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## LINKING WITH THE GLOBAL COMMUNITY

*While we strive for a cleaner and greener Singapore, we must remember that we live in an interdependent world and Singapore is only one tiny island in this great wide world. Many environmental issues today cannot be resolved by any one country alone. As a responsible member of the international community, Singapore must continue to play her part by cooperating with others in the effort to resolve emerging regional and global environmental problems.*

Minister for the Environment Teo Chee Hean,  
Earth Day, 22 April 1995

Global environmental challenges will continue to confront the world. From pollution by hazardous industrial waste in the 1970s to ozone layer depletion in the 1980s and climate change in the 1990s, the importance of environmental management has grown and become more transboundary in nature, in tandem with increased urbanization and population growth.

Singapore firmly believes that global environmental responsibility must first begin at home. The government's priority

thus lies in ensuring that domestic environmental issues are well managed, which provides the foundation for moving beyond Singapore's shores to collaborating with the international community on global environmental issues.

In the early years, Singapore lacked the necessary expertise in the environmental sector and relied on international assistance for its capacity building needs. In developing infrastructure and experimenting to find workable solutions for its environmental and water challenges, Singapore has gained useful best practices and experiences along the way. It is now thus able to contribute and share its experience with other countries that may be facing similar environmental challenges.

As Singapore built up its domestic environmental track record, it also became party to key Multilateral Environmental Agreements (MEAs) to partner the international community in solving shared environmental challenges. On accession to, or ratification of, these treaties, Singapore takes its obligations very seriously and puts in place systems and infrastructure to ensure that its responsibilities under these MEAs can be fulfilled. Despite being an export-oriented economy, Singapore did not pursue its trade interests at the expense of its environmental commitments, even if that meant foregoing certain economic opportunities. In seeking progress, every effort was made to balance the demands of economic development, social progress, and environmental sustainability.

At the regional level, Singapore participates actively in ASEAN environmental forums, joining hands with its neighbours to overcome issues of common concern, such as the perennial transboundary haze. It also collaborates bilaterally with partners such as Australia, China, and Germany on joint projects to facilitate capacity building and technology transfer. Singapore has over the years facilitated dialogue and exchange of environmental experience through the hosting of various high-profile environmental and water-related events such as the Singapore International Water Week, International Desalination Association's (IDA) World Congress, and EnviroAsia.

## LEARNING FROM OTHERS

After independence in 1965, Singapore was left to fend for its own environmental protection needs. The government then had little expertise and resources to commit to the hefty investments required for environmental infrastructure. Assistance from the global community was thus needed, both in terms of expertise and financing. The country also started building up its environmental systems and regimes by studying the best expertise and technology from various developed countries, and adapted these technologies to fit the local context.

### Import of Technology

#### *Incineration*

In the area of solid waste management, Singapore has benefited much from the experience of developed countries. When the government was considering the various alternative means of waste disposal, such as refuse compaction and composting, it shortened the learning curve by sending a fact-finding team to Japan and Europe to learn from their experiences of operating compaction and incineration facilities. This led to the selection of incineration as the most appropriate option for waste disposal in Singapore (as described in Chapter 4).

In 1971, following the construction of Singapore's first refuse incineration plant at Ulu Pandan with a throughput of 1,200 tonnes/day, M/s Fichtner Consulting Engineers from Germany were appointed as consultants, as the Germans were the front-runners in incineration technology. It was also the first time that Singapore embarked on a large incineration project, and the government looked to the World Bank (International Bank for Reconstruction and Development loan) for funding. The World Bank started the appraisal of the project in March 1975 and loan negotiations were completed in May 1975 for a sum of US\$25

million partially to finance the construction, and to procure 200 refuse collection vehicles and dump trucks.

The contracts were subject to international competitive bidding under procedures consistent with the Bank's procurement guidelines. The main contractor for the mechanical contract was a German company called Deutsche Babcock, which supplied the incineration roller grate system, and their subcontractor for the boiler parts was Kawasaki Heavy Industries (a Japanese company). The electrical equipment contract was awarded to a Swiss company, Brown Boveri Corporation (BBC), which supplied and erected the turbine generator, switch gears, and control and monitoring equipment. Assisted by international partners, the plant was ready for commissioning in December 1978.

### *Semakau Landfill*

Likewise, in planning for the offshore landfill in Semakau Island in the early 1990s, a U.S. company, Camp Dresser McKee (CDM), was contracted as consultant. The Environment Ministry conducted study trips to the United States to understand the various technologies that were available in the market better, and this led to the use of impermeable membranes from the United States to line the landfill. The study team had learnt that such membranes were a key feature of well-planned landfill sites in the world so no waste or leachate would leak into the surrounding waters.

