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A design of the Asian common energy strategy

— How can we solve a “triple dilemma” among economic growth, energy consumption and environmental safeguard in Asia ? —

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Content

Preface

There is a remarkable emergence of the possibility of the East Asian Community. Concerning this issues, there are five strategic regional cooperations aiming to build the East Asian Community. First one is the cooperation for the formation of the East Asian FTA (Free Trade Agreement)/EPA (Economic Partnership Agreement) (Note 1). The second is the cooperation for the formation of the Asian common Currency System (Note 2). The third is the cooperation for the formation of the Asian Green Space (Note 3). The forth is the cooperation for the formation of the Asian Erasmus Plan (Note 4) and the last one is the cooperation aiming for the formation of the Asian Energy System. Why are these five cooperations going to advance or getting ready for the strategy in East Asia ? The reason is because such five kinds of cooperation are inevitable for the building of the East Asian Community. The reason why these five cooperations are referred to as "strategic" depends on this context.

Among these cooperations, the cooperation in the energy and environmental fields is decisively important for the building of the East Asian Community from the long term viewpoint, namely from the viewpoint of sustainability, in Asia. Because there is a

severe "triple dilemma" among economic growth, energy consumption accompanied by procurement problem and environmental safeguard which impedes sustainable development in Asia especially in China. Then we should cooperate with each other especially in energy and environmental fields to solve such a "triple dilemma". To solve these issues, I will survey a design of the Asian common energy strategy being expected to contribute towards the formation of the Asian Energy System in this article.

I will explain an awareness of the issues because such an explanation will be convenient for you in order to understand the issues. Unfortunately, we cannot deny the fact that China is being impeded by the typical "triple dilemma" in Asia. For instance, in China, even if the amount of the primary energy consumption per GDP will decrease from 1.07 (Note 5) in 2000 to 0.50 (Note 6) in 2030 due to the increase of the utility ratio of the enargy, its economic growth – even in the standard case in which case Chinese economy will grow at an annual rate of 6.6% (real term) from 2000 to 2030– will conbine to the broad increase of primary energy consumption resulting in the triple time of its volume of consumption in 2030 comparing to present primary energy consumption level. Needless to say that such rapid increase of energy consumption will emerge two bottlenecks on its economic development.

Firstly, China will encounter the difficulty of domestic energy procurement resulting in over-dependence of energy resources from offshore districts. For instance, even in 2000 China depended on imports for its oil supply that resulted to nearly 50% offshore dependence ratio. In the future the ratio of offshore dependece in oil supply will increase more steeply accounting for even over 80% in 2030. Needless to say that this kind of overdependence on oil from offshore districts will inevitably induce severe tensions beteen China and other countries especially neighbouring countries in North East Asia.

Secondly, China will face toward a steep increase of CO_2 emission owing to this kind of rapid increase of energy consumption. For instance, China's CO_2 emission will increase from 4,772.5 million Tons in 2004 to 10,428.4 million Tons in 2030, thus bringing China's emission share in the world to 25.8% in 2030 from 18.3% in 2004.

Why dose China pursue this kind of high economic growth within which growth it cannot cancel out over consumption of primary energy by the increased utility ratio of energy resulting in steep increase of energy consumption accompanied by severe bottlenecks of its development due to two factors namely, the overdependence on offshore districts in energy procurement and the increase of CO_2 emission? I think there are two reasons. The first is a necessity of high economic growth inevitable to solve unemployment problems especially in rural districts. The second is the moterization, especially in urban districts where peoples income are going to increase due to high economic growth accompanied by rapid mortalization. Needless to say that high economic growth and rapid moterization invariably accompany steep increase of oil which would be impossible to aquire easily since its resources depend mainly on offshore districts.

Then China is going to face three issues in order to solve its "triple dilemma". First one is a transefer from unsustainable economic growth to a sustainable one. Second one is procurement of energy with safety avoiding tensions with offshore countries especially tensions with its neighboring countries in North East Asia. Third one is a reduction of CO_2 emission accompanied by regional cooperation especially with North East Asian countries.

I think the cooperation between China and Japan is most important cooperation among North East Asian cooperations because not only China but also Japan is facing over-dependence on offshore districts in energy procurement ; especially in oil and natural gass procurement. Then if there will be no cooperation between both countries, there will be the possibility of severe confriction in both countries for the acuisition of energy resources (Note 7). There is no need to say that such a confrict between China and Japan decisively impedes not only the cooperation in fields of energy and environmental safgurd but also the building of the "East Asian Community".

By the way, circumstances are severe not only in China but also in other countries in Asia. For instance, it is predicted that the amount of energy demand in Asia will increase from 3,140 million TOE in 2002 to 5,967 million TOE in 2030, owing to rapid economic growth in Asian countries resulting in for Asia to hold 46% of the amount of energy demand increase in the world till 2030.

Needless to say that such a rapid increase of energy consumption will contribute to the increase of CO_2 emission in Asia, too. For instance it is predicted that Asia, including China, will occupy over a half of the amount of CO_2 emission increase in the world from 2002 to 2030.

Therefore, to olve the triple dilemma not only in China but also in Asian countries, we should build a common energy strategy in Asia accompanied by not only the acquisition of energy resources in security but also the adjustment of policies contributing to stabilize macro-economy and to reduce CO_2 emission.

We should stress that there are two points to be taken in the consideration of common energy strategy. The first point is the significance of the "strategy". This point relates mainly to the cooperation between China and Japan. We have to take note with the context that such a common energy strategy will contribute not only to cooperations among Asian countries but also to the cooperation between China and Japan as mentioed-above. This will lead to avoideance of the possibility of severe confrict between China and Japan for the acquisition of energy resources. For this aim, Japan not only should directely promote the cooperation between both countries on the one hand but also should adopt the "strategy" by which we will be able to use regional institutions and treaties in Asia on the other (Note 8). The reason why Japan needs common energy strategy in Asia owes to this point, too.

The second point is the way how to cooperate. We should not neglect the fact that the "cooperation" has a limitation in the case of the building of the "East Asian Community", because the cooperation itself is incompetent to handle the dynamism in the change of international competitiveness in Asia. Then we should shift from the "ccoperation" to the "symbiosis" (Note 9) which is expected to be competent to handle it through the building of the "East Asian Community". Then, needless to say that such common energy stratergy in Asia should be promorted aiming not only for the regional cooperation but also for the building of the "East Asian Community".

According to the purpose of my article and an awereness of the issues, the construction of the article is consisted of four subjects which are (1) the present structure of energy demand and supply in Asia, (2) the triple dilemma among economic growth, energy cousumption accompanied by procurement problem and environmental safegurd in China, (3) the valunerability in energy procurement due to expremly low

level of self-sufficiency in Japan and (4) the strategic regional ccoperation for the formation of the Asian Energy System.

(Note 1) It is reported that Japanese Prime Minister Abe proposed a design of the East Asian EPA/FTA, January, 15th, 2007 in East Asian Summit, which will consist of 16 Asian countries (ASEAN 10＋3 [Japan･Korea･China]＋3 [India･Australia･Newzealand]) and it was agreed that it should be studied by 16 countries (Refer to Asahi Shinbun January, 16th, 2007). It is thought that the proposal of this design by Japanese Government owes to three reasons. The first reason is Japanese economic interest aimed at aquiring the Asian market which has been increasing steeply in resent years. For instance the amount of share of Japan's FDI (Foreign Direct Investment) toward ASEAN10･China･Korea in the total amount of Japan's FDI increased from 11% in 1999 to 26% in 2004 accompanied by two results in which Japanese overseas companies turnovers increased from ＄110 billion in 2003 fiscal year to ＄220 billion, being equivalent to 5% of Japanese GDP, in 2005 fiscal year on the one hand, while these companies local employments have reached to 2 million personnel in 2005 fiscal year on the other (Refer to Nihonkeizai Shinbun November 20th, 2006)；the share of the amount of Japan's export toward ASEAN10･China･Korea in the total amount of Japan's export increased from 36% in 1999 to 47% in 2004 and the share of the amount of Japan's import from ASEAN10･China･Korea in the total amount of Japan's import increased from 39% in 1999 to 44% in 2004 (Refer to Asahi Shinbun「East Asian EPA」April 21st, 2006). Moreover, if we take into account the case of all 16 ountries (ASEAN10＋3 [Japan･Korea･China)＋3 [India･Australia･Newzealand]), the amount of the trade between Japan and 15 countries (ASEAN10･Korea･Chian･India･Australia･Newzealand) is equivalent to about ￥50 trillion occupying about 40% of the amount of Japanese trade in aggregate, and the amount of GDP of 16 countries (15 countries mentioned above＋Japan) in aggregate is equivalent to about US＄9 trillion or close to US ＄12～13 trillion of NAFTA and EU (Asahi Shinbun August 2nd, 2006).

