

**The United States of America and Singapore Free Trade Agreement (USSFTA)  
Singapore's Environmental Review Report**

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## **1 OVERVIEW**

1.1 Over the years, Singapore has developed a comprehensive environmental regime. The success of its environmental regime is evident from the clean and green environment it enjoys. The levels of pollutants in our ambient air are within the WHO and USEPA standards. Inland waters support aquatic life and coastal waters meet recreational water standards. Potable water whose quality is well within WHO drinking water guidelines is supplied to all parts of Singapore.

1.2 The robust environmental regime has been developed even as the economy followed the trajectory of rapid growth. This achievement stems from a belief that environmental protection and economic development are equally important and mutually reinforcing objectives. Indeed, for a small city-state with a high population density, effective environmental protection is of paramount importance. Singapore can be easily overwhelmed by environmental disasters if we pursue socio-economic progress without any consideration of its environmental costs.

1.3 Free trade agreements (FTAs) form a key component of Singapore's current economic strategy to increase its linkages with the global economy. As with the earlier stages of our economic development, the challenge is to ensure that the heightened economic activity arising from the increased liberalisation of trade will not compromise the quality of our living environment.

1.4 This environmental review assesses the potential effect of the US-Singapore Free Trade Agreement (USSFTA) on our environment and concludes that the comprehensive environmental system in place is sufficiently robust to meet the expected increase in economic activity generated by the USSFTA. Furthermore, the USSFTA is likely to have positive spin-offs for the environment as it promotes closer cooperation between the environmental agencies of both countries in the exchange of ideas and best practices and in the sharing and development of technical expertise in environmental management.

## **2 THE ENVIRONMENTAL REVIEW PROCESS**

2.1 The Environmental Review (ER) studies how Singapore achieves its objectives of managing its scarce resources and protecting the environment in its pursuit of rapid economic growth. This review is timely as economic activities are expected to increase as a result of the free trade agreements that Singapore has entered into in recent years. Specifically,

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the ER assesses the potential environmental effect of the USSFTA on Singapore.

2.2 The National Environment Agency (NEA) coordinated the preparation of the ER report. A wide-range of government agencies, including ENV, MTI, MFA, MND, AVA, NParks, URA and PUB<sup>1</sup>, were involved. NGOs and the public will also be consulted on the ER report, before it is finalised.

### **3 THE USSFTA AND EFFECT ON THE ENVIRONMENT**

#### **3.1 Background of the USSFTA**

3.1.1 The US-Singapore Free Trade Agreement (USSFTA) was launched by former US President Bill Clinton and Singapore Prime Minister Goh Chok Tong in November 2000 at the fringe of the Asia Pacific Economic Conference (APEC) Summit in Brunei. The Agreement was substantially concluded after 11 rounds of formal negotiations.

3.1.2 The USSFTA is a comprehensive agreement, covering trade in goods, rules of origin, customs administration, technical barriers to trade, trade remedies, cross-border trade in services, financial services, temporary entry, telecommunications, e-commerce, investment, competition, government procurement, intellectual property protection, transparency, general provisions, labour, environment and dispute settlement.

3.1.3 A world-class agreement, the USSFTA surpasses the liberalisation commitments made by both countries at World Trade Organisation (WTO). The FTA also addresses new or emerging trade issues, such as the protection of intellectual property in a digital environment, the liberalisation of e-commerce trade and ICT services as well as transparency standards. More importantly, beyond trade liberalisation elements, the USSFTA safeguards the governments'

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<sup>1</sup> Full names of acronyms are as follows:

ENV	– Ministry of the Environment
MTI	– Ministry of Trade and Industry
MFA	-- Ministry of Foreign Affairs
MND	– Ministry of National Development
AVA	– Agri-food and Veterinary Authority
NParks	– National Parks Board
URA	– Urban Redevelopment Authority
PUB	– Public Utilities Board

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regulatory rights in the domain of public safety, labour and the environment and promotes bilateral cooperation in these areas.

## **3.2 Bilateral Economic Relations**

3.2.1 The USSFTA will strengthen the bilateral linkages between the two countries. The US and Singapore economies are complementary. The US is strong in many high-technology and knowledge-based sectors. Singapore can serve as a regional centre for command and control, research, design, production and logistics.