The logistics of transferring waste from the mainland to Semakau proved to be a challenging task. Semakau is about 8 kilometres away from the mainland at its closest point. It thus did not make economic sense for Singapore to construct a land route solely for the transfer of waste, unlike for many landfills in the world that are served by land routes. The only cost-efficient option available was to transport waste via the sea with barges over a span of about 30 kilometres, which translates to a three-hour journey. Owing to the long journey, Singapore could not duplicate the experience in

some parts of the United States, which was to put the waste in containers, and then transport them in barges. This would require massive facilities such as container-handling yards and cranes, and a logistic chain comprising containers being hauled from the incineration plants to the Tuas Marine Transfer Stations, and barged to Semakau, which would have required some 400 people to operate due to the complicated logistics and handling. Instead, 3,000-tonne barges were deployed, so as to maximize the load for each barge trip and lessen the logistic demands.

To enhance safety along the long sea route, Singapore engineered its own push-tug and coupling system, instead of the typical pull-tug system employed in the United States which tended to be less stable in stormy conditions. The barges were further fitted with a hydraulic metal fly ash cover, instead of just a netting that was deployed in some landfills, so as to ensure that the waste did not get wet during the long journey or be blown away in transit.

For conveying waste at the transfer station from land onto the barge, the initial intention was to operate existing overhead cable cranes, similar to those used in the incineration plants. However, the engineers who made the study trip to New York witnessed a more efficient manner of deploying huge long-arm, mining-type excavators to transfer the waste. Based on engineering estimates, deployment of the excavators proved to be the superior option as it cut down the time required for the transfer by half. Singapore has since adapted the U.S. experience of using excavators and giant mining trucks for waste transfer operations, which is in practice till this day.

Singapore had thus adopted some of the U.S. technologies and methods while modifying others to fit its unique context, such as adapting incineration technologies to the wetter refuse composition in Singapore. This led to the development of a successful waste management model and modern infrastructure to handle solid waste.

### *Water Reclamation*

Given the scarcity of natural water sources in Singapore, it had to turn to water reclamation, i.e. NEWater, to supplement existing water supplies. NEWater is essentially treated used water that has undergone stringent purification and treatment processes using advanced dual-membrane (microfiltration and reverse osmosis) and ultraviolet technologies. When assessing the feasibility of NEWater, Singapore first studied the use of reclaimed water in various parts of the United States, including Orange County Water District in Southern California. PUB/ENV found this to be a particularly interesting case study as it had been producing high-quality water, reclaimed from treated used water, since 1976. Another region that had an established history of using reclaimed water is Virginia where high quality reclaimed water has been discharged into Occoquan Reservoir since 1978. Occoquan Reservoir is a source of water supply for more than one million people in the vicinity of Washington, D.C. A study team from Singapore visited these facilities to learn more about their water reuse experiences. Based on two decades of experience in the United States, it was evident that planned indirect potable use (IPU) was viable and technological options were available to achieve the treatment objectives for IPU purposes. The fact that IPU had been safely used before was instrumental in giving confidence that IPU was a viable option for Singapore. The study trip yielded valuable learning points which led to the conceptualization of the subsequent NEWater demonstration-scale study, which, in turn, culminated in the successful launch of NEWater as Singapore's third "national tap".

### **Manpower Training**

Apart from environmental and water-related infrastructure, Singapore also relied on its international friends for assistance in training its people. When incineration was first embarked on and there was no existing plant in Singapore, engineers were sent

overseas to learn how to run such facilities. In 1975, the first batch of fresh graduate engineers and technicians were recruited for familiarization training on steam and power generating equipment at local power stations. Five of the engineers were further trained in West Germany in similar incineration plants built by Deutsche Babcock. Staff supervising the construction and commissioning activities of the incineration plants were also sent to Japan for training in plant process control, operation, and maintenance. They quickly learnt the best practices and work ethic of the Japanese, and adapted them locally on their return to train other staff in the safe operation and maintenance of the incineration plants.

With the experience gained from their European and Japanese counterparts, ENV officers liaised closely with international consultants at the outset to specify the parameters and performance standards of the new incineration plants. These officers would continue to supervise the construction and commissioning of the equipment, and ultimately, stay on to operate and maintain the plants.

In terms of capacity building and the upgrading of its people, Singapore was a beneficiary of fellowship programmes and scholarships offered by developed countries, the World Health Organization (WHO), and the Commonwealth in the 1970s–90s. These gave its officers the opportunity to gain greater exposure to various environmental systems and the regimes of other countries. The scholarships were offered to engineers working in the then Ministry of the Environment to pursue Master's programmes in Public Health Engineering (subsequently termed Environmental Engineering). Most of the engineers completed their one-year Master's programmes in U.K. universities, while others did so in Australia, the Netherlands, and the United States.