The second one is the avoidance of the confusion of trade system due to FTA. As well known, FTA depends on bilateral base. Then, as negotiations of FTA by each countries has advanced, it is inevitable that Asian trade system has dropped in trade confusion. We call this kind of confusion owing to bilateral FTA (the number of FTAs which have been concluded and have already taken effect after 1997 are 25, and the number of FTA which are going to be negotiated yet and are proposed newly are 36 [Refer to Tohiko Kuroda「Dose the unification of Asian economy advance ?」[Nihonkeizai Shinbun February 11th, 2006]) as "Cup Noodles Effect" (Refer to Richard Edward Baldwin「East Asian Economic Unity－It needs new trade system to avoide trade confusion－」[Nihonkeizai Shinbun March 13th, 2006]). To avoide such a kind of trade confusion, East Asian countries need to shift from old FTA being negotiated on the bilateral base namely on the "Line" base to new FTA being negotiated on the multilateral base namely on the "Space" base.

The third reason is political. Japanese design suggests that Japanese government is going to eager to take the initiative for the building of the "East Asian Community".

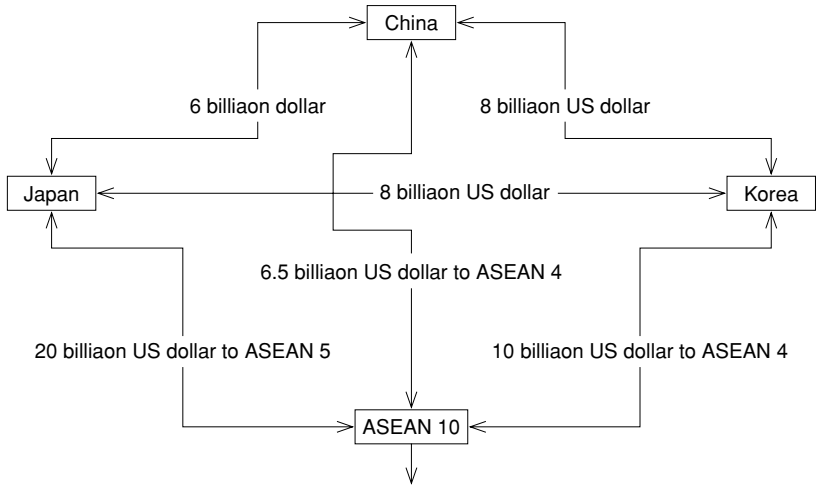
(By the way, we should take note two issues cocerning to a design of the East Asian EPA/FTA. A first issue is the point that there is a difference between EPA and FTA. As well known, EPA which is proposed by Japanese government includes not only the

retection of tariff ratio but also the advancement of FDI[Foreign Direct Investment] and the guarantee of IP [Interectual Property] etc. A second issue is the fact that EPA negotiation between Japan and ASEAN has already begun on April 13th 2005 aiming to agree by March 2007 along the "Plan of EPA Networks" putting the importance on EPA between Japan and ASEAN as the hub of East Asian EPA [Rfer to Nihonkeizai Shinbun April 14th, 2005.)

(Note 2) It is reported that financial misters of ASEAN＋3 (Japan･Korea･China) have agreed to study an "Asian Common Curency Unit" being expected to combine to "Asian Common Curency System" on May 4th 2006 (Refer to Asahi Shinbun May 5th, 2006).

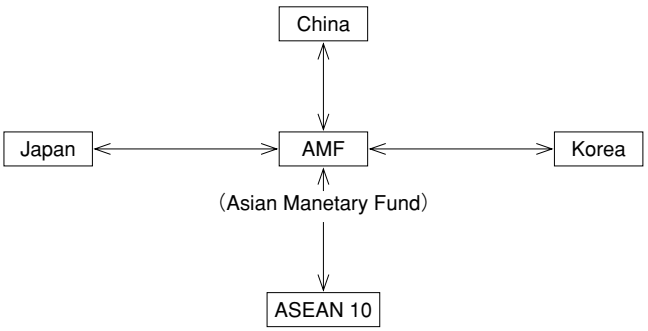
Related to this issue, it is noticeable that there are some advances in fields of financial and investment cooperations including (a) the development of the "Chiengmai Initiative", (b) a design of the creation of AMF (Asian Manetary Fund) and (c) a design of the creation of "Asian Bond Market." Among these cooperations ranging from (a) to (c), we should notice the development of the "Chiengmai Initiative" which has already been deployed as East Asian currency swap system on the base of bilateral agreement between East Asian countries (refer to bellow Chart[The "Chiengmai Initiative" in present]) owing to the meeting at Chiengmai in Thailand on May 2000 being held on the purpose to avoide the vicious effect from the currency crisis that prevailed in East Asian countries in 1998. Because it is reported that finacial ministers of ASEAN＋3 (Japan･Korea･China) have agreed to cooperate in the formation of a new framwork of the "Chiengmai Initiative" which is intended to develop from the bilateral base to multilateral base including a design of the creation of AMF (Asian Manetary Fund) (refer to bellow Chart [A design of new "Chiengmai Initiative"]) on the background of a possibility of steep "dollar slide" in near future, too (refer to Nihonkeizai Shinbun May 5th, 2006 and Asahi Shinbun May 11th, 2006).

A design of new "Chiengmai Initiative"
[The "Chiengmai Initiative" in present]



（Source ; Asahi Shinbun November 30th, 2005）

[A design of new "Chiengmai Initiative"]



(Note 3) According to The Kiyoto Mechanism, there are three kinds of international cooperation related to the reduction of air pollution owing to energy consumption. First one is Clean Development Mechnism (CDM). Second one is Joint Implementation (JI). Last one is Emissions Trading (ET). Then there are substantially three kinds of cooperation in the framework of The Kiyoto Mechanism. (Genarally saying, these three kinds of cooperation are called as "Haisyutu-ken Torihiki" in Japan.)

Bsides CDM/JI projects which were approved by Japanese government in February 2005, there are several cases concerning to CDM. For instance, as in Chinese cases, Japanese enterprises namely Nikki, Marubeni, Shinnittetu, Mitubishi Syoji, and Mitui Bussan etc have aquiered CDM.

Moreover, biside The Kiyoto Mechanism, there is another international cooperation namely Asia-Pacific Partnership related to Clean Development and Climate, which consists of six countries in Asia-Pacific region namely United States, Japan, China, India, Korea and Australia. This cooperation is leaded by United States from viewpoints not only of energy・environmental problems but also of security problems. This is because there is a familiar relationship between energy problem especially energy procurement problem and security problem in Asian-Pacific region. It is reported that this cooperation has decided a design to reduce air pollution in eight fields on January 12th 2006 (Refer to Nhonkeizai Shinbun January 12th, 2006).

Related to this issues, it should be stressed that there are two regional approachs in EU and Asian countries. At first we will introduce EU approach because EU environmental policies have decisive effect not only on the management of enterprises in European countries but also on the management of enterprises especially global enterprises in the world. The first one of environmental policies in EU is WEEE which orders recycling of almost all electric&electronics resulting in cost burden on exporters of these manufactures to EU and foreign manufactures concerned to these manufactures in EU. The second one is RoHS which prohibits 6 kinds of toxic chemical substances and the third is EUP order which requires a design of energy saving manufactures and an assessment of zero-CO_2・SO_2 emission manufactures. (Refer to Asahi Shinbun「Decrease of environmental burden in the management of foreign trade and foreign investment as key factor」July 29th, 2006). Secondly it should be pointed out that there is another approach in Asian countries. Concerning to China, the Chinese government has decideded on March 3rd 2006 that the amount of energy consumption per GDP should be decreased 20% in 2010 comparing to the

ratio of it in 2005 and that total amount of emission should be decreased 10% from 2005 to 2010 according to the new eleventh "Five Year Plan" (Refer to Asahi Shinbun March 6th, 2006 and to Toyokeizai April 22nd, 2006 [p.109]). ASEAN countries are going to promort more strict plan of the reduction of air pollusion especially automobile exhaust gas from 2006, too (Refer to Nihonkeizai Shinbun February 2nd, 2006).

