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Sino-Japan Collaboration for Air-pollution

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Summary

Recently, many mega-cities in China are suffering from heavy soot-laden smog including small particulate matter such as PM2.5. First reason is that there must be a very stable atmospheric condition with weak vertical exchanges of air between a boundary layer and upper layer that leads to the formation of fogs and haze. Second reason is the very high concentration of aerosol (mixed by Particulate Matters, SO_4^{2-}, NO_3^-, NH_4^+, etc.) exceeding the threshold. Most of aerosol derives from human economic activities and everyday life, for example, fossil fuel burning (particularly, coal and oil), industry process, construction activities, cooking, etc.

The Chinese government has attempted to show their willingness to solve the problems with various measures such as shut-down/relocation of the factories, promotion of clean energies, restriction on the number of cars on the road in mega-cities. However, the background of current smog problem is the issue of energy mix (fossil-fuel dependence) and unsustainable development pattern, and there is no instant solution available. Therefore, although it may take time, to ameliorate the seriousness of current situation requires additional and more fundamental measures to be taken. Such measures include: further optimization of energy mix (de-carbonization), capping of the energy consumption, energy system reformation, improvement of oil quality and development of de-dusting infrastructure.

As for the quantitative impacts of trans-boundary air-pollutions carried to Japan, the analysis of Japan's research organizations showed that certain amount of PM2.5 emitted in China are being transported to Japan, although the PM2.5 concentration in January 2012 in its North Kyushu area, Japan, were not significantly higher than that in January 2011. This means that the relationship between the PM2.5 concentration increase in China and the PM2.5 concentration increase in Japan is not so simple, at least for now. Still how the problem develops in the future is uncertain so that it is important to take proper measures from the precautionary principle perspective.

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The Sino-Japan cooperation in air pollutions is expected in several areas. In the technologies cooperation field, China is still hunger for dust collection technologies to capture the very small-sized particular matters from fossil fuel combustion and industrial process, though de-sulfurization and de-nitration equipment are already disseminated widely in this country. Another hot-spot is new energy automobile such the electricity car. Nevertheless, it should be noted that, since the most part of the technology transfer will be implemented between private companies on commercial basis with a long time perspective, immediate PM2.5 measures Japan can provide/transfer to China are limited.

To build a concrete Sino-Japan collaboration framework, it is imperative to develop All-Japan and/or All-China support not only in the specific areas shown above, but also in broader areas of energy and global warming issues. If top leaders issue clear instructions, it will likely have greater importance in terms of long-run political and economic impacts to both countries, beyond the purpose of solving air pollution problems in China. Concrete agenda as a package in this perspective may include: joint energy resource development; joint research in energy technology; joint energy stock building in oil and natural gas; joint infrastructure-building for international energy supply system in Asia and linking emissions trading systems.

In addition, it is desirable to have a bilateral framework with some targets which gives political and economic incentives for both countries to participate. So, for example, it may be possible that, firstly, both China and Japan re-address voluntary domestic PM2.5 emission reduction target. Secondly, a joint environmental fund can be set up by two countries to contribute to the target attainment.

Last but not least, the emphasis should be placed on the needs to transfer the experiences of the Fukushima nuclear power plant accident in 2011. In order to prevent such tragedy to be repeated, it is important to let Chinese people be aware of the details of Fukushima accident.

During 1980s, President Gorbachev of the former USSR made a historical shift in their diplomatic policies by addressing the issue of global environmental problem as a “common enemy of humans”. Even under current political tensions between Japan and China as well as Japan and Korea, Asia should duplicate such history of environmental and energy issues bring peace in the region and the world. In Chinese, the term “crisis” implies “opportunity.” In an ideal scenario, high-level cooperative relationship can be built by taking advantage of the current environmental crisis. If done properly, it is fully feasible.

The views expressed in this working paper are those of the authors and do not necessarily represent those of IGES. Working papers describe research in progress by the authors and are published to elicit comments and to further debate.

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1. Current situation

Recently, many mega-cities in China are suffering from heavy soot-laden smog including small particulate matter such as PM2.5. Some reports, in several cities, the level of airborne soot exceeding 30 times the level recommended by the World Health Organization (WHO), raising concerns on their social effects, especially in terms of serious health hazards. The scientific cognition identifies two major causes of such heavy smog.