Singapore has also sought to learn from the Dutch who have a sound reputation in water management. With about half of the Netherlands less than 1 metre above sea level, the Dutch have built up a vast experience over the years in the areas of flood control, as

well as water quality and ecology. PUB has thus been sending its engineers to the Netherlands to learn about their flood management strategies and infrastructure. As recently as 2006, PUB engaged the Dutch consultant, Delft Hydraulics (now part of Deltares), to study water quality issues pertaining to the Marina Reservoir. In the process, five PUB officers were trained by Deltares in various components of the hydraulic and hydrological catchment model, the pollution emissions model, the hydrodynamic model, and the three-dimensional water quality model. With this knowledge, PUB officers can now use the water quality model for scenario planning and analysis, as well as apply their expertise to other reservoirs in Singapore.

## **SHARING SINGAPORE'S EXPERTISE AND EXPERIENCE**

Through the process of learning and adapting from the experience of others in developing environmental and water infrastructure and management systems, Singapore has acquired some useful best practices and experience that can be shared with friends from both the developing and developed world.

### **Technical Assistance Programmes**

At the 19th Special Session of the United Nations General Assembly in June 1997, Prime Minister of Singapore, Goh Chok Tong, launched the "Singapore Technical Assistance Programme for Sustainable Development", aimed at promoting sustainable development amongst developing countries. During its three-year run, the programme benefited more than 1,100 officials from eighty-one developing countries. The programme dealt with various themes of sustainable development, ranging from urban management to wastewater engineering. Since 1999, Singapore has launched other technical assistance programmes, such as the Small Island



Developing States Technical Cooperation Programme, to provide training opportunities to other government officials from the Small Island Developing States, such as Barbados, Mauritius, and Papua New Guinea.

## **Institutions of Learning**

### *Singapore Environment Institute*

In 1993, the Centre for Environmental Training (CET) was set up as an internal training arm of the Ministry. Besides meeting the training needs of ENV staff then, the CET also provided training to government officials from other countries as and when requested. Between 1997 and 2002, CET conducted more than fifty regional environmental training programmes for some 700 participants from more than fifty countries. Building on the strong foundation of CET, the in-house training arm was transformed into a full-fledged education and training institute called the Singapore Environment Institute (SEI) in February 2003.

SEI is actively engaged in the process of knowledge transfer through competency and capacity building programmes such as courses, workshops, training attachments, and technical visits to public and private organizations. Working with various governmental agencies, key industry players, the academia, and local and international organizations such as Singapore's Ministry of Foreign Affairs, Civil Service College, WHO, the United Nations (UN), Asian Development Bank (ADB), Hanns Seidel Foundation, and various foreign governmental training agencies in China, India, Japan, Korea, and ASEAN, SEI delivers close to 200 training programmes in Singapore and overseas to more than 6,000 policy-makers, industry professionals, and conscientious members of the public annually. SEI's training areas span across varying themes such as Pollution Control Management, Solid Waste Management, Environmental Public Health Management, Urban Environmental Management, Climate Change, and Energy. Since its inception in

2003, SEI has conducted more than 130 regional training programmes for some 2,700 international participants from more than sixty countries.

### *WaterHub*

In the effort to contribute towards the water industry both internationally and locally, WaterHub was formally launched in December 2004 by PUB. WaterHub seeks to bring together all the elements of water technology development, learning, and networking for members of the water industry, under one roof. It collaborates with local governmental agencies and water industry players, namely the Singapore Water Association (SWA), as well as international water organizations and aid agencies such as the International Water Association (IWA), WHO, ADB, and United States Agency for International Development (USAID), to host capacity building programmes, seminars, symposiums, and exhibitions. Through these initiatives and training tie-ups, PUB hopes to build a vibrant water industry through knowledge sharing and quality exchange of expertise in water-related areas. WaterHub has trained some 1,000 participants mainly from ASEAN, Middle East, China, India, and various Asia-Pacific countries. It has also received more than 20,000 delegates and visitors at its facilities to date.

WaterHub now houses the IWA Regional office that serves its network of members, stakeholders, and collaborators in the Asia-Pacific region. The close partnership between IWA and Singapore has led to a number of collaborations such as the inaugural IWA Leading Edge Technology Conference and Exhibition 2007, amongst other activities, which provide platforms for water professionals to develop effective and sustainable methods of water management. In addition, the set-up of corporate research institutes such as Siemens, Nitto Denko, and Konzen at WaterHub has supported PUB's effort in helping to develop R&D clusters and broaden the spectrum of technologies for the water industry.

As one of the lead agencies in the Asia-Pacific Water Forum (APWF), PUB partners ADB and the United Nations Education, Science and Cultural Organization (UNESCO) to improve coordination and promote the sharing of water knowledge in the Asia-Pacific region through the development of a network of knowledge hubs. The APWF, the Governing Council of which is chaired by Singapore's Ambassador-At-Large, Professor Tommy Koh, aims to boost investments, build capacity, and enhance cooperation in the water sector at the regional level so as to contribute to sustainable water management in Asia and the Pacific. It is the desire to share that has led to the establishment of the Asia Training and Research initiative for Urban Management by International Enterprise Singapore and ADB, to promote knowledge sharing in urban infrastructure and water management by Singapore's governmental agencies. More than sixty Chinese and Indian policy-makers have since attended the capacity building workshops on urban water management conducted by PUB at the WaterHub.

