S-3 Low-Carbon Society Scenario toward 2050: Scenario Development and its Implication for Policy Measures

4. Integrated Measures of Technologies and Lifestyles against Global Warming - Ecodesign of ICT (Information Communication Technology) Society -

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1. Introduction

Due to the development and diffusion of information and communication technologies, we can get various benefits in all scenes of social life. Great social structure change will occur (ICT revolution). As consumption form of resources depends on social structure, ICT revolution will make it possible to bring about large influence on the environmental load of society. At present when it starts moving to ICT revolution, adding environmental consciousness to ICT revolution will lead to reforming industrial activity and life style into sustainable ones. This is our research perspective.

2. Research Objectives

We have been studying the influence of ICT diffusion on environmental problems. From previous study's results, we selected three important ICT applications. These are a "SCM(Supply Chain Management) system", which reduces resources used in the industry sector, "advanced traffic utilization system & teleworking", which increases energy use efficiency and decreases the frequency of traffic use, and "Eco-life guidance system", which changes people's actions to a more environmentally conscious one. We investigated these effects on environmental loads in more detail. In addition to these, we studied how to reshape our society into a more sustainable one through ICT.

3. Results and Discussion

(1) Eco-life guidance system

From the result of classifying existing eco-lifestyle navigation cases we surveyed, most of existing eco-lifestyle navigation cases are those systems which support the reduction of lost energy in usage. There should be some support systems in the scenes of purchase and re-using, recycling and wasting.

According to the report of CRIEPI and JYURI[2004][1], HEMS (Home Energy Management Systems) reduce about 2 to 7% of amount home energy usage, and eco-drive support systems improved fuel economy of private car by 6%. Automatic execution systems, which directly carry out the consumer's environmentally-conscious behavior as a proxy, are particularly efficient on the low environmental consciousness group. Conscious support systems, which offer consumers quantitative information about environmental loads, enhance the environmental load reduction effect of the automatic execution systems.

We estimated CO_2 reduction in 2020 by forecasting the adoption rate of eco-drive support systems and HEMS in 2020 based on the data in the report of Japan MIC[2005][2]. According to our forecast, eco-drive support systems for private car will improve fuel economy by 5.8% and be adopted by 1.5% of private cars. Therefore, eco-drive support systems for private car will reduce the demand of gasoline and diesel oil for private car by 8.7×10^{-2}% in 2020. The systems also reduce 1.1×10^{4} tons of CO_2 if applied to CO_2 emission in 2002 Japan. eco-drive support systems for transportation vehicles will improve fuel economy by 10% and be adopted by 30% of transportation vehicles. Therefore, eco-drive support systems for transportation vehicles will reduce the demand of gasoline and diesel oil for transportation vehicle by 3% in 2020. The systems also reduce 3.1×10^{6} tons of CO_2 if applied to CO_2 emission in 2002 Japan. HEMS will reduce home energy use by 10.4% and be adopted by 34% of households. Therefore, HEMS will reduce total home energy use in Japan by 3.5% in 2020. The systems also reduce 5.8×10^{6} tons of CO_2 if applied to CO_2 emission in 2002 Japan.

(2) Advanced traffic utilization system & teleworking system

We examined a model of how people will commute and work in the future which is based on individuals and their local communities[3]. We calculated the effect of the model in reducing CO2 emissions and examined the role of ICT in constructing the model.

First, we summarized examples of executing (or planning) an ITS (Intelligent Transport System) and teleworking and used this information as the basic data to create an eco-designed movement model. We present the concept for the model together with estimates of the reduction in CO2 emissions that would be achieved by a modal shift in commuting and the promotion of teleworking as a result of the proposed system[4].

We propose an eco-designed movement model that includes a real-time secure traffic system and a decentralized office-sharing system[5]. This traffic system would automatically generate and adjust an individual's transportation mode and schedule based on their personal schedule and the traffic situation, and would enable seamless use of multiple transportation systems such as buses, trains, LRT, AGT, and car sharing/pooling. A decentralized office-sharing system would enable flexible working styles such as teleworking according to individual circumstances (sex, age, family

structure, and skills). As a result, the mode of transportation used for commuting would shift from cars to public transport, and commuting distances would decrease.

Three types of modal shifts in car commuting are assumed: modal shifts to buses or car pooling, and conversion to compact cars, i.e., hybrid and electric cars. The estimated reduction in CO2 emissions in 2010 as a result of these modal shifts is described below[6]. If the target for fuel consumption in 2010 is achieved, there will be an estimated reduction of 11.3% in CO2 emissions. If hybrid and electric cars are used more widely as expected, there will be an estimated reduction of 13.6 and 11.5%, respectively, in CO2 emissions with an overall reduction of 13.7%. A modal shift to buses will have the greatest effect, reducing emissions by 17.1%. If all the proposed elements are achieved, CO2 emissions will be reduced by an estimated 19.1% in 2010.