First, there must be a very stable atmospheric condition with weak vertical exchanges of air between a boundary layer and upper layer that leads to the formation of fogs and haze. In fact, such smog has occurred in Beijing frequently not only this year but every year. What is significant in recent days is that such condition persists more frequently since last year.

Second cause is the very high concentration of aerosol (mixed by Particulate Matters, SO_4^{2-}, NO_3^-, NH_4^+, etc.) exceeding the threshold. Most of aerosol derives from human economic activities and everyday life, for example, fossil fuel burning (particularly, coal and oil), industry process, construction activities, cooking, etc.

The estimate is that about half of pollutants in Beijing smog comes directly from fossil fuel burning in residential, power/heat system, industries, and transportation sectors in Beijing and its suburbs, while the rest were the secondary pollutants from the heterogeneous chemical reaction of the primary ones, or flowed into from other areas. The percentages of urban origin pollutants, however, may differ for different cities due to varied energy mix and production/consumption patterns.

Although the current smog situation in China is quite serious, air-pollution problem is not limited to China. According to the WHO, more than 1 million premature death is observed every year in the world. Moreover, more than few in China indicate the seriousness of water pollution equals to or even greater than air pollution.

Besides the pollutants discharging, greenhouse gas (GHG) emission in China is rapidly rising along with the increasing combustion of fossil fuel, particularly coal. As the sources of air and climate pollutants are generally overlapped, mitigation of these pollutants could be achieved from one set of policy packages, therefore benefiting local and global environmental quality.

2. Necessary domestic policies in China

The Chinese government has attempted to show their willingness to solve the problems, but the background of current smog problem is the issue of energy mix and unsustainable development pattern, and there is no instant solution available.

From the "11th-five-year" period (2006-2010), the Chinese government has taken various measures such as the shutdown of the outdated factories, relocation of the heavily polluting facilities, promotion of clean energies, restriction on the number of cars on the road in mega-cities [3]. In addition, measure such as population control that started 30 years ago is believed to have contributed to air pollution abatement (NDRC, 2007). Moreover, family registration system which blocks the migration from the rural area to the city area aiming to avoid the uncontrollable formulation of the megacity with problematic slum areas has also helped to avoid further deterioration of the air condition. These measures are, arguably, non-democratic measures that may be infeasible or impossible to implement in many other developed countries. So it is wrong to criticize China for not taking any measure.

Actually, measures mentioned above, especially shut-down/relocation of the factories and car restriction successfully brought blue sky during the Beijing Olympic Games in 2008. The environmental concern was one of major obstacles in holding Beijing Olympics, so China took national actions to solve

[3] Currently in Beijing, the number plates of cars are to be obtained through a lottery system and the probability of winning the plates is about 1/70.

environmental problems in its capital city, by moving factories to suburban areas and other provinces, closing factories and restaurants in the city, restricting the number of incoming cars, etc. As a result, air quality in Beijing was improved significantly then. They expected that such improved situation would continue even after the Olympics, but the effects of such measures were temporary, particularly, car stock soared as before. The air pollution in Beijing has returned, if not exacerbated, to previous situation before the Olympics.

Nevertheless, to ameliorate the seriousness of current situation requires additional and more fundamental measures to be taken. Such measures include: further optimization of energy mix (de-carbonization), improvement of oil quality with large capital investment and development of dust collection infrastructure in power supply/demand system.

Still, human activities in urban area are likely to increase and invigorate further for the next 10 years at least, at the overwhelming rate of infrastructure development. Furthermore, the priority of de-carbonization of energy supply is not as high as ensuring a reliable and accessible energy and power supply in China where more than 10 million people are living without electricity.

Therefore, although there is no instant solution to the serious air pollution in China, Chinese Government needs to adopt the following additional measures in terms of short-term, mid-term, and long-term perspective, however difficult they may be to implement:

1) Tighten the control of coal consumption

In short and medium term, coal consumption should be completely abolished in metropolitan areas, gradually switching toward natural gas, electricity and renewable energy. By 2020, natural gas should become the major fossil fuel of residential households and district heating system in metropolitan areas of all mega-cities in China. As the energy used in building, electricity should be dominant with complement from renewable energy. In the long run, the share of coal in energy mix should be reduced to less than one third by 2050. Obviously China confronts with the problem of insufficient natural gas supply. The good news is the recent development of natural gas goes beyond the original expectation. According the updated estimation, natural gas supply would amount to 260 billion cube meter in 2015, about one time higher than 2010; up to 2020, the supply would be close or even over 400 billion cube meter, owing to domestic gas resource exploitation and import expanding (Xu 2012). At that time, power generation and district heating in metropolitan area could be supported by natural gas.

