waste alkali by concentration treatment	99.1%	99.5%	0.2
Waste plastics/rubber	Material and thermal recycling of synthetic resin, synthetic rubber, and waste tire	75.7%	94.0%	33.4
Waste paper	Paper recycling, use in civil engineering and construction materials, use in agricultural materials, and use as fuel	86.8%	95.0%	0.9
Waste wood	Use as timber, processing into building materials, carbonization and gasification, chemical treatment, and composting	92.2%	98.0%	7.6
Waste textile	Reuse of fiber, separation and recycling of component materials, and melting and reformation of synthetic fiber	89.0%	95.0%	0.0
Animal/plant residues, etc.	Food production, anaerobic congestion, methane gasification, use as feed/fertilizer, and use of minerals in soil conditioners	98.8%	99.0%	0.0
Waste metal	Use of scrap, separation of rare metal, and extraction and use of hazardous metal elements	94.4%	96.0%	1.3
Waste glass/pottery	Collection of cullet, reuse of glass bottles, and use in tiles/blocks, ultralight aggregates, and asphalt pavement	81.4%	92.0%	12.3
Slag	Collection of metal, use in cement, concrete aggregates, ground conditioners, and use for road construction and filling	94.8%	98.0%	2.1
Debris	Screening and recycling of construction waste, and use in road pavement materials	97.8%	99.0%	13.6
Dust	Use in cement and concrete, subgrades, ground conditioners, aggregates, and agricultural materials	43.3%	90.0%	0.7
Animal waste	Use as organic fertilizers, carbonization, and methane gasification	100.0%	100.0%	0.0
Mixed waste	Mechanical and manual separation, reuse of parts, and melting and slagging of shredder dust	39.4%	90.0%	14.7

*2 Landfill reduction effect: mount of the landfill reduced by the increase in the recycling rate in 2030

Research methodology

Our research team aims to study the scenario to realize sustainable Shiga and propose the method to realize it. For the purpose, we decided to set the environmental targets for 2030, identify measures to meet the targets based on the assumption of the future society, and present the policies necessary for the promotion of the measures. We also developed various estimating tools to obtain necessary quantitative information. They consisted of macroeconometric tools and socioeconomic/environmental impact snapshot tools, which can estimate population and number of households, gross product in the prefecture, time budget, industrial structure, employment, business buildings, passenger and freight transport, energy consumption, GHG emissions, water pollutant load generation and inflows, and waste generation and landfill at present and in future in a consistent manner to assess the effect of environmental measures. As a long period of more than two decades was covered, we firstly set environmental targets and socioeconomic conditions to be achieved. Next, we examined the social mechanism, technologies, and policies necessary to realize the social conditions. We established a scenario to realize it based on the technologies currently in practical use or expected to be widespread by 2030 as well as the potentially feasible policies.

The specific research procedure is shown in the figure below. The page numbers in the figure indicates the corresponding sections of this booklet. Firstly, we determine the targets representing the vision of sustainable Shiga (1). Secondly, quantitative target values are set for each of the targets (2). The levels of the target values are decided based on international discussion of global environmental problems and the conditions in Shiga Prefecture. Next, among the targets, the levels of environmental load emissions (GHG emissions, waste landfill, and water pollution load discharge) greatly depend on the conditions of social and economic activities. Therefore, we estimate social and economic indicators in future, and for this purpose, qualitatively describe the images of different fields such as industrial conditions, transport and urban area, rural area, and health and welfare based on the assumption of people's sense of basic values in future (4). Then, with the estimating tools we developed, the specific values of the social and economic indicators are estimated based on the social images identified in 4 (5). Under them, we estimate the environmental load emissions (6), and identify the level of the introduction of measures necessary to meet the environmental targets (7). The measures needed on the landscape and ecosystem in Lake Biwa are directly determined based on the differences between the current status and the targets. We will extract and organize policies for the promotion of the measures identified in the process and propose them as a policy model (8).



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Shiga's scenario towards the realization of a sustainable society
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