## **BEING A RESPONSIBLE GLOBAL CITIZEN**

Apart from sharing its environmental experience, Singapore also contributes as a global citizen towards the protection of the environment by partnering international bodies in tackling transboundary issues of common concern. Singapore thus takes its obligations under the Multilateral Environmental Agreements (MEAs) that it is a party to very seriously.

### **Montreal Protocol**

The "Vienna Convention on the Protection of the Ozone Layer" and the "Montreal Protocol on Substances that Deplete the Ozone Layer" are treaties aimed at preventing further damage to the ozone layer through the elimination of the production and consumption of ozone-depleting substances (ODS). Singapore has

been a party to the 1985 Vienna Convention and the 1987 Montreal Protocol since January 1989. It has also been party to all further amendments to the Protocol, which have been made to ensure that efforts to prevent ozone layer depletion are on track.

In particular, Singapore successfully phased out the consumption of controlled ODS such as chlorofluorocarbons (CFCs) and halons within a span of only six years (1990–95). This did not come easily. When Singapore took the decision in 1989 to accede to the Montreal Protocol, intensive inter-agency consultations were conducted to consider the trade-offs between its environmental concerns and the impact on trade. In fact, the ozone problem would not have been immediately felt in Singapore as it is fortunate enough to be sited in the equatorial region, some distance away from the Antarctic Ozone Hole.

On the other hand, there were significant trade implications as the economy was highly dependent on chemical industries. Although Singapore had never produced any ODS, significant quantities were used in electronics manufacturing operations, refrigeration, and air-conditioning applications. Nonetheless, as a responsible global citizen, Singapore decided to commit to the Montreal Protocol. This required the cooperation of the industries. Extensive consultations were carried out with the industries to phase out the use of controlled CFCs by the year 2000, in accordance with the Montreal Protocol.

To take into account the interests of various stakeholders and smoothen out the potential trade impact, Singapore was one of the first to regulate the use of ODS with an innovative market-based mechanism. Instead of legislating an outright ban, the then Trade Development Board (TDB) introduced a Tender and Quota System in October 1989 to control the consumption of CFCs in Singapore, which helped the industry wean itself off the use of CFCs at a manageable and economically feasible pace. This helped prepare the industry for the eventual ban on the import and manufacture of non-pharmaceutical aerosols and also polystyrene sheets and products made using the controlled CFCs in 1996.

These efforts produced prompt results. Consumption of the controlled CFCs in 1986 was about 4,000 tonnes in Singapore. By 1990, this was reduced to about 3,500 tonnes, and further to 1,900 tonnes in 1992. Singapore's success in phasing out CFCs and halons consumption in 1996 was way ahead of the schedule prescribed by the Montreal Protocol, leading to its winning an award for "Outstanding Ozone Unit" in 1997 from the United Nations Environmental Programme (UNEP).

### **Basel Convention**

The Basel Convention is another MEA that Singapore is party to. The Convention was adopted in March 1989 and came into force in 1992 in response to concerns about toxic wastes from industrialized countries being dumped in developing countries. It dictates that transboundary movements of hazardous wastes be reduced to a minimum, consistent with their environmentally sound management; and that movements of such wastes be subject to the prior informed consent of the importing and transit states. The Convention also calls for the generation of hazardous wastes to be reduced and minimized at source, and for the wastes to be treated and disposed of close to their source of generation.

As a small country with a substantive manufacturing sector, it is, therefore, pertinent that Singapore has a robust pollution control regime to protect its environment, and ensure that it does not become the source of pollution to another country. With this in mind, Singapore became a party to the "Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal" in January 1996.

The Hazardous Waste (Control of Export, Import and Transit) Bill was passed by Parliament in November 1997 to ensure sound and effective management, transportation, and disposal of hazardous wastes in Singapore. Under the Hazardous Waste (Control of Export, Import and Transit) Act and its Regulations, any person who wishes to export, import, or transit hazardous

wastes will require a permit from the Pollution Control Department (PCD) of NEA, the national competent authority for the Basel Convention. NEA will only issue a permit if it is satisfied that all the relevant competent authorities of the other countries have given their consent to the movement. NEA will prevent the import of hazardous and other wastes if it has reasons to believe that the wastes in question will not be managed in an environmentally sound manner. It also does not permit hazardous and other wastes to be exported to, or to be imported from, a non-Party/State.

To ensure that the government has full control over any transboundary waste and its disposal in a manner that does not pose any health and environmental hazards, all new industries are required to obtain clearance from NEA before they operate in Singapore. As part of the process of obtaining the clearance, NEA will require them to furnish full details of the chemicals they use in the process, the process itself, and the chemicals that are released as a result of their manufacturing processes. In this way, NEA is able to track both toxic chemicals that have to be used or imported, as well as the toxic and hazardous substances that are generated. NEA will also require them to illustrate how they intend to treat the hazardous materials that are released. They can either do it in-house or will have to get the services of one of their licensed toxic waste collectors who will then dispose of the chemicals for them.

