

Aiming for a Sustainable Society that can Provide both Economic Growth and Protection for the Global Environment

Anticipated Technical Developments and the Hitachi Group's Strategy for the Global Environment

Ongoing climate change on a global scale has started to cast a dark shadow over the activity of life on our planet, including human beings. Abnormal weather events are one example of the form which these changes are taking. Dealing with these changes and protecting the global environment are issues that need to be confronted jointly by the entire world. What we need to create is a sustainable society that can provide both economic growth and protection for the global environment. But to achieve this, what sort of vision do we need to guide our activities, and what sort of technologies will we require? Shigeru Azuhata, Manager of the Environmental Strategy Office, Hitachi, Ltd. responsible for steering Hitachi's environmental policy poses these questions to Yoichi Kaya, Director-General of the Research Institute of Innovative Technology for the Earth (RITE), the preeminent figure in environmental science in Japan and a leader in dealing with global warming.

Hitachi's Environmental Policy Based on "Environmental Vision 2025"

Azuhata You have had a long involvement with the problems of energy and the environment through your specialist field of energy systems. As the preeminent figure in this field, I would like you to give us an overview of the global environmental problems that have become an issue for the entire world in recent years. Before that, I would like to start with a summary of the Hitachi Group's approach to the environmental issues around the world. Hitachi established its new Environmental Strategy Office on January 1st 2008. Global environmental issues have a significant impact on corporate activities, and reducing the burden on the environment through our products as well as through our day-to-day operations can have a direct bearing on corporate value. The Hitachi Group has had a long involvement in environmental protection as part of its social responsibilities. Now, with global warming having come to be seen as a particularly serious environmental problem, we recognize the importance of further strengthening its activities including establishing specific achievement targets. These are being driven by the Hitachi Group's "Environmental Vision 2015" formulated in 2006 and its "Environmental Vision 2025" formulated in 2007. Environmental

Vision 2025 aims to have Hitachi Group products contributing to a reduction in global CO₂ emissions of 100 million tons a year. The Environmental Strategy Office is the department responsible for working towards the achievement of these targets.

Kaya Annual emissions of greenhouse gases by Japan are currently equivalent to 1,300 million tons of CO₂ per year, so 100 million tons represents about 7% of current emissions. This is a significant percentage of total emissions.

Azuhata If we keep on the right path, I believe that this level of reduction is possible across the entire world. The Hitachi Group is involved in a wide range of different businesses and, taking as an example the field of electricity generation which is one of the major sources of CO₂ emissions, we supply products on both the generation and consumption sides. In electricity generation, we will do our utmost to provide technologies for reducing CO₂ emissions including nuclear power, renewable energy, and making thermal generation more efficient. On the demand side, we will make a comprehensive effort to improve the energy efficiency of products ranging from domestic appliances to industrial equipment. To this end, our various business units and group companies are currently working out the CO₂ emissions of their products and the likely reductions that can be achieved through specific measures in order



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Doctor of Engineering



to reduce CO₂ in ways appropriate to the characteristics of each business. The reduction target of 100 million tons is based in part on the expected results from this work.

Kaya Improving the efficiency of power generation systems and major industrial machinery will have a large impact when considered on a global scale, and it is very significant that consideration of what measures to take is to be done in conjunction with rigorous evaluation.

Azuhata In addition to CO₂ reduction, Hitachi has also adopted a practice whereby we evaluate the environmental footprint of each product based on our own standards and then certify those products that reach a certain level as “Eco-Products” which are environmentally compliant. The aim of Environmental Vision 2025 is to make all Hitachi Group products environmentally compliant.

Alongside measures to deal with global warming, the other main pillars of Environmental Vision 2025 are “the sustainable use of resources” which aims to promote recycling, and “ecosystem conservation” which relates to the atmosphere, water, soil, and other ecological resources. In particular, water-related issues such as pollution and supply shortages are also likely to become more severe internationally as warming increases. Hitachi is also involved in

equipment and systems for water supply and sewage services and we aim to contribute to solving the world’s water problems through technologies such as water treatment equipment by wisely leveraging on our expertise to realize possibilities of these systems. For the atmosphere, Hitachi has technologies that have been honed by working together with electricity utility companies. These include air pollution control equipment such as electrostatic precipitators and DeSO_x and DeNO_x systems for thermal power stations. We believe that these technologies will prove useful not only in Japan but around the world.