Still more, concerning to the issues of the formation of the Asian Green Space, secondly it should be stressed that there is another important theme which should be studied beside the theme related to the relationship between air pollution and energy consumption. That theme is related to the recycle of resources and goods in East Asia. Concerning to this theme, regional logistic system of "Venous Economy" in East Asia should be especially studied (Refer to professor Eishi Hosoda「It needs to build East Asian Venous Logistic System」[Nihonkeizai Shinbun August 19th, 2004]).

(Note 4) Japanese Ministry of Economy, Trade and Industry has proposed a design of "Humman Resources Upbringing" in Asia (Refer to Ministry of Economy, Trade and Industry『White Paper on International Economy and Trade』[2005] p.311～314). Related to this issues, there are three points which should be referred. Firstly, professor Kei Amago insists that there is ineed to prepare common curriculums in professional education (for instance energy, environment, regional regeneration, building of peace, culture and information etc) in East Asia with the intention to form the "Asian Erasumus Plan" (Refer to Asahi Shinbun February 15th, 2006).

Secondly, Mr. Kin Tanaka, Prof. Jiturou Terajima and Prof. Takashi Shiraishi make general proposal consisting of (a) humman resources upbringing, (b) education, (c) research－which have familiar relationship with the building of the East Asian Community. Namely, concerning to (a) humman resources upbringing, it is needed to form the system of humman resources upbringing related to "functional cooperation" －namely regional cooperations in each fields－. Concerning to (b) education, it is needed to provide education for future generation from the viewpoint of the building of East Asian Common Identity. Concerning to (c)research, it is needed to study basic themes contributing to the building of the East Asian Community－namely energy, environment and security etc－which will be expected to be advanced by the leadership especially by Japanese leadership. (Refer to Mr. Kin Tanaka, Prof. Jiturou Terajima and Prof. Takashi Shiraishi 「Japan should advance toward the East Asian Community with self-confidence」[Toyokeizai May 6th 2006] p.124～131.)

Thirdly, there is a education in Japanese university which puts the importance on ethical themes especialLy in the field of business education－namely, (a) symbiosis education to co･exist with peoples in neighbouring countries, (b) business ethics education in the age of globalization, (c) language education for the communication with foreigners who have diversity of life, culture and identity－to promote the common education in Asia in which it needs to synthesize the contradictional relationship between the market mechanizm and the ethics (Refer to Yasuhiko Ebina「A sutdy of the reform of university－the "Global Business Education" in the age of the East Asian Community－<Discussion Paper>」[Niigata University of Managerment･Cooperate Study<2006> p.5～32).

(By the way, EU has another two common education systems besides Erasumus Plan which aims to "enhance the quality and reinforce the European dimension of higher education by encouraging transnational cooperation" [Refer to URL of "SOCRATES-ERASMUS"]. One is College of Europe Which was build in 1949 aiming to educate EU bureaucrats especially high-ranking officials [Refer to Nihonkeizai Shinbun May 15th, 2005].

Another one is a plan to build European College of Technology that aims to promote the development of most advanced high-technology in EU [Refer to Nihonkeizai Shinbun February 25th, 2006].

(Note 5) The amount of the primary energy consumption per GDP in 2000 is equal to 1.07 TOE/10,000 yuan (929,329 KTOE/8,702.4 billion yuan) (Refer to Zhidong「Energy and environment problems in China」 [http://www.rieti.go.jp/jp/papers/jounal/0410/bs01.html] [Supplement] p.28). By the way, TOE means "Ton of Oil Equivalent".

(Note 6) The amount of the primary energy consumption per GDP in 2030 will be equal to 0.50 TOE/10,000yuan (2,973,983 KTOE/59,450.7 billion yuan) (Refer to Ibid).

(Note 7) Then, this point indicates for us that the energy procurment problem extending over two countries of China and Japan has familiar relationship with security problem not only across East Asia but also even across North Pacific including U.S.A. (Related to this point, refer to professor Takashi Shiraishi「The necessity of a Tripartite Council among Japan, U.S.A. and China concerning energy cooperation, security problems and territorial waters problems of the East Chinese Sea which are key factors from the viewpoint of strategic purposes consisting of both of the inducement of the paricipation of China to the "East Asian Community" and the restriction of its "overpresence" in East Asia especially in North East Asia」(Yomiuri Shinbun July 30th, 2006) and Kokushi Maeda「Control China by energy resources－The framework of American new policy-mix owing to the linkage of the energy and the security in North East Asia－」[Chuo Koron] <May 2005> p.144～153).

(Note 8) This issue has familiar connection with Chinese policy in Japan. Namely, Japan has to use ommon rules in Asia not only to induce positive participation of China but also to restrain of the over-presence of it in Asia. Concerning to this issues, refer to Yasuhiko Ebina「Japanese economy in the age of Low Fertility and the significance of Asian Unification－A New Growth Scenario of Japanese economy and society under demographic and geographic changes－」(Niigata University of Management『Journal of Niigata University of Management』(No.12) p.27～29.

(Note 9) Concerning to the concept of "symbiosis", refer to Ibid p.25～27.

Ⅰ. The present demand and supply structure of energy in Asia

1. The survey of the world energy situation

(1) A prospect of demand and supply structure of primary energy in the world

① The demand structure

IEA (International Energy Agency) predicts that primary energy demand in the world will increase at the average ratio of 1.7% per year from 2002 to 2030, so that its amount in 2030 will reach an incredible 16,487 MTOE (Note 1) which will increase about 160% comparing to the level of 10,345 MTOE in 2002 (Note 2). It is noticeable that the average increase ratio of 1.7% per year from 2002 to 2030 is less than the average increase rate of 2.0% per year over the past 30 year due to the increase of energy

efficiency and the shift of industrial structure from heavy industry-oriented stucture to service industry-oriented structure especially in developed countries.

But we should not neglect another trend in the demand of primary enargy ; that is the rapid increase of the demand in developing countries. IEA predicts that developing countries will share 2/3 of 6,142 MTOE equivalenting in amount increasing from 10,345 MTOE to 16,487 MTOE owing to rapid economic growth and steep increase of population in developping countries.

The new trend in the demand of primary energy owing to developing countries reflects on the structure of primary enegy demand. Fossil fuels consistig of oil, natural guss and coal will occupy about 85% in increasing amount of the demand of primary enrgy from 2002 to 2030 resulting in continuation of its position as main source in energy demand. Among such kinds of fossil fuels, natural gas will rapidly increase due to the increase of the demand in the field of electric power especially in developing countries and oil will steadily increase owing to the increase of demand in the field of transportation not only in developed countries but also in developing countries (Note 3).

As the result, It is estimated that demand condition of primary energy will shift from 2004 to 2030 as follows. For instance, in the case of oil, total amount of demand will increase from 82.1 million B/D in 2004 to 115.4 million B/D (Note 4) in 2030. And the share will broadly change. The share of developing countries will increase from 36.7% (China 7.6%, India 3.2%, other Asian developing countries 6.6% out of 36.7%) to 46.9% (China 11.4%, India 4.5%, other Asian developing countries 22.4% out of 46.9%) whereas the share of OECD countries will decrease from 58.0% to 47.7% and the share of countries transferring from central planning-oriented economy to market mechanizm-oriented economy will not change from 5.4% level (Note 5).

Especially we must stress the emergence of Asian countries in the transefer of share positionning, because China, India and other developing Asian countries steeply increase their shares in primary energy demand. In particular, China's demand of oil will increase rapidly. Accoding to IEA, China will increase its share from 7.6% in 2004 to 11.4% in 2030 resulting in a double increase mentioned above.

② The supply structure

Related to the prediction of primary energy supply in the world, IEA estimates the supply condition as follows. Concerning oil, the amount of the supply will increase from

82.1 million B/D in 2004 to 115.4 million B/D in 2030. Then, concerning oil it is estimated that the increase ratio of demand and supply are equal in IEA prediction. But it is noticeable that the position of share among oil suppliers in the world will steeply change owing to the emergence of Middle East OPEC countries which will increase its share from 27.8% in 2004 to 58.1% in 2030 (Note 6). And Russia is going to emerge gradually. Its chare will increase from 12% in 2002 to 13% in 2030 (Note 7). In short, there is a possibility that the world will stress its present primary energy dependency on Middle East OPEC countries through the oil dependency on them.