NEA will not hesitate to prosecute violators of the Act. Corporate entities may be subjected to a fine not exceeding S\$300,000, while individuals have to pay a fine not exceeding S\$100,000 or serve an imprisonment term not exceeding two years, or both.

To meet its obligations under the Basel Convention within Singapore, the government has thus diligently put in place strict regulations and enforcement regimes that are rigorous enough to withstand scrutiny by all, be it lobby groups or NGOs. In keeping to its obligations under the MEAs, some unintended benefits have also arisen. When one of the neighbouring countries blamed Singapore for dumping illegal waste in its territory, Singapore

could rely on the regimes it had in place to ascertain that the allegation was unfounded. With the assistance of the Basel Secretariat, the matter was amicably resolved with the release of a joint press statement by both countries which stated clearly that Singapore did not breach the Basel Convention. Singapore's strong reputation in meeting its obligations under the MEAs had helped in a major way in convincing the international body of Singapore's arguments in this particular case.

### **United Nations Framework Convention on Climate Change**

In the area of global warming, Singapore has ratified the United Nations Framework Convention on Climate Change (UNFCCC) in May 1997 as well as acceded to the Kyoto Protocol in April 2006 to demonstrate its commitment towards global efforts to mitigate climate change. Although Singapore is not obligated under the Convention or the Kyoto Protocol to take on emission reduction targets as a developing country, and despite being an energy disadvantaged country, it has adopted a climate change strategy to play its part in climate change mitigation, such as through implementing energy efficiency policies.

The country's leaders have also been advocating for more to be done on environment sustainability and climate change. At the UNFCCC meeting in Bali in December 2007, Prime Minister Lee Hsien Loong stressed the need for countries to pursue pragmatic and cost-effective ways to reduce greenhouse gas emissions by exploiting technologies to improve energy efficiency and reduce wastage. He also called on the global community to work together to protect the world's carbon sinks and set overall targets to reduce emissions.

Meeting obligations under various international MEAs is not without trade-offs for all countries, including Singapore. Before signing on to any MEA, Singapore carries out intensive consultations

amongst the relevant ministries and agencies to ensure that it is able to meet the obligations and that the necessary measures and legislation are, or can be, put in place. The government also consults the business community and provides necessary assistance so that these businesses are not unfairly affected by Singapore's obligations towards the MEAs. The bottom line is that Singapore is prepared to take tough decisions, even at the expense of its trade interests, so that it can also do its part towards preserving and protecting the global environment.

## **FACILITATING INTERNATIONAL ENVIRONMENTAL NEGOTIATIONS**

While Singapore may be a small country, it has no qualms about making its opinions heard in the international arena. When called upon, it also does not shy away from taking up crucial roles in facilitating international negotiations on environmental issues. In December 1989, the UN General Assembly passed Resolution 44/228 which called for the United Nations Conference on Environment and Development (UNCED) in 1992. The UNCED (also known as the Earth Summit) held in Rio de Janeiro in Brazil was attended by 116 Heads of State. More than 178 governments adopted Agenda 21, a programme of action to reverse the negative impacts of human activity on the environment, and to promote environmentally sustainable development. Two personalities were instrumental in facilitating and forging agreement during the intense negotiations that took place between 1990 and 1992, namely, the Secretary General of the Conference, Maurice Strong of Canada, and Singapore's Ambassador-At-Large, Professor Tommy Koh, as Chairman of the Preparatory Committee, and subsequently Chairman of the Main Committee.

Professor Koh was invited to steer the Preparatory Committee (Prepcomm) given his role in concluding the United Nations Convention on the Law of the Sea (UNCLOS) in December 1982,



where an unprecedented 119 countries signed up to the Convention on the first day it was open for signature. Singapore was also a natural choice to chair the Prepcomm as it was seen as an honest broker in the North-South divide, and could play a useful role in reconciling the differences between the “Developed North” and the “Developing South”.

In Singapore’s efforts to join hands with its global partners in solving the world’s environmental problems, it has been open in sharing with the world its state of the environment, the difficult trade-offs it has faced, and the solutions it has come up with in striving towards environmental sustainability. Singapore published its first Singapore National Report to the 1992 UNCED Preparatory Committee in 1991 and also formulated the first Singapore Green Plan 1992–2002, which is Singapore’s blueprint for charting its long-term vision of attaining environmental sustainability. The second Singapore Green Plan 2002–2012 was subsequently released at the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa, in September 2002.

## **REGIONAL AND BILATERAL COOPERATION**

Apart from environmental issues that have a global reach, some transboundary and emerging environmental challenges may have a direct impact on Singapore and its surrounding region. Geographically, Singapore is a small island within the intricate ecosystem of ASEAN. It is inevitable, therefore, that environmental issues that affect neighbouring countries would have an effect on Singapore as well.