3.2.2 In fact, the US and Singapore are already major trading and investment partners. The US is consistently one of Singapore's largest trading partners, while Singapore is the US' 12th largest trading partner in the world and the largest partner in Southeast Asia. Bilateral trade stood at US\$31 billion in 2002. Key Singapore exports to the US are machinery and transport equipment, manufactured articles and chemicals and related products. Key US exports to Singapore are integrated circuits and semiconductors, printed circuit boards, scientific equipment, specialised machinery and aircraft and parts.

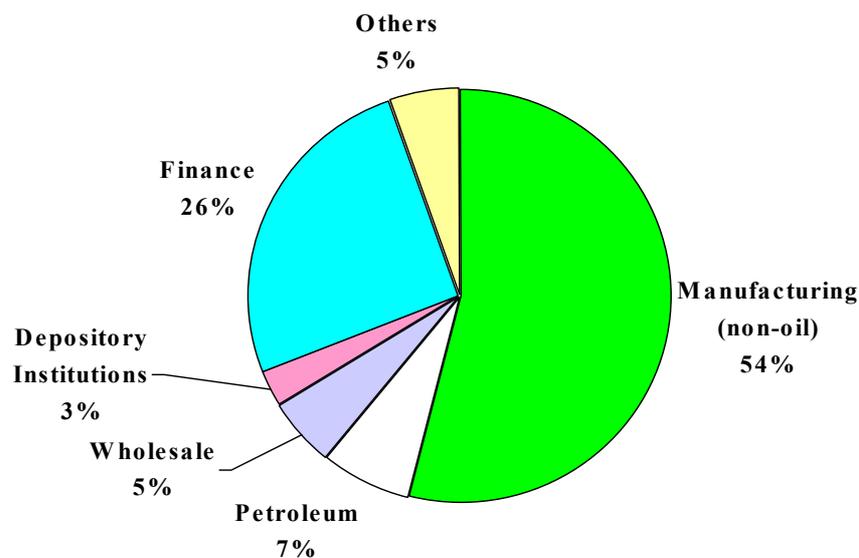
3.2.3 Singapore does not compete in the sensitive sectors of the US. Singapore is a net importer of agricultural products. On average, Singapore imports US\$200m worth of agricultural products from the US per year. Agriculture accounts for only 1% of Singapore's total domestic exports. These exports are primarily processed Asian foods, such as Chinese spring roll skins. Additionally, Singapore does not have automobile, leather or footwear industries. Singapore has a small steel industry that imports iron scrap to make into steel products. There are approximately 200 Singapore companies that manufacture textiles and garments. The industry mainly produces garments made from knitted cotton and synthetic fibre. Singapore has never used up its textiles quotas from the US.

3.2.4 In the area of investment, the US is the largest foreign direct investor in Singapore, while Singapore is the US' third largest investment destination in Asia, after Japan and Hong Kong. US foreign direct investment (FDI) in Singapore stood at US\$27.3 billion or 2.0% of US investment overseas, as at end 2001 (see **Chart** for distribution of US FDI). Singapore also plays host to 1,300 US companies and 15,000 US citizens.

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**Chart: US FDI in Singapore, 2001**

(Source: US Department of Commerce)



3.2.5 Singapore investments in the US have also been growing steadily in recent years. Singapore is the second largest Asian investor in the US after Japan. Our foreign direct investments in the US, on a historical cost basis, are more than twice that of South Korea, Hong Kong and Chinese Taipei. As at end 2001, the investments in the US stood at US\$6.5 billion, almost 2.5 times the amount in 1997. Investments are primarily concentrated in the areas of manufacturing, real estate and depository institutions.

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3.2.6 The US and Singapore have also cooperated in promoting partnerships between our Small and Medium Enterprises. The US-Singapore Business Partnership Initiative, supported by the US Chamber of Commerce and International Enterprise Singapore, was launched on March 2002. Through an on-line web portal, the initiative seeks to promote collaboration between the US and Singapore businesses by facilitating the matchmaking of individual enterprises. Since its inception, the initiative has successfully matched close to 2,000 small and medium enterprises on both sides through the on-line portal and 200 matches from off-line facilitation.

