"The Mid- to Long-Term Global Vision for Challenges against Global Warming"
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<Keynote Speech>

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"Japan's Mid- to Long-Term Vision – Scenarios for Greenhouse Gas Reduction and Japan's Role"

I would like to talk about mid-term and long-term Japanese vision – GHG emission reduction scenario and the role of Japan.

(Slide 1) The world as a whole is on the way of decarbonization, trying to reduce its dependence on fossil fuel, to replace them by nuclear energy and renewable energy. Scheduling is being discussed – well there may be no one who opposes to this scheduling I believe, but as to the energy allocation I am sure that there are a lot of discussions.

The Mid-term target study committee has been discussing this issue under the leadership of Dr. Fukui, so their study will be referred to among the trend of Japan as a country. As of myself, I have been engaged in the technology development field, so the transformation of technology development affected by climate change is what I would like to focus on in my presentation.

(Slide 2) The previous slide showed the ratio of energy mix. With the growth of the global economy, the amount of energy use will surely increase. This picture shows the energy demand under the scenario with a global economy growth of 2.5% and an energy conservation of 1%. It shows the energy mix similar to the "B1 scenario" in the Third Report of IPCC, and with even higher energy decrease, but still in 2050, we cannot reduce fossil fuel or carbon dioxide. They will remain at about the same level.

(Slide 3) Now I would like to explain what I mean by "Triple50". This trend of energy allocation, or "Self-sufficiency 50% Initiative", was mentioned around 7 or 8 years ago by Dr. Fukui, in which I took part as well. Then, University of Tokyo and volunteers from the industry joined together to study Triple50. This is different from that of the earlier Double50 (reduce 50% by 2050). This "Triple50" aims to achieve 50% in three elements -self-sufficiency, dependency on fossil fuel, and energy efficiency.

Today in Japan, the energy efficiency is about one-third. More than two-thirds of the energy is being discarded or wasted and this needs to be improved. The world average hardly has reached 30% yet but we are aiming to achieve Triple50.

The graph at below left shows the energy allocation of Japan in 2000. And by 2030, we want to change the allocation to the one on the far right. Without changing the industrial structure, we want to improve the

energy efficiency from 35% to 50%, which means that energy supply will decrease. All of these elements are being taken into consideration to calculate the balance of energy source and supply.

(Slide 4) CO_2 emission reduction scenario is what I would like to focus on first. Earlier in this symposium, Dr. Matsuno showed the long term reduction scenario and the allotment. I would like to focus on the next bullet point. Climate change or global warming is requiring us to think about ideal energy mix, and to achieve this ideal energy mix is never an easy task. It is requiring us to fundamentally transform the energy composition and it is requiring technology development. I would like to talk about the technology deployment and new international framework as well. These elements will also be discussed in the panel discussion later on.

(Slide 5) This triangle reflects the idea developed at the committee. Scientific view point of climate change, CO_2 reduction required by preventing global warming, and the fairness among countries are indicated. As often referred, in Japan, the energy conservation is quite advanced and, therefore, from the view point of equal abatement cost globally, if the advanced countries reduced 25% of the CO_2 emission, perhaps 10% may be sufficient for Japan. This kind of discussion is the fairness I mentioned here. At meanwhile, it is important to promote energy conversion based on the balance between feasibility and economy.

(Slide 6) Let me show an example of feasibility. This shows a simulation result of Japan's reduction in the case of the developed countries as a whole reduced 25% of CO_2. RITE (Research Institute of Innovative Technology for the Earth), The Institute of Energy Economics Japan, National Institute for Environmental Studies and some other institutes have made calculation, and they said that internal reduction corresponds to about 10%. The Mid-term target study committee, where I was a member, conducted a series of systematic simulation based on the calculations of various research entities, as to how the energy allocation should be changed under the economic forecast. As a result, the committee proposed six cases.

(Slide 7) the abatement cost of 1 ton of CO_2 is shown on the far left. Internationally, this is the level that is often referred to. In the case of Japan, $50 will abate 5%, $100 will abate 10%, and $200 will abate 15%. Combining the simulation conducted by various research institutes, we have come to these numbers. So six cases were studied, which varies from -5% to -30% as compared to 2005, and the former cabinet has decided on -15%. Then the new cabinet declared a new target of -25% compared to 1990. EU members strongly praised this new target, but there are various challenges regarding cost, matters of economy, technical matters and so on, which all need to be considered in order to achieve that number.

(Slide 8) METI (the Ministry of Economy, Trade and Industry) have considered varieties of technologies and policies among industries, residential and commercial sectors, transportation, etc., and conducted detailed statistics analysis about investment cost and CO_2 reduction effects. These statistical data will be very important for Japan's decision making process in the coming times.