### **ASEAN Summit**

ASEAN leaders have grown increasingly concerned about environmental issues that may affect the precious environmental

heritage and natural resources in the region. Recognizing that attaining environmental sustainability is a key pillar of sustainable development, Singapore played its part in focusing ASEAN leaders' attention on environment issues when it hosted the ASEAN and East Asia Summits in November 2007. The Heads of States adopted three key declarations related to the environment and climate change, outlining the commitment of countries in the region towards environmental protection, and paving the way for more initiatives to be implemented in these areas.

In particular, two key challenges facing the ASEAN region are transboundary haze pollution and sprawling urban cities creating undue stress on the environment.

### *Transboundary Haze*

Transboundary haze from land and forest fires has been a challenge confronting ASEAN since the 1990s. In the 1997 El Nino year, the ASEAN region suffered the worst case of transboundary haze pollution, which affected the health of the people, the business climate, as well as investors' confidence and tourism in the region. According to the ASEAN Secretariat's Environment and Disaster Management Centre, the 1997-98 haze cost regional economies US\$9 billion.

The key source of smoke haze in the ASEAN region is fires, particularly in Sumatra and Kalimantan, caused by land clearing practices by farmers and plantation companies. The smoke haze situation was aggravated during El Nino years such as 1994, 1997, and 2006. In October 2006, the particulate matter level rose beyond alarming levels of 300 parts per million in Indonesia, resulting in reduced visibility and posing respiratory problems to its citizens. At the same time, the air pollutant index at its worst in Malaysia reached unhealthy levels of 160 in Kuala Selangor and 221 in Sri Aman, Sarawak. The 24-hour PSI levels in Singapore likewise hit

the “unhealthy” range, that is, rising above 100, on three days in October 2006.

As transboundary haze had previously been viewed as a local and regional problem, international assistance to combat it has been limited. However, with new knowledge that the ASEAN land clearance and forest fires account for a significant amount of carbon emissions to the atmosphere contributing to climate change, the international community has come to realize that the ASEAN haze is more than just a local or regional problem. Consequently, international resources have begun to flow towards controlling the haze situation in ASEAN.

Fighting land clearance and forest fires is a long-term process that requires sustained effort from all parties involved. Indonesian authorities will need to step up enforcement actions against plantation owners and companies that carry out illegal land clearing practices by fires. This will be a long-haul process which will require a substantial amount of commitment from Indonesia, with assistance from ASEAN countries, regional, and international organizations.

Singapore has been working closely with the Indonesian Government to help mitigate the fires and smoke haze under the ASEAN mechanism. In December 1997, Singapore hosted the first ASEAN Ministerial Meeting on Haze (AMMH), which developed the Regional Haze Action Plan (RHAP). The Plan sets out measures to prevent and suppress land and forest fires as well as provide early warning and monitoring to detect smoke haze in the region.

Unfortunately, the ASEAN Haze Agreement signed in June 2002 has made little progress and the haze problem remains. As of August 2008, two countries – Indonesia and the Philippines – have yet to ratify the Agreement. Recognizing that a top-down approach of instituting broad regional mechanisms could not adequately address the haze problem, Singapore thus embarked on a bottom-up approach and took up Indonesia’s invitation for ASEAN countries to work directly with its fire-prone provinces and districts.

Singapore has collaborated with the Jambi Provincial Government to jointly develop a Master Plan to deal with land and forest fires in the Muaro-Jambi Regency. The Master Plan focuses on the prevention of land and forest fires to mitigate transboundary haze pollution. Similarly, Malaysia has offered to work with the Riau Province. Since the signing of a Letter of Intent (LOI) in November 2007, Singapore has been assisting the Muaro-Jambi Regency of the Jambi Province in implementing selected action programmes under the Jambi Master Plan, such as the setting up of air and weather monitoring stations and the hosting of “Socialisation Workshops” on sustainable farming and zero-burning practices to assist villagers in adopting alternative methods of land clearing. The collaboration with Jambi also comprises efforts to help local villagers find alternative livelihoods such as through the fishery industry. By introducing alternative livelihoods to the local farmers, Singapore hopes to find a sustainable solution to prevent land clearing practices using fires. Singapore has committed S\$1 million to assist the Muaro-Jambi Regency in implementing the Master Plan. If successful, the Jambi Master Plan can serve as a model that can be replicated in other fire-prone areas in the ASEAN region.

Apart from its work in Jambi, Singapore has also been deploying its advanced satellite imagery and weather monitoring technologies to help the ASEAN region in tracking the hotspot and haze situation. Singapore’s Meteorological Services Division (MSD) under NEA has served as the ASEAN Specialised Meteorological Centre (ASMC) to provide weather forecast and monitoring of smoke haze, land, and forest fires in the region since 1995. Singapore Civil Defence Force firefighters and the Air Force’s C-130 cloud seeding aircraft also joined their Indonesian counterparts in helping to combat the worst fires in Sumatra, Indonesia, in August 2005.