It is estimated that the amount of the investment for energy supply equipment will reach to about US $ 16 trillion in the accumulation by 2030 (Note 8). The amount of the investment owes mainly to developping countries especially China and other Asian countries, and concentrates in the field of elactric power. They have greedy appetit for energy in both fields of electric power and transportation mentioned above.

(2) A prospect of CO_2 emission due to the consumption of energy

Related to the final consumption of enrgy, IEA predicts that it will increase at the average rate of 1.6% per year from 2002 to 2030 resulting in the constant ratio (namely 68%) of the final concumption of energy in primary energy demand. Nevertheless IEA is afraid there will be steep increase in the final consumption of energy especially in the field of transportation, because IEA estimates that the final consumption of enrgy in the field of transportation will increase at the average rate of 2.1% per year.

This type of energy concumption will necessarily induce the emission of pollutants owing to energy consumption so steeply that the globe will be unable to avoid severe air pollusion. IEA predicts that the emission of CO_2 due to energy consumption will increase at the average rate of 1.7% per year from 2002 to 2030, which will over the average rate of 1.6% per year in the case of final consumption of energy, which means that the amount of CO_2 emission in 2030 will reach 38,214 million Ton, an increase of about 160% comparing to the level of 23,579 million Ton in 2002 (Note 9).

Moreover main fields of CO_2 emission will be two, that are electric and transportation in which fields developing countries are main actors occupying 2/3 of the amount of increase in CO_2 emission in the world (Note 10). Especially it is predicted that China will occupy 25% share in the amount of increasing of CO_2 emission in the world from 2002 to 2030 even in the case of average growth rate 4.8% (real term) per

year in Chinese economy (Note 11).

2. Energy problems in Asia

(1) The structure of the energy market

① The demand structure

A. The increase of energy consumption

The amount of primary energy consumption in Asia (Note 12) has increased from 736 million TOE in 1971 to 2,774.5 million TOE in 2003 resulting in the increase at the average rate of 4.2% per year from 1971 to 2003. It will be easy to understand how 4.2% is rapid comparing to 2.0%, which is the average ratio per year from 1971 to 2003 in the case of the world (Note 13). As the result, Asian share of energy consumption in the world has broadly increased from 14.1% in 1971 to 28.5% in 2003 (Note 14).

There are two factors in such a kind of rapid increase in energy consumption in Asia. First factor is economic growth and second is the increase of population. Owing to rapid economic growth namely average rate of 4.1% (real term) per year from 1971 to 2001, Asian GDP (real term, in the aggregate of main ten countries) has increased from US $ 2,699 billion in 1971 to US $ 8,957 billion in 2001 (Note 15). Especially the growth rate was high in China (8.5%), Shingapole (7.6%), Taiwan (7.5%), Korea (7.2%), Malaysia (6.8%) and Thailand (6.3%) etc. Except China in which rapid growth rate has not necessarily conbined with energy consumption per GDP owing to the increase of energy effect mentioned bellow (refer Chapter Ⅱ), such rapid growth rate in above-mentioned countries has conbined with the increase of the amount of energy consumption per GDP (Note 16).

Asian population (in the aggregate of main ten countries) has steadly increased from 1,762 million in 1971 to 2,877 million in 2001 resulting in the increase at the average rate of 1.6% per year (Note 17). Among Asian countries China (1,272 million in 2001) and India (1,032 million in 2001) have big population. On the other hand, the amount of energy consumption per head has steeply increased in many Asian countries (Note 18). Then even steady increase of population has brought about broad increase of energy consumption mentioned above.

B. The structure of energy consumption

From the viewpoint of each country in Asia, main tractors of the increase of primary

energy consumption in Asia are Korea, Inia, China and ASEAN countries resulting in the increase of energy consumption share of these countries namely China (from 35.6% in 1971 to 45% in 2003), India (from 9.1% to 12.4%), Korea(from 2.1% to 7.6%), ASEAN 5 (from 4.6% to 10.8%) in Asia except Japan (from 40.4 to 18.2%) (Note 19).

From the viewpoint of each energy source in Asia, main contributors of energy consumption are coal, oil, natural gas and nuclear energy resulting in the increase of energy consumption share of natural gas (from 1.9% in 1971 to 10.2% in 2003) and nuclear energy (from 0.2% to 3.8%) among these sources. But the fact should be noted that the consumption ratio of coal (from 45.7% in 1971 to 45.2% in 2003) and oil (from 46.8% to 36.2%), both of which have steep relationship with the air pollution as a fossil fuel, is high even now maintaining their position as main contributor in primary energy sources and as main contributor to air pollution at the same time (Note 20).

C. A prospect of energy consumption

According to the IEA, it is projected that the amount of energy demand in Asia will increase from 3,140 million TOE in 2002 to 5,967 million TOE in 2030 at the average increasing rate of 2.3% per year resulting in Asia ocqupying 46% of the amount of energy demand increase in the world till 2030 (Note 21).

Relating to the structure of countries, IEA predicts that Chinese demand will increase from 1,243 million TOE in 2002 to 2,539 million TOE in 2030 at the average increasing rate of 2.6% per year resulting in China taking up 21% of the amount of energy demand increase in the world by 2030 (Note 22). Especially Chinese demand for oil will increase steeply leading it to occupy a broad share in the world, already mentioned above.

Related to the structure of sources, IEA predicts that natural gas will steadly increase but coal will maintain its position namely, top runner resulting in its maintaining of present structure of energy sources (Note 23).

② The Supply structure

A. Oil production shortages

a. Coal

As aleady explained, main energy sources in Asian primary energy supply are coal and oil (See Note 20). Then we will study the supply condition of coal and oil. At first

we will pick up coal. In the case of coal, the production is equivalent to consumption. The amount of coal production in Asian countries (China, India, Indonesia and North Korea)is 1,985 million TON in 2003 (Note 24), whereas the amount of coal consumption in Asian countries (China, India, Japan, Korea, North Korea and Taiwan) is 2,099 million TON in 2003 (Note 25).

In near future, there will be no shortage in the demand and supply condition in Asia. According to IEA prediction, the amount of the increase of coal production from 2002 to 2030 in Asian countries (China, India and Indonesia) will be 1,587 million TON (converting into oil) (Note 26), whereas the amount of increase of coal consumption from 2002 to 2030 will be 1,038 million TON (ibid) (Note 27).

b. Oil

On the contraly, in the case of oil there will be severe shortage in Asian demand and supply condition especially in near future.

The amount of oil production in Asia is 6.16 million B/D in 2002 and the production share is 8% in 2002 (Note 28). On the other hand, the amount of oil consumption is 7.70 millon B/D in 2002 and the consumption share is 10% in 2002 (Note 29).

Then we can find the fact that there is a little oil shortage of 1.54 million B/D in the demand-supply condition even in 2002 in Asia.

But such a kind of oil shortage will steeply increase in near future. Firstly we will return to the amount of oil production in Asia. It will be 3.63 million B/D in 2030 and the production share will be only 3% in 2030. Secondly we will pick up a prediction of oil consumption (See Note 29). We can find the prediction of Asian oil consumption in 2030. The amount of oil consumption will be 17.0 millon B/D in 2030 and the consumption share will be 14% in 2030 resulting in huge oil shortage of 13.37 million B/D in 2030 in Asia.

B. Import of oil

a. Huge amount of import

Then, concerning to the oil, Asia is obliged to import from other districts to compencate its own shortage. For instance, the amount of production of oil is 349 million TOE in 2003 and the amount of its consumption is 1,004 million TOE in same year resulting in huge amount of oil import (net import) namely 655 million TOE in

same year, whereas the amount of production of coal is 1,126 million TOE in 2003 and the amount of its consumption is 1,254 million TOE in same year resulting in a little amount of coal import (ibid) namely 126 million TOE in same year (Note 30). Moreover, in the case of natural gas in which field the amount of consumption is increasing rapidly mentined above, Asia has no need to import huge amount like oil. The amount of production of gas is 245 million TOE in 2003 and the amount of its consumption is 283 million TOE in same year resulting in the import (ibid) of only 38 million TOE in same year (Note 31).