(Slide 9) This is the first time that a policy decision making process have involved so many organizations, especially the private sector institutes, in order to conduct detailed analysis and set up a future view. The result is, minus 25% compared to 1990, minus 60% to 80% in the long term, because that the industrial countries have determined to reduce 80% by 2050. These figures will surely be on the basis when Japan should carry out any energy or environmental policies.

(Slide 10) This shows the necessary key measures and policies. Above the line is the ones for minus 15% from 2005, or minus 7% from 1990. Photovoltaic power generation will have to be 20 times the current level, and nuclear power plants will have to be operated at 80%. The level of Japan's nuclear power technology is very high but the operating rate of the nuclear power plants is 60% today. A very important issue is how to raise the rate to 80% or even 90%. In the case of minus 25% scenario, the nuclear power plant operating rate must be 90%. About automobiles, 50% of new cars will have to be next generation automobiles such as hybrid cars in the 7% scenario, and 90% in the 25% scenario.
Turning to housing in residential sector, new thermal insulation structure must be incorporated at the level of 80% for new houses, under the 7% scenario. But under the new 25% scenario, 100% of the new houses must have advanced insulation, and even the reformed houses will all need to have insulation structure for energy conservation.
So these are the key measures required to achieve these targets and they result based on very detailed calculation.

(Slide 11) What about the impact on the economy when reducing 7% or 25%? What will be the impact on GDP, unemployment rate, or the change of capital investment in the private sector? What about the household burden of energy bill? Some estimate that the household burden will be 360,000 Yen per year per household if the -15% scenario is adopted.
And then there is marginal abatement cost which is discussed in terms of fairness among international society. 2000 Yen or 5000 Yen per ton is the reference figure when talking of carbon credit, where 82000 Yen per ton of CO_2 will be the marginal cost for the target of 25%, against that of 15000 Yen for the 7% target. So things are now being understood on quantitative terms as you can see.

(Slide 12) What will the energy composition be like? Both the power supply side and the CO_2 emission targets for different sectors can now be understood in the cases of 15% (2005) and 25% (1990). Under the 25% case, nuclear energy will need to exceed half of all power supply. Also under the 25% scenario, industry will need a reduction of 29%, transport 34%, commercial 41%, and conversion efficiency will have to improve by 33%.
(Slide 13) So what I have just said is summarized on this slide.

(Slide 14) Different research institutes around the world have also conducted various long term simulations about Japan. From 2020 to 2030, significant reduction is expected and fossil fuel will gradually

decrease. Nuclear and renewable energy will increase. Fossil fuel is expected to be reduced to less than half in 2030 or 2050.

(Slide 15) As I mentioned at the outset, the direction that Japan is aiming to proceed, is that Triple50 will have to be achieved by 2030. Fossil fuel dependence will be 50% and nuclear power 25%. It seems that we are approaching to straighten the framework where these targets are becoming gradually achievable.

(Slide 16) On the other hand, in our study group for midterm targets, we requested to review these issues, but not full review was conducted. The red line is the G8 agreement that is cutting by half by 2050, and the bold black line is the B1 scenario. The gap is so great between these two. CRIEPI (Central Research Institute of Electric power Industry) conducted this specific analysis under the research for Ministry of Education, and as the gap centering around 2 degrees; I should say this matter is really worth considering. That is why I have paid attention to this and Professor Matsuno and Professor Maruyama have conducted a detailed analysis to explorer such flexible pathway of reduction.

(Slide 17) Now today, what we have heard in the previous presentations is that following this emission path, the average temperature will rise over 2 degrees at one time but gradually come down. So the emission path was proposed. Already the developed countries have made commitment on 80% reduction by 2050 so these countries, internationally speaking, are to abide by this commitment that cannot be changed easily. As for developing countries, there is a lot of debate as to what they should do, it is still uncertain. If you look at the top line, this is presented to us by Professor Matsuno and Professor Maruyama, where the global temperature rise can be contained at around 2 degrees. And if this line could be shared around the globe then the share of developing countries would automatically be determined in this manner, D-1 line, so developed countries together with developing countries would add up to make this blue line up here.
So normally thinking, the reduction scenario should be shared around the globe first, and based on that scenario developing countries and developed countries should discuss the share of the burden, allocate how much reduction should be made by either party. But what it turned out to be, the developed countries first decide the reduction target and the following discussions are made afterwards.

(Slide 18) Next, let me brief through about energy technologies that Japan should develop, or technologies that are much effective in terms of energy conservation.

The most important issue is how we can efficiently use fossil fuels that is accounting for about 80% to 90% of energy. The natural gas combined cycle is a very efficient option in reducing emissions, in which the thermal efficiency is over 60%.

The second option is IGCC (Integrated coal Gasification Combined Cycle), where a large scaled commercial type is now available, and this IGCC developed by Japan could make a great contribution to the worldwide emission reduction.

Next I would like to mention about the development status of renewable energy today.