Global Warming is the Biggest Problem since the Dawn of History

Kaya The environmental problems faced by the world are an intertwined combination of global issues that start with climate change but also include resources, the food supply, and the ecosystem. I believe that performing comprehensive evaluation and adopting diverse actions through products that are used around the world are important matters for corporations that operate global businesses.

Considering global warming in particular, the report of the IPCC (Intergovernmental Panel on Climate Change) states that the

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warming of the planet is now clearly evident in things such as the increase in the average temperatures of the atmosphere and oceans, widespread melting of ice and snow, and the rise in average sea levels. The cause is believed to be the rising concentrations of greenhouse gases in the atmosphere and annual emissions of CO₂, which makes up the majority of such gases, increased by approximately 80% between 1970 and 2004.

If nothing is done, it is anticipated that the global climate will be subject to large fluctuations, with rises in sea level and abnormal weather events such as abnormally high temperatures, heavy rain and drought, and associated problems including food crises, exacerbation of water shortages, and loss of biodiversity that will have a significant impact on our way of life. In terms of the severity of the consequences and the difficulty of doing anything about it, the situation can be said to represent the biggest problem faced by humanity since the dawn of history.

The Club of Rome published a report entitled "The Limits to Growth" in 1972. The report attracted much attention at the time due to its claim that, whereas growth was being driven by economic and demographic factors, resources such as available land and energy would place a limit on growth, and that zero growth in the population and economy would result in a sustainable global society. The question was how to maintain a balance between growth and its constraints. The issue raised by the Club of Rome remains with us today and has in fact become an even more pressing problem for humanity. Considering current circumstances, even zero growth would not be enough. If we continue to use resources and emit CO₂, even if at the same rate as at present, the concentration in the atmosphere will still continue to rise.

Azuhata We are almost at the point where we cannot emit any more. The Fourth Assessment Report of the IPCC forecasts an increase in temperature of 0.2 per decade over the next twenty years regardless of which scenario it assumes for what we do.

Kaya According to studies by the WMO (World Meteorological Organization), the average concentration of the atmospheric CO₂ that is causing global warming was 381.2 ppm in 2006. This is a 36% increase on the level prior to the industrial revolution. Because concentrations have already increased by this much, we would not be able to stabilize average temperatures unless we drastically reduce our emissions from their current level back to close to the natural level of emission. Use of fossil fuels is the primary reason for the increasing concentration of CO₂ in the atmosphere. From this, I have concluded that an important prerequisite for achieving a truly sustainable way of life is not zero growth but a shift to a "low-carbon" way of life. Unless we change our current social system with its high dependence on carbon, I do not think it is realistic to aim for significant reductions in CO₂ emissions. Fossil fuel resources are by their nature finite. To solve this problem, I believe we need to make a wholehearted effort to bring about a "low-carbon society."

Supporting the Environment and the Economy through More Efficient Technology

Azuhata In parallel with a transition to a low-carbon society, we need to confront the issue of reducing CO₂ emissions. Whereas it has been suggested that we need to share a common vision in developing as well as in developed countries, resistance to the idea of accepting restrictions is evident in developing countries

whose standard of living will rise in the future. Given these circumstances, it is recognized that, as well as technology, an approach that includes cooperation at the political and economic level will be essential if we are to achieve reductions.

Kaya The need is for mutual understanding and specific measures. The consensus among scientists around the world is that stabilizing the level of CO₂ in the atmosphere over the long term will require an ultimate reduction in CO₂ emissions of 70 to 90%. Bearing this in mind, our current measures for dealing with warming should be undertaken with consideration for the balance between their effects on the environment and the growth of the global economy. Talk of balance is often interpreted as meaning a compromise, but we also need to understand the attitude of developing countries who do not want to pass up on their current opportunities for development.

That specific measures for achieving this aim will involve the use of energy conservation and other advanced technologies is beyond doubt. There are many areas such as industrial technology where the efficiency of developing countries is poor compared with the developed world. Improvements in these areas will provide economic as well as environmental advantages to these countries and I believe this is the best way to go about solving the problem.