2) Lower down the exhaust emission from motors

Inferior oil quality is one of the main causes of recent air pollution. Actually, the implemented emission standard of light-duty vehicles in China is not bad, equal to Euro 4 level from 2011[4]. However, the oil quality is not improved accordingly. For example, the quality of gasoline merely meets the requirement of EURO 3. The worst case comes from motor diesel. EURO 4 requires the sulfur content of diesel less than 50 ppm, however, in most cities in China, the sulfur content of diesel is about 2000 ppm. It is planned that EURO 5 standard would be implemented in China in 2018, but what is more important is to improve oil quality synchronously, otherwise pollutant reduction effect would be much offset.

3) Reform the energy pricing mechanism

Up to now, coal is still the cheapest fuel, while the prices of natural gas and electricity are, unlike the coal, controlled by the government. However, rapid economic development has raised the consumers' willingness to pay for cleaner fuels. In other words, it is the time to reform energy pricing system to reflect correctly its environmental value.

[4] EURO 4 is the emission standard in the EU countries which ended in 2009. Currently, EU is adopting the EURO 5 which is more stringent than EURO 4. In China, big cities adopt the stringent standard fast and other cities follow it.

4) Set a cap on overall energy consumption[5]

It is one of valuable lessons learned from past practices of 30 years, if energy consumption increases rapidly under economically-irrational system, it is extremely hard to optimize energy mix. So a strict cap on energy consumption will lead to, or force, the transition to energy-efficient economy development pattern by promotion of advanced services, phase out of inferior capacities and reversion of export-orient mode that has been dominated by low value-added or energy-intensive products.

3. Trans-boundary impacts

Well-known scientific fact warns us the trans-boundary nature of air pollution. In 1970s, trans-boundary air pollution caused massive acidification of ecosystems throughout Europe, which led to the creation of the Convention on the Long-Range Trans-Boundary Air Pollution (LRTAP) and several associated protocols.

In Northeast Asia, specific trans-boundary air pollutants drew attentions in the past, namely SO_X in 1990s, Yellow dusts in early 2000s, and Ozone (O_3) in late 2000s. Due to the absence of "sufficient" harms done to human health and ecosystem both in a source country and in a receptor country, these incidents did not raise much political attention, so that there is no effective regional cooperative regime established in this area, partly because of difference in political and economic situation between Europe and Northeast Asia regions, and partly due to less political and economic incentives to join in such a binding agreement[6]. This "little incentives" problem is due to the insufficient harm both on human health and on economy especially in Japan and in Korea, and insufficient benefits for all parties involved including China.

Recent problems of PM2.5, however, may have ever more impacts than before, as they have more serious and obvious effects on human health and life. It should also be noted that, in the background, there is a mass coverage by the media on PM2.5 and raised environmental awareness in China due to its economic growth. The sense of responsibility as a superpower is expected to grow further also, which may create a certain political incentive to join international framework.

As for the quantitative impacts of trans-boundary air-pollutions carried to Japan, the analysis by Japan Agency for Marine-Earth Science and Technology, National Institute for Environmental Studies and other organizations showed that certain amount of PM2.5 emitted in China are being transported to Japan, although the PM2.5 concentration in January 2013 in its Kyushu area, Japan, were not significantly higher than that in January 2012 (Kanaya, 2013). This means that the relationship between the PM2.5 concentration increase in China and the PM2.5 concentration increase in Japan is not so simple, at least for now[7]. Therefore there is no need to have irrational fear of trans-boundary PM2.5, and one should not play a blaming game. Still how the problem develops in the future is uncertain so that it is important to take proper measures from the precautionary principle perspective.

4. Sino-Japan cooperation

The Sino-Japan cooperation in air pollutions is expected in several areas listed below in the form of actual technology transfers and joint researches:

In the technologies cooperation field, China is still hunger for dust collection technologies to capture the very small-sized particular matters from fossil fuel combustion and industrial process, though desulfurization and denitration equipments are already

[5] On Jan.24, 2013, Chinese government officially announced that the total primary energy consumption will be restricted to 4 billion tce/year by 2015. The figure in 2011 was 3.48 billion tce/year.

[6] The Acid Deposition Monitoring Network in East Asia (EANET) was established in 1998, but its scope was only limited to monitoring.