Above all, it is quite important that in Japan the batteries such as Lithium-ion battery to be linked together with renewable energy. Already 50,000 kW wind farm is equipped with 35,000 kW batteries, and are in commercial operation supplying power. As for wind power generation, its availability is unstable. By attaching battery, it can be turned into a very stable source of power, and that effort has already been begun. This is proving to be quite effective.

Japan is rich in geo-thermal, and ocean energy is also abundant. These are under-utilized renewable energy sources, and there is momentum to use these sources of energy more. Policy to strengthen the use is now being discussed.

And as for photovoltaic power generation, a fixed tariff system to purchase these powers at a high price of about 48 Yen per kWh starts from November of this year (2009). With this, Japan's photovoltaic power generation could see a rapid growth.

(Slide 19) As for nuclear power, people around the globe are looking at nuclear energy with refreshed eyes as we are seeing "Nuclear Renaissance" today. China and India, as well as Europe and US, are recognizing that nuclear energy is quite effective in preventing global warming. For example, let us look at the energy mixture where I have conducted some calculations. If the reduction is to be 50% in 2050, taking into consideration the growth rate, covering 50% with fossil fuel and 25% with nuclear energy is not enough. CO_2 emissions could not be reduced.

If we want to reduce CO_2 emissions by 50%, and the reduction will be achieved by nuclear and renewable energy by 50% to 50%, how much nuclear energy will be necessary?

The global total is 3,600 gigawatts, which means 3,600 nuclear power plants with 1 million kW each will be needed by 2050. This is a very large figure. Of course CCS (Carbon dioxide Capture and Storage) is not taken into account, so this number could be somewhat reduced. Even with that in mind, roughly speaking it is very difficult to rely 50% on nuclear energy to reduce emissions by 50%. Even before that, by 2030, if relying 17% on nuclear energy, the amount of confirmed reserves of uranium may be exhausted.

Even if we were to keep CO_2 at a certain level not as much reduction as 50%, 11 million tons of uranium would be required, out of the total reserve amount of 15 million tons.

This means if we keep using uranium at the current rate, the resource would be depleted.

So FBRs (Fast Breeder Reactors) or FBR cycle would be needed in the future.

(Slide 21) Not only that, we can see that the improvement of operation rate of nuclear power plants give us a lot of potential of the entire reduction. 13% of total reduction could come from higher operation of nuclear power plants. Construction of new plants could also lead to same level of reduction achievement, but the work with local communities and various regulations makes it a lot more difficult. Policy measures are expected to be implemented on this matter.

(Slide 23) Let me go back to this graph that Professor Shozo Kaneko put together. Currently we have a double combined cycle, and are going to go into Triple cycle before 2050, which shows how important it is to make efficient use of fossil fuels.
Global average of the thermal efficiency is around 30% today, and by achieving higher efficiency we will be able to cut CO_2 emissions by half.

(Slide 24 – 27) 3 Years ago Professor Satoru Tanaka launched "Japan's National Strategy for Global Nuclear Development", which gave positive and massive change to the stance of Japan's development on nuclear power, whereas the Fast Breeder Reactor is one of the results. Another is the next generation light water reactor, with high level of safety, minimal construction period and high resistant from earthquakes. Such next generation light water reactor is now being developed here in Japan.
Japan is also continuously developing HTTR (High Temperature engineering Test Reactor), the type of reactor which will provide industrial heat. This kind of steady development over the long term continuously is the core of Japan's nuclear power policy. Also about batteries that I have already mentioned, its development is under way by various manufactures, with hope that it could be the key to stabilize the unstable photovoltaic power generation or wind power generations.

(Slide 28) Furthermore from the projection that it may not be sufficient enough, development and research of CCS is underway with force. The feature of Japan is that there is not a large potential of geological sites on land available for CCS, so if Japan were to carry out CCS, the sequestration will have to be under sea or under sea bottom. This is going to be much more difficult than on land, but such research on ocean sequestration work is now being conducted very steadily.
We here in Asia need to work together with China, India and other countries in Asia to share new technologies to enable CO_2 reduction. That is the big challenge for us here in Asia. In the following panel discussion session, I hope to exchange views on this point as well.

(Slide 33 – 36) There is an appendix attached. Professor Zhou of China and other experts touched upon this "Japan-China Cooperation Forum on Environment, Energy, and Logistics", to talk about what can be done about the future energy composition. There was a discussion about Triple50. Japan is advanced in its efforts in doing Triple50 by 2030 and China would also implement a thorough research to seek what would happen if Triple50 is done by 2050.
A lot of information is being exchanged to discuss the future of Japan and China or the globe by 2050, to seek the position in the global environment, in terms of the CO_2 emission reduction. 2.7ton is the global emission per capita, so by referring to such numbers, how can we go about shifting energy? Such discussions have been made between China and Japan and we intend to deepen these efforts.
With this I would like to conclude my presentation. Thank you for your attention.