As the result, Asia has steadily decreased its ratio of self -sufficiency of energy owing to the oil import. For instance, the ratio of self-sufficiency (Note 32) has decreased from 74.57% in 1990 to 70.5% in 2003 (Note 33).

b. Over dependence on the Middle East

There is another worry in Asian oil import. That is over dependence on the Middle East. According to the trend of import sources of oil in Asia, the ratio of dependence on the Middle East was 74.4% in 1990 and is 71.5% in 2003 resulting in the maintenance of seventies even now (Note 34).

By the way, we should not neglect the fact that the seventies as the ratio of dependence contains very severe seriousness not only from the view point of economy but also from the viewpoint of international affairs. It is conceivable that such a huge ratio of dependence on special districts is never stable from a comparision in cases of Europe and U.S.A. For instance, the ratio of dependence on the Middle East in the case of Europe is 27.5% in 2003 and its ratio even in the case of U.S.A which is supposed to be eager in the commitment to Middle East affairs generally is only 21.1% in same year (Note 35).

Saying shortly, the supply condition of energy in Asia lack the security owing to over dependence of oil supplying on the Middle East.

(2) CO_2 emission

① Present condition

The trend of the amount of CO_2 emission in Asia is as follows (Note 36). Many Asian countries have increased the amount of CO_2 emission owing to steep increase of the amount of energy consumption mentioned above. Among them, China is biggest

country not only in the aspect of the amount of emission but also in the aspect of increase rate of emission. Chinese amount of CO_2 emission owing to the consumption of fossil energy increased from 1,444.71 million TON in 1980 to 3,322.40 million TON in 2002 resulting in the average increase rate of 3.9% per year from 1980 to 2002 and resulting in the share of 13.7% in CO_2 emission in the world in 2002 (Note 37). We cannot stop astonishing how such a increase ratio of emission is high (Note 38) and such a amount of emission is huge.

Moreover, we should be carefull to the fact that the CO_2 emission accompanied with air pollution owing to the consumption of fossil energy is concentrating in Asian mega-polices including Chinese ones (Note 39).

② A prediction

By the way, it is predicted that the amount of CO_2 emission in Asia will increase in near future (Note 40). And IEA predicts that, as the result, whole Asia including China will occupy over a half of the amount of CO_2 emission increase in the world from 2002 to 2030 (Note 41).

(Note 1) MTOE equivalent to one million ton in the term of oil.

(Note 2) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2006] Chart& Table 111-1-11 <p.20>. According to Nihonkeizai Shinbun, IEA has published on November 7th, 2006 that the primary energy demand in the world in 2030 will increase about 165% comparing to the level of 10,345 MTOE in 2002, so that its amount in 2030 will reach 17, 095 MTOE (Refer to Nihonkeizai Shinbun November 7th, 2006).

(Note 3) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005] Chart& Table 111-2-1 <p.32>.

(Note 4) B/D ; Balel/Day

(Note 5) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2006] Chart & Table 111-1-12 <p.20>.

(Note 6) Refer to Ministry of Economy, Trade and Industry『Ibid』[2006] Chart & Table 111-1-16 <p.22>.

(Note 7) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005] Chart & Table 222-1-8 <p.243>. By the way, "Russia" means old USSR.

(Note 8) Refer to Ministry of Economy, Trade and Industry『Ibit』[2005] Chart & Table 222-2-4 <p.33>.

(Note 9) Refer to Ministry of Economy, Trade and Industry『Ibit』[2005] Chart & Table 111-2-5 <p.33>. Noticeably, IPCC (The Intergovernment Panel on Climate Change) insists in its third report that if we expect to stabilize the concentration of CO2 in the air on 550 ppm, we should halve present CO_2 emission level by 2100 all over the globe (Refer to Mitutune Yamaguti「A design of New International Energy Organization being linked with IPCC」[Nihonkeizai Shinbun October 30rd, 2006]).

(Note 10) Ibid.

(Note 11) Refer to Zhidong「Energy and environment problems in China」 [http://www.rieti.go.jp/jp/papers/jounal/0410/bs01.html] 3/5

(Note 12) In this chaper, Asia means the reagion consisting of Brunei, Cambodia, China (including Hong Kong), Indonesia, Japan, Laos, Malaysia, Mongolia, North Korea, the Philipines, Shingapore, Afghanistan, Bangladesh, India, Myanmar, Nepal, Pakistan, Sri Lanka, Korea, Taiwan, Thailand, Viet Nam, Papua New Guinia etc.

(Note 13) In the case of more long length, the average rate of the increase of primary energy cunsumption per year from 1965 to 2004 in the world is 2.5%, which is more higher than 2.0% per year from 1971 to 2003 in the case of the world, resulting in the increase of demand amount in the world from 3,900 million TOE to 10,200 million TOE (Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2006] p.211).

(Note 14) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005] Chart & Table 112-4-1 <p.42>.

(Note 15) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart＆Table 112-4-5 <p.44>.

(Note 16) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 112-4-3 <p.43>.

(Note 17) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 112-4-2 <p.42>.

(Note 18) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 112-4-4 <p.43>.

(Note 19) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 112-4-6 <p.44>.

(Note 20) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 112-4-7 <p.45>.

(Note 21) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 112-4-8 <p.45>.

(Note 22) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 112-4-9 <p.46>.

(Note 23) Ibid.

(Note 24) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 222-5-3 <p.270>.

(Note 25) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 222-5-6 <p.271>.

(Note 26) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 222-5-12 <p.274>.

(Note 27) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 222-5-11 <p.273>.

(Note 28) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 222-1-8 <p.243>.

(Note 29) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 222-1-7 <p.243>.

(Note 30) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 112-4-21 <p.52>.

(Note 31) Ibid.

(Note 32) The ratio of self-sufficiency = the amount of domestic production/the amount of domestic production + the amount of net import.

(Note 33) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005] Chart & Table 112-4-20 <p.52>.

(Note 34) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 112-4-22 <p.53>.

(Note 35) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 112-4-23 <p.53>.

(Note 36) Refer to Ministry of Land, Infrastructure and Transport『White Paper on Land, Infrastructure and Transportation in Japan』[2005] Chart & Table Ⅰ-2-3-1 <p.47>.

(Note 37) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005] Chart & Table 113-1-9 <p.63>.

(Note 38) The East Asia share of CO2 emission in the world increased 13.0% in 1971 to 25.5% in 2002 (Refer to Ministry of Economy, Trade and Industry『White Paper on International Economy and Trade』(2005) p.322 [Note 86]).

(Note 39) Refer to Ministry of Land, Infrastructure and Transport『White Paper on Land, Infrastructure and Transportation in Japan』[2005] Chart & Table Ⅰ-2-3-2 <p.48>.

(Note 40) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005] Chart & Table 113-1-11 <p.63>.

(Note 41) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005]Chart & Table 113-1-10 <p.63>. By the way, it is reported that IEA announced new predicts of CO_2 emission in 2030 on 7th November 2006 (Refer to Asahi Shinbun 21st November 2006). According to new IEA predicts, the volume of CO_2 emission will increase from 26,079 million Ton in 2004 to 40,420 million Ton in 2030. And the share of emission in the world will change as follows. Chinese share will increase 18.3% in 2004 to 25.8% in 2030. Indian share will increase from 4.2% in 2004 to 6.3% in 2030. The share of other countries in Asia will increase from 5.3% in 2004 to 6.6% in 2030. The share of other countries in the world will increase 24.8% in 2004 to 25.7% in 2030. Reversely, Japanese share will decrease from 4.6% in 2004 to 2.9% in 2030. The share of U.S. will decrease from 22.1% in 2004 to 17.7% in 2030. The share of EU will decrease from 14.8% in 2004 to 10.4% in 2030. Russian share will decrease from 5.8% in 2004 to 4.7% in 2030.

Ⅱ. A "triple dilemma" among economic growth, energy consumption, and environmental safeguard in China

We should still take up three problems − namely a pattern of Chinese economic growth, the demand and supply structure of energy market and CO_2 emission due to the consumption of energy − to study Chinese energy problems.

1. The economic growth and energy consumption in China

There are two issues concernning to a pattern of Chinese economic growth related with energy problems. First one is the ratio of economic growth and second one is the change of economic structure under its economic growth.