[7] Although the direction of the atmospheric current in the spring time will enhance the transportation of pollutants from China to Japan, the coal consumption in China usually declines in spring.

disseminated widely in this country. This kind of end-of-pipe technologies is especially critical before the energy mix is promoted noticeably. Another hot-spot is new energy automobile. China has focused it effort on plug-in and pure electricity vehicles, almost giving up R&D on hybrid cars whose know-how is owned by Japanese companies. However, the technical progress of either plug-in or electricity car is relatively slow even in the world, let alone China. The technology transfer and expanded cooperation between Japan and China is highly expected in this area, which will benefit much air and climate pollutant mitigation.

In the energy and environment policy area, practices in on-going power system liberalization, energy (power) price system, introduction of fuel (environmental) tax, emission trading scheme, Volatile Organic Compounds (VOCs) management system could be reviewed and used for reference both in China's and Japan's relevant reform.

As the new government is launched and urbanization will be in a new stage in China, concept and practices on compact land use planning relevant to efficient and clean urban transport system is highly realized and acknowledged. With the instant cooperation from other countries will help China go towards low-carbon and low-pollutant direction, avoiding the old pathway of urban sprawl.

Nevertheless, it should be noted that, since the most part of the technology transfer will be implemented between private companies on commercial basis with a long time perspective. Therefore, it is not preferable and effective to have public support by governments play a bigger role. (export support by government's temporary subsidies would not be sustainable and have led to many failures in the past.) It is not politically realistic to find the Japanese Government resuming financial aids such as Official Development Aids (ODA). Moreover, Japan has already transferred to China the information on its pollution experiences in 1960'S and 1970's and know-how on possible measures. As mentioned above, China has currently adopted more active or advanced environment/energy measures than those in Japan for some areas (e.g. limiting number of cars, renewable energy promotion, etc.). So what advices and immediate PM2.5 measures Japan can provide/transfer to China are limited.

Still, the importance of further elevating the level of Sino-Japan cooperation in many areas is emphasized. Moreover, to develop such effective cooperative and collaborative system, it is essential to have clear policy direction shown by the national leaders of both countries, such as the joint communiqué announcing the significance of Sino-Japan cooperation. The reason for this is because of the history of failures in this region in developing a Northeast Asian regional cooperative framework to address air pollution. Such attempts were failed as only environmental authorities participated in negotiation from Japan side as well as China side. In other words, the absence of whole government wide support led to the collapse of effective institutional development, with less incentive in China to participate in such a framework.

To build a concrete Sino-Japan collaboration framework, it is imperative to develop All-Japan and/or All-China support not only in the specific areas shown above, but also in broader areas of energy and global warming issues. These issues may provide incentives for both Japan and China to participate. If top leaders issue clear instructions, it will likely have greater importance in terms of long-run political and economic impacts to both countries, beyond the purpose of solving air pollution problems in China. Concrete agenda in this perspective may include: joint energy resource development; joint research in energy technology; joint energy stock building in oil and natural gas; joint infrastructure-building for international energy supply system in Asia (Asia Super Grid); and linking emissions trading systems. Economic growth through green investment and job creation should also be pursued as common targets.

In addition, it is desirable to have a bilateral framework with some targets which gives political and economic incentives for both countries to

participate. So, for example, it may be possible that, firstly, both China and Japan re-address voluntary domestic PM2.5 emission reduction target. Secondly, a joint environmental fund can be set up by two countries to contribute to the target attainment.

Last but not least, the emphasis should be placed on the needs to transfer the experiences of the Fukushima nuclear power plant accident in 2011. In order to prevent such tragedy to be repeated, it is important to let Chinese people be aware of the details of Fukushima accident. It also has significance in view of national security issues in China and Japan.

During 1980s, President Gorbachev of the former USSR made a historical shift in their diplomatic policies by addressing the issue of global environmental problem as a “common enemy of humans”. His “new-thinking diplomacy” led to the peaceful mitigation of the East-West conflicts. European Union (EU) did start its union from cooperative system in iron and steel and energy sectors. Even under current political tensions between Japan and China as well as Japan and Korea, Asia should duplicate such history of environmental and energy issues bring peace in the region and the world. In Chinese, the term “crisis” implies “opportunity.” In an ideal scenario, high-level cooperative relationship can be built by taking advantage of the current environmental crisis. If done properly, it is fully feasible.

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