Azuhata Japan's proposed idea is to take a "sector-by-sector approach." This involves estimating the energy efficiency of individual sectors such as power generation, steel making, transport and construction, and prioritizing measures such as the transfer of advanced technologies to those areas where efficiency is low and CO₂ emissions are high. This approach can be expected both to help counter global warming and to promote economic development.

Kaya We need to investigate areas such as how to undertake technology transfer and how to perform measurement and verification. This is likely to be an effective idea if it is done in a cooperative way across the entire world.

Greater Recovery and Reuse of Waste Heat is a Key Measure against Warming

Azuhata To combine action on global warming with economic development, we need to accelerate the development of new technologies. For example, although CCS (carbon capture and storage) has been the subject of much attention with research and development into its commercialization underway around the world, a revolution in energy storage technologies that promise a much wider application is also important.

Kaya The development of technologies for storing large amounts of electrical energy cheaply is likely to be a key factor in the adoption of renewable energies such as solar and wind. The output of renewable energy sources is strongly dependent on the weather and increasing the volume of such generation will in some cases place a burden on the electricity system. Absorbing variations in output will require measures such as the use of thermal power stations or existing high-cost storage batteries. The cost of these measures is becoming an issue.

There is another important aspect to energy storage that is separate from storage of electricity. This is thermal storage at tempera-



tures of 100 °C or less. When we consider consumer demand for heat, more than half is made up of low-temperature heat such as water heating and space heating and cooling. This is currently supplied by electricity or gas, but the energy losses are large. For temperatures as low as this, systems that use heat pumps to increase the temperature of natural energy or waste heat sources become an effective measure in terms of their contribution to minimizing global warming. In particular, if industrial waste heat can be utilized, this becomes a sensible measure in terms of overall efficiency. There are systems in Europe where waste heat from industry is carried to consumers via pipelines, but in regions where such systems are not practical there is a need for improvements in storage technology such as being able to transport the waste heat and store it temporarily. Technologies for the storage of latent heat are currently being investigated from a number of different perspectives, particularly the development of thermal storage materials. It is anticipated that these energy storage technologies will have a major role to play in future measures for dealing with global warming.

Azuhata What other promising technologies are there in addition to low-temperature thermal storage?

Kaya The research topics we are working on at RITE include separation of CO₂ from thermal power station exhaust gases, technology for storing the captured CO₂ in underground aquifers, technology for using biomass to produce useful products such as hydrogen with high efficiency, techniques for using plants to fix CO₂, and methods for evaluating measures for dealing with global warming. We have high hopes for these technologies. We also propose and recommend ideas for new ways of using energy, and my particular interest in this area is with the utilization of geothermal energy, or the possibilities for using the geothermal power from as little as 10 m or so below the surface. This idea is being increasing-

ly adopted around the world and a system that sinks a pipe into the ground below the house and then uses a heat pump to utilize this heat in air conditioning and similar is already in use in approximately 500,000 homes in the USA and 50,000 in Switzerland. As a way of dealing with global warming, the issue of reducing CO₂ emissions by consumers is one shared by all the countries of the world. Looking at how heat pump technology is developing, taking advantage of the geothermal energy close to the earth's surface in the manner of a natural heat storage system is, I believe, an effective way forward.

Azuhata Following on from oil, the price of coal is also starting to rise rapidly and is expected to remain high. Given this situation, technologies like this for responding to climate change may well measure up even if they do involve a certain cost.

Kaya The keys to keeping the increase in average global temperature down to around 2 to 3 °C, with a target of 2050, will be investment in research into new technologies along with various efforts for reducing emissions. CO₂ reductions and creating a low-carbon society will require major innovations in both technology and in the structure of our society. To maintain the sustainability of the global environment, RITE intends to fulfil steadfastly our role as a research institution specifically aimed at technologies for dealing with climate change and we are looking forward to breakthroughs in environmental technology from Hitachi with its high level of technological capabilities.

Azuhata In addition to pouring our efforts into research and development, we will continue working towards achieving the goals set out in our Environmental Vision 2025. The Hitachi Group as a whole will work towards bringing about a sustainable global society that can both protect the global environment and deliver economic progress.