(1) The economic growth

There will be three scenarios of Chinese economic growth in future 30 years (Note 1). First scenario is a standard case in which case Chinese economy will grow at an annual

rate of 6.6% (real term). Second scenario is a high growth case in which case its economy will grow at annual rate of 7.7% (ibid). Third scenario is a low growth case in which case its economy will grow at annual rate of even under 5.0% (ibid). I think that the most plausible case will be a high growth case and the least plausible case will be a low growth case in China. Because China necessarily needs rapid economic growth owing to solve severe employment problems especially in rulal districts. Then we should study the change of Chinese economic structure being obliged to combine with its high economic growth for the purpose to make sure the causal relationship between the economic growth and energy consumption in China.

(2) The economic structure

There are three points concerning to the change of the economic structure under Chinese economic growth. First point is the development of the manufacturing being substituted of the retreat of the agriculture. For instance, the amount of the production of steel and cement will increase twice time and the amount of the production of ethylen will increase fifth time until 2030 in China (Note 2).

Second point is the innovation especially in the field of manufacturing which needs the increase of productivity mainly owed to the innovation for the purpose of the strengthening of interenational competitiveness. As a result, the innovation will contribute to Chinese economic growth as the main factor of economic growth even in a standard case mentioned above (Note 3). Needless to say that the innovation will contribute to increase the ratio of energy utility (Note 4) because IT (Informatin Technology) substitutes for energy even in China.

Third point is the moterization due to the increase of incomes especially in the urban district under the high economic growth. There is the rapid moterization in China paralleling with the high economic growth (Note 5). Such kind of rapid moterization induces huge increase of oil demand, too (Note 6). For instance, Chinese oil demand has increased 110,000,000 Ton from 1990 to 2000 in which increase a quarter has owed to the moterization (Note 7). Moreover it is predicted that the amount of automobile will reach to 120,000,000 car (the saturation level ; 8.2%) in 2020 and its amount will reach to 240,000,000 car (the saturation level ; 16.0%) in 2030 (Note 8). We can easily image how such a kind of rapid moterization will combine with huge increase of oil demand, too.

Then the high economic growth containning the great change of the economic

structure especially rapid moterization is inevitably going to conbine with the increase of the enargy demand in China (Note 9), neverthless the innovation has a possibility of the increase of the utility ratio of the energy partially (Note 10).

2. The demand and supply structure in Chinese energy market

(1) The demand structure

From above-mentioned context, we can predict a figure of Chinese energy demand in near future. Namely even if Chinese primary energy consumption ratio to GDP will decrease from 1.07 (TOE/10 thousand Yuan, 1995 year price) in 2000 to 0.50 (ibid) in 2030 due to the increase of the utility ratio of the energy, the economic growth, even in the standard case in which case Chinese economy will grow at annual rate of 6.6% (real term) from 2000 to 2030, will combine to broad increase of primary energy consumption, resulting in about 3,000,000,000 TOE (Note 11) – in the case of the triple time of its volume of consumption comparing to present Chinese primary energy consumption – in which case its primary energy consumption will grow at annual rate of 4.0% from 2000 to 2030 (Note 12).

Even according to the prediction of IEA which predicts Chinese growth ratio as low case relatively in which case Chinese growth rate will decrease from about 10% in 2000 to only near 4% in 2030, the amount of Chinese primary energy consumption will increase from about 1,000,000,000 TOE in 2000 to near 2,500,000,000 TOE by 2030 (Note 13).

If we want to check factors of the increase of demand, there are three main factours – namely industry, transportatin and others (containning the people's livelihood and agriculture/forestry/fisheries) – in the increase of demand. But we should not neglect rapid increase of the shair of transportation due to rapid mortarization in China especially (Note 14).

(2) The supply structure

The structure of energy demand in China refrects on the stucture of suppy in it. The suppy condition of Chinese primary enegy is as follows (Note 15). The main factor of increase is the increase of coal. But it should not be negrect the fact that the weight of oil has steeply incrased (Note 16). Moreover such a kind of increase depend on steep increase of import of oil. For instance, even in 2000 China depended on imports for its oil supply in the level of near 50% (Note 17). In the future the ratio of offshore

dependece in oil supplying will more steeply increase resulting in even over 80% in 2030 (Note 18). Needless to say that such a kind of overdependence of oil on offshore districts will inevitably induce severe tensions between China and othercountries especially neighbouring countries in North East Asia.

3. CO_2 emission

(1) Present condition

Chinese CO_2 emission has steeply increased from 1,444.71 million ton in 1980 to 3,017.11 million ton in 2000 (Note 19) resulting in the increase ratio of 4.1% at annual rate from 1980 to 2000 on the background of high economic growth rate, namely at annual rate 9.7% (real term) from 1980 to 2000, even in the condition that primary energy consumption/GDP has decreased from 3.02 in 1980 to 1.07 in 2000 (Note 20).

(2) A prediction

In the case of the prediction, Chinese CO_2 emission will rapidly increase from 3,307 million ton in 2002 to 7,144 million ton in 2030 (Note 21) resulting in the increase of emission share in the world broadly. Namely Chinese share will increase 13.7% in 2002 (Note 22) to 17.9% in 2030 resulting in the successor to the first runner namely 19.8% of U.S.A·Canada (Note 23).

Such a kind of rapid increase means that China will continue present trend even in near future. Namely, even if Chinese primary energy consumption ratio to GDP broadly decreased from 1.07 (TOE/10 thousand Yuan, 1995 year price) in 2000 to 0.50 (ibid) in 2030 due to the increase of the utility ratio of the energy mentioned above, as its high growth ratio – even if Chinese economy will grow at annual rate of 6.6% (real term) from 2000 to 2030 –, will result in broad increase of primary energy consumption, its primary energy consumption will grow at annual rate of 4.0% in same period (Note 24).

In conclusion, we cannot stop to say that there is severe "triple dilemma" among economic growth, energy consumption·procurerment and environmental safegurd in China, and such a kind of dilemma will be more severe in the near futuer resulting in the serious affection not only on China itself but also on the world beyond the Asia without foudamental solution of the triple dilemma in China.

(Note 1) Refer to Zhidong「Energy and environmental problems in China」(http://www.rieti.go.jp/jp/papers/jounal/0410/bs01.html) 2/5
(Note 2) Refer to Zhidong「Ibid 」(Supplement) p.19.
(Note 3) Refer to Zhidong「Ibid 」([Chinese Growth Accounting]) (Supplement) p.18.
(Note 4) Chinese energy consumption ratio to GDP is 0.185 (TOE/1,000 PPP Dollar) in 2000, whereas Japanese ratio is 0.153 (ibid) in same year (Refer to Ibid [Supplement] p.11).
(Note 5) Refer to Zhidong「Energy and environmental problems in China」([Energy demand and supply condition in China] (Supplement) p.10.
(Note 6) Refer to Zhidong「Ibid 」([Energy demand and supply condition in China] (Supplement) p.7.
(Note 7) Refer to Zhidong「Ibid」(Supplement) p. 10.
(Note 8) Refer to「Ibid」(Supplement) p. 19.
(Note 9) Refer to「Ibid」([Energy demand and supply condition in China] (Supplement) p.7. China has increased the volume of consumption not only in the field of energy but also in fields of another resources. For instance, according to the VNCTA Report, Chian has increased the volume of consumption 30%～60%from 2003 to 2005 in fields of main resources. As the result, the ratio of increase contribution of the cotton in the world has increased 89.2% from 2003 to 2005, the same ratio of the copper in the world has increased 67.3% in same term and the same ratio of the oil in the world has increased 27.6% in same term. (Refer Nihonkeizai Shinbun September 1st, 2006.)
(Note 10) Even if Chinese primary energy consumption ratio to GDP broadly decreased from 3.02 (TOE/10 thousand Yuan, 1995 year price) in 1980 to 1.07 (ibid) in 2000 due to the increase of the utility ratio of the energy, as the high growth ratio, Chinese economy grew at annual rate of 9.7% (real term) from 1980 to 2000, resulted in broad increase of primary energy consumption, its primary energy consumption grew at annual rate of 4.1% in same period (Refer to Zhidong「Energy and environmental problems in China」[Supplement] p. 28).
(Note 11) 3,000,000,000 TOE equivalents to the amount of energy consumtion consisting of the amount of energy consumtion both of U.S.A and Japan in 2000 (Refer to Zhidong「Energy and environmental problems in China」[URL] 3/5).
(Note 12) Refer to Zhidong「Energy and environmental problems in China」(Supplement) p.28.
(Note 13) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005] Chart & Table 224-2-2 <p.293>.
(Note 14) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 224-2-4 <p.294>.
(Note 15) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 224-2-3 <p.294>.
(Note 16) Ibid.
(Note 17) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 224-2-12 <p.297>.
(Note 18) Refer to Zhidong「Energy and environmental problems in China」[URL] 3/5.
(Note 19) Refer to Ministry of Land, Infrastructure and Transport『White Paper on Land, Infrastructure and Transportation in Japan』[2005] Chart & Table Ⅰ-2-3-1 <p.47>.
(Note 20) Refer to Zhidong「Energy and environmental problems in China」(Supplement) p.28.
(Note 21) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005] Chart & Table 113-1-11 <p.63>.
(Note 22) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 113-1-9 <p.63>.
(Note 23) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 113-1-10

<p.63>.