### *Environmentally Sustainable ASEAN Cities*

Singapore has been proactive in bringing in foreign expertise and assistance to the ASEAN region. One example is through the ASEAN

Initiative on Environmentally Sustainable Cities (AIESC), which aims to promote environmentally sustainable cities in the ASEAN region. The ASEAN Working Group on Environmentally Sustainable Cities (AWGESC) was formed to develop strategies and action plans to drive and develop the AIESC.

Singapore chaired the AWGESC from 2003 to 2007. By focusing on experience sharing and capability building, it managed to successfully channel useful foreign expertise for the benefit of all in ASEAN. For instance, many international organizations and global partners contributed funding and technical support towards the work of the AWGESC. These include the UNEP, UNDP, USAID, United Nations Centre for Regional Development, Hanns Seidel Foundation, Japan-ASEAN General Exchange Fund, United Nations University-Institute of Advanced Studies (UNU-IAS), Asian Institute of Technology (AIT), Clean Air Initiative-Asia, GTZ (German Technical Cooperation Agency), and many others. Through the AIESC, Singapore also shares its experience with fellow countries, especially in areas such as urban environmental management, water technologies, pollution control, and solid waste management.

### **Germany-Singapore Environmental Technology Agency**

To facilitate the transfer of environmental expertise from Germany and Europe to the Asia-Pacific region, the Germany-Singapore Environmental Technology Agency (GSETA) was set up in 1991 under a bilateral arrangement between the then Ministry of the Environment (ENV) and the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). Both ENV and BMU jointly administer this Agency. Since its inception, the GSETA has successfully organized eighteen regional events such as seminars, workshops and conferences on environmental issues, including waste management, air and water pollution control, environmental protection strategies,

environmental quality standards, and energy efficiency. These have benefited close to a thousand participants from the Asia-Pacific region.

The GSETA events have been well received by Asia-Pacific participants as good knowledge-sharing forums. To promote environmental sustainability, Germany and Singapore remain committed to the efforts of forging greater environmental partnership among Germany, Singapore, and the Asia-Pacific economies. The GSETA serves as an effective platform for information sharing and a vital link between Germany and Asia in the field of environmental protection.

### **Bilateral Sharing of Expertise**

By adapting innovative technologies and environmental systems from the global community for the local context, Singapore has managed to leverage some of these state-of-the-art technologies to turn its limitations into strengths. Though Singapore is not well endowed with water supplies, it has creatively harnessed innovative technologies such as water reclamation (NEWater) and desalination to bolster its limited water supplies. Singapore's success in water technologies gained international recognition when its national water agency, PUB, won the Stockholm Industry Water Award in 2007. This has given Singapore further credibility and opportunity to share its experience with the global community, including various developed countries.

PUB has also been sharing its experience in water reuse with several states in Australia, which were plagued by droughts in recent years. PUB's Director for Technology serves as advisor on the Queensland Expert Advisory Panel set up by the State's Water Commission in 2007. PUB undertook advanced water analysis of effluent samples for Australian Capital Territory Electricity and Water (ACTEW) Corporation Limited from Canberra in June 2007, which is the water, sewerage, natural gas, telecommunications, and

energy utility in Canberra, Australia. PUB was also involved in the testing and commissioning of the Bundamba Advanced Water Treatment Plant that is part of the Western Corridor Recycled Water Scheme in Queensland between August and November of 2007.

Singapore also has long-standing bilateral environmental cooperation with regional countries such as Brunei, Malaysia, and Indonesia. To take bilateral cooperation with Malaysia as an example, Singapore has been working closely with the Malaysian government in areas such as the reduction of smoky vehicles from Malaysia, monitoring of water quality in the Straits of Johor, and emergency response to chemical spills at the Second Link. Such collaborations have provided opportunities for sharing of environmental experience bilaterally, and also enhanced the friendship of environment officers between the countries.

Apart from joint environmental cooperation, Singapore also seeks to lend a helping hand where possible. Many coastal states in the Indian Ocean were caught offguard by the fateful tsunami that struck on 26 December 2004. During the initial difficult period, swift actions were undertaken by the authorities in the affected countries, and generous assistance poured in from the international community to help soothe the immediate needs of the affected people. Singapore launched a significant relief operation to render immediate assistance. As part of this relief effort and longer term reconstruction assistance, Singapore assisted the Maldives in its recovery efforts.

MEWR/PUB recognized that providing drinking water was a critical step that would help support the Maldives' reconstruction efforts, and PUB's desalination expertise could be put to good use in providing a sustainable supply of drinking water. PUB worked closely with private water companies in Singapore, such as Keppel Integrated Engineering, to send a 240-cubic-metres-per-day water desalination plant to the Maldives. In addition, GrahamTek also contributed a water desalination plant with a capacity of 200 cubic

metres per day, and Hyflux Ltd dispatched its “Dragonfly” water generators to the Maldives. Singapore was able to provide relief assistance promptly because of the close partnership between PUB and private companies.