The estimated reduction in CO2 emissions as a result of greater numbers of people teleworking in 2010 is described below4). It is assumed that 13.4 million people who are not teleworkers in 2000 will become teleworkers by 2010. In comparison to this number of people not teleworking in 2000, the amount of CO2 emissions generated by people's daily movements including commuting in 2010 will decrease 2.1 million tons a year, i.e., a reduction in CO2 emissions of 22.4%.

(3) SCM system

We investigated about the environmental impact of using ICT[7], for example of production and distribution management system such as SCM, in food, textile, medicine and cosmetics industries, and that how much influence went out to the environmental burden reduction when the information cooperation progressed to the whole in food, textile, medicine and cosmetics industries. This study suggested that the reduction of the environmental loads were about 3.9 millions t-CO2, corresponding to more than 10 % of amount of total CO2 emissions in these industries.

(4) Future impact of ICT

This table summarizes the impact of ICT diffusions on the total CO2emissions of Japan around the year 2020. The last column shows the impact forecast from previous studies regarding the impact in the year 2010. These numerical values, which indicate ICT impact in the year 2020, were obtained from our studies. These values reveal that CO2 reduction caused by ICT diffusion will be at the most 10% in 2020.

Table 1 the impact of ICT diffusions on the total CO2emissions of Japan around the year 2020

	Industry	Freight transport	Passenger transport	Office	Home	Recycling	Impact on CO2 emmisions	
Diffusion of ICT equipment	Resource consumption			Electric power	Electric power	Waste	Negative I	
Supply chain management (B to B)	Resource consumption	Transport					Positive I	**-3 to -4%**
Internet shopping (B to C)	Resource consumption	Resource consumption		Number of shops			Negative/Psotive	
Teleworking			Transport	Number of offices	Electric power		Positive III	**-1%**
Advanced traffic utilization system (modal shift in commuting, ETC, etc.)		Transport/ Energy consumption	Energy consumption				Postive II	**-1%**
Dematerialization system (newspaper, magazine, and CD)	Resource consumption	Transport		Number of shops		Waste	Positive III	**-1%**
Eco-life guidance system(HEMS,BEMS,etc)		Energy consumption	Energy consumption	Electric power	Electric power	Waste	Positive I	**-1 to -2%**
A product and manufacture management	Resource consumption						Positive I	
Recycling information system	Resouce consumption					Waste	Negative/Psotive	
E-government			Transport			Wastes	Positive III	

	Rate to the total 2020' emissions
I	3-5%
II	1-3%
III	0-1%

Reduction
Unknown
Increse

4. Summary

We described the influence of ICT diffusion on environmental problems. There is no doubt that ICT can make a large contribution to the solution of environmental problems. In particular, we take notice of their two contributions. The first, ICT enable people to get a concrete image about environmental problems from various points of view. This would lead people to an environmentally conscious life. The second, ICT removes the restriction about “distance”. This would cause large changes in an urban structure. It may be possible to make a new society which minimizes movement of goods, resources and people.

When we presume the impact of ICT in the year 2050, we have to forget these above results, because the progress of ICT will be too rapid to forecast both the state of technologies and its diffusion in society. For starters, we will draw a clear vision of a networked society, which many people desire strongly, under the condition of achieving low carbon emissions.

Reference

1) Central Research Institute of Electric Power Industry, Jyukankyo Research Institute Inc., Ippankateiniokeru HEMS dounyujissyousiken’niyoru syouenerugikouka no hyoukakaiseki, 2004

2) Ministry of Internal Affairs and Communications, yubikitasunettosyakai no sintento kankyou ni kansuru tyousakenkyukai, 2005

3) Ministry of Land, Infrastructure and Transport, White paper on land, infrastructure and transport in Japan, 2002
4) K.Nakano et al, Proceedings of EcoDesign2002 Japan Symposium, 2002
5) H.Ueda et al, IASTED International Conference on Environmental Modelling and Simulation (EMS 2004)
6) K.Nakazawa et al, 4th SETAC World Congress (2004)
7) J.Nakamura, K.Honjo, H.Tatemichi, T.Tanaka, Y.Ibata, and S.Nishi, “Evaluation of Environmental Impact of the Spread of the Information Communications Service in Japan”, Proceedings of 11th SETAC Symposium, pp.73-74, Lausanne, Switzerland, Dec.2003.