(Note 24) Refer to Zhidong「Energy and environmental problems in China」[Supplement] p.28.

Ⅲ. The vulnerabirity in enrgy procurement due to extremly low level of self-sufficiency in Japan

1. The economic growth and the energy problem in Japan

There are two characteristics in the relation between the economic growth and energy problem in Japan. First one is a correlationship between the amount of GDP (real term) and the amount of energy demand and supply. According to the increase of GDP, the amount of energy demand and supply has increased almost parallel (Note 1). Second one is the gap between the amount of primary energy supply and the amount of final energy consumption. The gap means the fact that there is a loss in case of energy transfer from primary energy supply to final energy consumption. We call such a kind of loss as "tarnsfer loss". Even in present "transfer loss" amounts about 30% (Note 2). Then it is indicated that Japanese economy needs to improve such a kind of "transfer loss" nevertheless Japanese energy efficiency is relatively higher than other Asian countries mentioned bellow (Note 3).

2. The demand and supply structure in the energy market

(1) The demand structure

Japanese energy consumption has increased almost parallel with the increase of GDP (real term) (Note 4). But the structure of consumption has steeply changed. The share of the peoples livelihood sector and the share of transportation sector have increased whereas the share of industrial sector has decreased (Note 5). Moreover it should not be neglected the fact that Japanese ratio of energy utility is very high comparing not only another Asian countries (Note 6) but also even advanced countries (Note 7) due to the high ratio of energy utility mainly in the field of industrial sector especially after first oil shock and second oil shock (Note 8).

Then concerning to the prediction in 2030, even in the case of relatively high economic growth rate − at annual rate of 2% − as Japan, the amount of final energy consumption will increase at annual rate of 0.3% (Note 9).

(2) The supply structure

As above-mentioed, Japanese primary energy supply has increased almost parallel with the increase of GDP. But its structure has changed broadly. Namely the share of newclear energy has increased to 9.4% in 2003 and the share of natural gas has increased to 14.3% in 2003 whereas the share of oil has decreased from 77% in 1973 when first oil shock emerged to 50.0% in 2003 (Note 10). Neverthless Japanese oil dependence ratio is 49% in 2001～2002, it should not be neglect that there are two important points－not only this figure is overwhelmingly high comaparing to other advanced countries (Note 11) but also Japanese oil dependence ratio on the Middle East has steeply increased from 67% in 1987 to 87% in 2003 (Note 12) －.

Then even if Japanese energy consumption will be restrained in the range of economic growth in near future, it should not be forget that Japanese primary energy procurement structure will be very vulnerable due to the over dependence of oil supplying on offshore districts especially on the Middle East. And Japanese vulnerability of energy procurement is reflected on the low energy self-sufficiemnt ratio in Japan. Namely Japanese energy self-sufficiency ratio is only 19% (Note 13) in 2002 fiscal year even including newclear energy (Note 14).

3. CO_2 emission

In present, Japanese CO_2 emission is increasing slowly from 1990 to 2002 (Note 15). Concerning to the prediction in 2030, even in the case of high economic growth at annual rate of 2%, the amount of Japanese CO_2 emission will increase at annual rate of 0.1% (Note 16). As the result, Japanese share of CO_2 emission in the world will decrease from 5.0% in 2002 (Note 17) to under 5.0% in 2030 (Note 18).

4. Japanese “New State Energy Strategy”

Japanese government has proposed the “New State Energy Strategy” on May 29th, 2006. Accoording to this Strategy, Japanese government intends to increase its self-sufficiency ratio steeply in near future through the utilization of new policies consisting of (a) the increase of self-development of oil from 15% in present to 40% in 2030 through the support for Japanese energy companies engaging in offshore development, (b) the improvement of energy efficiency at the rate of 30% by 2030, (c) the decrease of the ratio of energy dependence on oil from about 50% in present to under 40% in 2030, (d)

especially in the above case, the decrease of the ratio of the energy dependence on oil in the field of transportation from about 100% in present to about 80% by 2030, (e) the expansion of the ratio of newclear power generation from about 30% in present to about 40% in 2030 (Note 19).

(Note 1) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005] Chart & Table 211-1-1 <p.128>.
(Note 2) Ibid.
(Note 3) This point means that Japan has still space to increase its energy efficiency.
(Note 4) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 211-1-1 <p.168>.
(Note 5) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005]Chart & Table 211-2-1 <p.169>.
(Note 6) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 112-4-3 <p.43>.
(Note 7) Refer to Weekly Toyokeizai (April 22nd 2006) p.108.
(Note 8) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 211-2-1 <p.169>.
(Note 9) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 111-1-13 <p.28>.
(Note 10) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 211-3-1 <p.170>.
(Note 11) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 211-3-2 <p.170>.
(Note 12) Refer Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 213-1-5 <p.192>.
(Note 13) Japanese energy self-sufficiency ratio is only 4% in 2002 in the case of exclusion of newclear energy.
(Note 14) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005] Chart & Table 211-4-1 <p.171>.
(Note 15) Refer to Ministry of Land, Infrastructure and Transport『White Paper on Land, Infrastructure and Transportation in Japan』[2005] Chart & Table Ⅰ-2-3-1 <p.47>.
(Note 16) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005] Chart & Table 111-1-14 <p.28>.
(Note 17) Refer Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 113-1-9 <p.63>.
(Note 18) Refer to Ministry of Economy, Trade and Industry『Ibid』[2005] Chart & Table 113-1-10 <p.63>.
(Note 19) Refer to Ministry of Economy, Trade and Industry「the "New State Energy Strategy"」 p.24～26).

Ⅳ. The strategic regional cooperation for the formation of Asia Energy System

1. Two strategic roles of the energy cooperation

To solve the "triple dilemma" among economic growth, energy consumption･procurement, and environmental safeguard in Asian countries especially to support a

“sustainable development” of Chinese economy through the solvation of most severe “triple dilemma” in Asia annoying China, we need common energy starategy in Asia being expected to cobine to the creation of the Asian Energy System. Because the building of the “East Asian Community” inevitably needs regional cooperations not only in fields of trade & investment contributing to the formation of Asian EPA/FTA, finance·exchange·currency contributing to the formation of the Asian Common Currency System, environmental reduction combining to the formation of the “Asian Green Space” and human resources upbringing contributing to the formation of the “Asian Erasumus Plan” but also in the field of energy contributing to the creation of the Asian Energy System. Then there are five cooperatins as strategic cooperation to build the East Asian Community and the energy cooperation should play a role of the strategic cooperation as one of five cooperations.

There are two reasons why the energy cooperation should play strategic role. One reason owes to the necessity of the solvation of the “triple dilemma” mentioned above. Another one owes to the familiar relationship between the Asian Green Space and the Asian Energy System.

Especially, we have to take note the fact there is a specific relationship between the Asian Green Space and the Asian Energy System because the formation of Asian Green Space decisively depend on the formation of Asian Energy System due to the specific reason why the air pollution, which is most important issues in environmental problems, depends decisively on energy consumption (Note 1). Then the formation of Asian Green Space owes to the formation of the Asian Energy System because the reduction of the air pollution depends on energy saving including the development of alternative energy resources to fossile fuels (Note 2).

Thus, we should recognize the fact that the energy cooperation has two strategic roles in the building of the East Asian Community.