## **FOSTERING A CULTURE OF SHARING AND LEARNING**

Singapore’s success in environmental management and water supply systems has also attracted interest from many foreign officials who wish to learn from the Singapore experience. The country has hosted many visitors at its environmental facilities, such as its incineration plants and landfill, and in the process shared how it has been able to overcome its environmental challenges despite being a small island state devoid of resources.

### **Singapore International Water Week**

To facilitate the sharing of experience and best practices on water management further, Singapore hosted the inaugural Singapore International Water Week (SIWW) in June 2008. SIWW is a platform for government officials, industry leaders, and water specialists to meet and discuss policies, business solutions, and water technologies. Comprising a Water Leaders Summit, Water Convention, and Water Expo, the SIWW culminates in the presentation of the Lee Kuan Yew Water Prize, a prestigious international award to recognize outstanding contributions in solving water issues.

### **Dengue Collaboration with WHO**

In another example, Singapore has experienced a resurgence of dengue in recent decades and put in place a robust, integrated vector control programme to combat this. In so doing, Singapore has also accrued valuable experience and expertise that can be shared with other dengue-endemic countries. Singapore has,



therefore, partnered the WHO in developing a strategic dengue control plan for countries located in the Southeast Asian and Western Pacific regions. The plan will serve as a blueprint for the countries to strengthen their dengue control programme. This programme provides a platform for mutual learning as it is implemented. Singapore has also entered into a Memorandum of Understanding with Cuba in September 2007 that would allow both countries to leverage each other's expertise and experience in dengue control.

### **Eco-City in Tianjin**

As environmental challenges grow more complex with each passing day, more innovative solutions will also need to be formulated to overcome these challenges. Since 2007, Singapore, led by the Ministry of National Development, has partnered China, led by the Ministry of Housing and Urban-Rural Development and Tianjin Municipal Government, in a joint venture to build an Eco-City in Tianjin. With the support of government agencies such as NEA, PUB, HDB, LTA, BCA, as well as private sector companies such as Keppel and Surbana, through a Master Plan team led by URA, the project seeks to test bed and demonstrate environmentally sustainable and economically viable approaches for urban development. When completed, there will be some 350,000 residents living and working in energy and water efficient buildings in the Eco-City in Tianjin's Binhai New Area.

Setting high, yet realistic, targets will ensure that the Eco-City measures up to the high standards of other environmentally friendly cities in the world. Of particular note, the site for the Eco-City is in an area experiencing water shortages and poor surface water quality. These challenging circumstances provide greater impetus for the planners to devise innovative environmental solutions to ensure that the target of achieving more than 50 per cent of the water supply from non-traditional sources such as recycling, rainwater harvesting and desalination can be met and that the surface water system is rehabilitated.

When completed, the Eco-City will become a model of sustainable development for other cities in China. There will also be opportunities for Singapore to gain from the experience in the Eco-City partnership, and bring back some of the innovative environmental solutions and technologies to Singapore.

### **Zhangjiagang Water Supply Project**

MEWR has also been working closely with China in the area of water management. Singapore signed an MOU with China's Ministry of Construction (MOC)<sup>1</sup> in July 2007 to collaborate in the area of integrated utilization of water resources in urban environments. In particular, the Zhangjiagang Water Supply Project was proposed between Sembcorp and the Zhangjiagang Government as a demonstration project between both countries to improve water supply, water treatment, and water conservation in China. Under Phase 1 of the project, SembCorp will focus on providing one-stop service to industries to treat industrial waste water, and recycle the treated industrial effluent for reuse. The project will also cover the management and operation of used water treatment in Zhangjiagang city.

## **CONCLUSION**

Singapore's environmental interactions with international partners had humble beginnings. Options available to the young nation then were limited, which necessitated learning from the experiences of developed countries. Where relevant, overseas technologies were adapted to Singapore's local context. Through this continuous learning process, Singapore has managed to turn some of its constraints into strengths, such as overcoming its lack of water resources to become a leader in applying and adopting water technologies.

Singapore is committed to being a responsible global citizen and became party to MEAs in the hope of solving common environmental problems. This did not come easily as there were times when certain difficult trade-offs had to be made in order for Singapore to meet its obligations under the MEAs. Nevertheless, Singapore remains steadfast in its commitment and puts in place strict regulations and enforcement regimes to ensure compliance.

Singapore will not rest on its laurels, but will continue to share its expertise with others as well as to learn from others who are all taking this same journey in seeking environmental sustainability for their communities. It is keen to continue partnering international bodies in coming up with innovative policy and technical solutions to the ever-changing and complex environmental challenges. Moving forward, Singapore is happy to continue to share the expertise it has acquired over the years to the global community, as it firmly believes that it is only through joint action by all countries that the world can be an environmentally sustainable home for future generations to come.

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