2. Some issues in the energy cooperation

There are some issues in the energy cooperation (Note 3) consisting of (a) the oil stock in Asia, (b) the maintenance of energy market in conditions of the competitiveness and the transpearency, (c) the expansion of the development and the utilization of new energy and recyclable energy as alternative energy resources to fossile fuels, (d) the security of energy procurement and (e) a design of the construction

of the “Sustainable Energy Procurement System in the Middle East”.

(1) The oil stock in Asia

Addition to the excess expansion of energy consumption and the excess dependence of enrgy procurement on the Middle East in Asian countries mentioned above, there is the emergence of expensive oil price due to the tightness of supply and demand condition in oil market (Note 4). Then the issue of safety procrement of oil is going not only to be important but also to be emergent in Asian countries. But, nevertheless such kind of importance and emergence, almost Asian countreis except Japan and Korea do not have enough oil stock even now (Note 5).

Then it needs to cooperate among Asian countries to build the Asian Oil Stock System especially under the initiative of Japan and Korea that have already accumlated knowhows to stock oil.

(2) The improvement of Asian energy market

It is pointed out that Asian energy market are not so competitive and trancepearent comparing to global energy market. As the result, Asian energy consumers owe expencive price especially in oil, oil manufacturing and natural gass. For instance Asian oil consummers are obliged to pay Asian premium (Note 6). Needless to say that such kind of premium accellates expencive oil price especially in Asia.

To avoide such kind of Asian premium, Asian countries need to cooperate for the improvement of Asian energy market toward the strengthnung of competitiveness and trancepearency.

(3) The energy saving and the emvilonmental reduction

As already mentioned, there is severe problem in fields of envilonmental emmissions especially in the field of CO_2 emission due to energy consumption on the background of rapid economic growth in Asian countries especially in China.

To avoid such a kind of environmental emissions especially CO_2 emission, we need two scinarios namely energy saving including the development of alternative energy resources to fossile fuels and environmental reduction. For instance, alternative energy resources to fossile fuels (coal, oil and natural gas) in Asian countries including Japan are not so enough to substitute fossile fuels (Note 7). Moreover the ratio of energy

efficiency in Asian countries except Japan is staying in very low level (Note 8).

Needless to say that for the aim to accomplish two scinario we need strong regional cooperation among Asian countries especially among North East Asian countries particularly Japan, China and korea. Especially it is expected that Japanese technology and experience in the field of energy saving (See Note 8) will contribute to energy saving and environmental reduction in Asian countries especially in China.

(4) The security problem of the energy procuremnt in Asia

Over dependence of energy procurement in Asian countries on offshore districts especially on the Middle East necessarily induces the security problem in the procurement of energy. It is well knowned that almost of the deliverly of oil and natural gas from the Middle East to Asian countries depends on the Straits of Malacca.

Then, if there is a accident or a struggle in this district, many Asian countries will be unable to import their oil and natural gass from the Middle East. How do they solve such a kind of security problem. I think that it is very severe and difficult to solve such a kind of issue. If there is a solution of the issue, it will depend on the diversity of oil and natural gas procurement in Asian countries. Then to diversify the procurement of oil and natural gas, Asian countries should cooperate to develop new resources of oil and natural gas in the region.

We should take note the fact that Japan should especially eager to ccoperate with Asian countries particularly with North East Asian countries namely China, Korea and Russia (Note 9) in the developing of new resources of oil and natural gas because Japan depend energy procurement especially oil and natural gas procurement extemely on offshore districts especially on the Middle East above-mentioned .

(5) A design of the “Sustainable Energy Procurement System in the Middle East”.

Lastly, nevertheless we couldn’t neglect the fact that the Middle East has the importance as the most big procurement route of oil and natural gas in Asia, even if the overdependence of oil and natural gas on the Middle East will relatively decrease in near future mentioned above. Then we should stress the necessity of a design of the construction of the “Sustainable Energy Procurement System in the Middle East” (Note 10) especially in the region relating to the West Asia and the Central Asia” (Note 11) aiming to aquire the procurement route of oil and natural gas under the sustainabile

condition in Asia.

The Sustainable Energy System in the West Asia and the Central Asia will be expected to contribute not only to the favourable circuration of economic development, energy concumption･procurement, and environment in many Asian countries including Japan but also to the favourable circuration in related countriesits in the West Asia and the Central Asia (Note 12).

(Note 1) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005] Chart & Table 113-2-1･2 <p.64～65>.

(Note 2) For instance, the share of CO_2 emissions due to the burning of fossile fuels in total amount of gas of the greenhouse effects occupies about 90% in Japan (Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005]p.73). Reversaly saying, the reduction of CO_2 emission which plays main role of air pollution depends decisively on the saving of the consumption of fossile fuels which consists main energy resources in present.

(Note 3) Concerning Japanese energy policy aiming to cooperate with Asian countries, refer to Ministry of Economy, Trade and Industry the "New State Energy Strategy" (on 29th May, 2006) p.54～59.

(Note 4) Refer to Ministry of Economy, Trade and Industry『Annual Energy Report』[2005] Chart & Table 222-1-9 <p.244>.

(Note 5) Refer to Ministry of Economy, Trade and Industry『White Paper on International Economy and Trade』[2005] Table 3-4-40 <p.318>.

(Note 6) It is reported that Middle East oil price being delivered toward Asian countries is expencive from US＄1 to US＄1.5 comparing its oil price being delivered toward U.S.A. and Eropean countries(Refer to Ministry of Economy, Trade and Industry『White Paper on International Economy and Trade』[2005] p.319).

(Note 7) Refer to Ministry of Economy, Trade and Industry『Concerning to the advancement of Japanese energy industry in Asia』[March 30, 2005] p.1～11.

(Note 8) The energy efficiency level in Asian countries is astonishingly low comparing to Japanese energy efficiency level. For instance, in the comparision to Japanese efficiency level, Indian efficiency level is 1/23.3 (in the case of Japanese efficiency level as 1), Chinese efficiency level is 1/9 (ibid), Indonesian efficiency level is 1/5.6 (ibid), Malaysian efficiency level is 1/4.9 (ibid) and Thailand efficiency level is 1/4.7 (ibid) (Refer to Nihon Keizai Shinbun November 10th, 2005). Moreover, the Toyokeizai explains how Japanese energy efficiency is high comparing to other main countries in the world (Refer to Toyokeizai [April 22nd, 2006]).

(Note 9) Especially in the case of Russia, the Sahalin project and a design of Pacific pipeline are important for Japan as a chance of the acquisition of big procurement route of oil and natural gas.

(Note 10) This design could be called as "Modern Mesopotanian Sustainable Plan" because main countries relating to the West Asia and the Central Asia mentioned bellow are allocated in the Meso-region between the River Tigris and the River Euphrates.

(Note 11) The region relating to the West Asia and the Central Asia consists of Turkey especially East Turkey (namely Asian districts in Turkey), West Asian countries (Iraq, Iran and Syria etc) and Central Asian countries (Azerbaisian, Armenia and Georgia etc). By the way, related to the point mentioned above, we can originally define the Asia as very broad

region ranging over East Asia (ASEAN10＋Japan･Kora･China [Refer to <Note 1> in Preface]), South Asia (India, Pakistan and Sri Lanka), West Asia above-mentiond and Central Asia(above-mentioned countries＋old U.S.S.R countries＋Afghanistan).

(Note 12) Related to this point, we should especially take note a strategic role of Turkey owing to its geographical and geopolitical reasons. Because Turkey has two advantageousness in its standpoint. One is the geographical constitution. Turkey consists of two different regions from the viewpoint of culture and civilization. One region is European region, where is allocated in West districts from Istanbul, accompanied by European culture and civilization. Another region is Asian region, where is allocated in East districts from Istanbul, accompanied by Asian culture and civilization. These two characteritics are expected to play a role of co･odinating in the favourable circulation mentioned above not only in the Asia but also in the Middle East. Because, say methodologically, to co･ordinate the favourable circuration, we need our sense of values which has compounds eyes on both of European culture･civilization and Asian culture･civilization. Another one is geopolitical position. Turkey has overlapping networks of pipelines of oil and natural gas being delivered not only from Wast Asian countries especially from Iraq and Iran but also from Central Asian countries especially from countries alongside the Caspian Sea to Istanbul through East districts especially the district of the Kurds. It is no need to say that such kinds of network are expected to contribute not only to the development of Turkey especially East Turkey, in which the economic development is especially necessary, but also to the strenghenning of procurement route of oil and natural gas being delivered toward Asian countries including Japan.