### **3.3 Economic and Environmental Effect of the USSFTA**

3.3.1 The USSFTA is expected to generate greater economic exchanges between the US and Singapore. Increased trade flows will be due to the reduction of barriers for market access in goods and the consequent increased productivity from a reduction in input costs. This will enable businesses on both sides to achieve greater economies of scale in production and to redirect resources to more competitive product segments. In the long term, the FTA will help promote intra- and inter-industry specialisation.

3.3.2 Businesses can also take advantage of new opportunities in services (including financial and telecommunications services), investment and government procurement under the USSFTA. The FTA addresses two important aspects. First, they establish common rights and obligations, in line with international standards. This includes compensation at fair market value for expropriated property and the removal of performance-related restrictions on investments. Second, both countries have undertaken obligations to open up a broad range of activities under the so-called negative list approach. Unless specifically exempted in the FTA, investors and potential service suppliers on both sides will enjoy the same level of protection and market access as a local service provider or investor. Singapore has made broad ranging commitments in the areas of environment management, education, healthcare, direct selling, express delivery and ICT services.

3.3.3 Additionally, the FTA provisions on customs regulations, competition and transparency will secure the open and pro-business operating environment in both countries. The e-commerce and intellectual property obligations ensure that our respective regimes keep pace with developments in the digital environment.

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3.3.4 According to an internal study using a computable general equilibrium (CGE) model<sup>2</sup>, the USSFTA is expected to raise Singapore's real GDP and trade. Much of the increase in trade flow will be attributed to intra-MNC activity given that 62% of US-Singapore trade is intra-MNC trade. These statistics reflect, in part, the already low tariff barriers and open investment regimes in both countries.

3.3.5 In assessing the environmental effect of the USSFTA, the manufacturing sector must be accorded special attention. Manufacturing, as compared to the services sector, has the greatest potential to affect the environment adversely, both in terms of pollution load and resource consumption. This is particularly so for the electronics and chemicals sectors. Both sectors require large quantities of energy and water in their production processes, constitute significant proportions of Singapore's manufacturing sector value-added (37% and 17% respectively) and may pose pollution problems with increased production.

3.3.6 However, this is unlikely to result in a net adverse effect on the environment. There are two reasons. First, Singapore does not have substantial presence in heavy industries that are pollutive in nature. Relatively higher land and labour costs do not make these activities viable in Singapore. Second, the boost in manufacturing and/or a rise in US inward investments would largely fall in the areas of high technology and high value-added segments, such as LCD production under the electronics and the biomedical industries. These industries tend to be less pollutive and are more environmentally friendly. In fact, it is conceivable that the FTA may lead to a net improvement in the environment as it accelerates Singapore's transition to a knowledge-based economy and the growth of higher value-added sectors with the concurrent displacement of lower value-added, resource-intensive and pollutive activities from Singapore.

3.3.7 Although economic activity in the services sector is expected to increase concurrently, we do not expect any negative effect on the environment because these services are clean and pollution free.

## **3.4 Environmental Opportunities**

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<sup>2</sup> The CGE estimates here are confined to static gains through the lowering of tariff and non-tariff barriers as a result of the USSFTA. Dynamic gains, such as the rise in investment inflows, increased efficiency and productivity gains in domestic industries due to the USSFTA are extremely difficult to estimate and are therefore not included in the analysis.

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3.4.1 From Singapore's point of view, the USSFTA will provide a valuable opportunity to enhance bilateral cooperation in environmental matters.

3.4.2 Even before the launch of the USSFTA, the US and Singapore had already recognised that cooperation in the field of environment can produce substantial benefits to both countries as well as the region. Since 1994, Singapore's Ministry of the Environment (ENV) had enjoyed a good working relationship with its US counterparts through the US-Asia Environmental Partnership (US-AEP) programme.

3.4.3 Over the years, the US-AEP had been a useful and effective channel to facilitate the transfer of environmental expertise from the US to Singapore and the Asia Pacific region. Areas of co-operation include air monitoring, pollution control, vehicle emission standards, etc. Joint activities with the US-AEP had also provided an important platform for technical exchanges at the regional level through the staging of environmental and related events.

3.4.4 The USSFTA includes provisions to protect the environment. In addition to a commitment by both sides to enforce its own laws, both sides have also agreed to consult and cooperate closely on environmental issues of concern.

3.4.5 Specifically, under the FTA, the US and Singapore will work on a Memorandum of Intent (MOI) to advance further technical cooperation on environmental management at the bilateral as well as regional levels. The MOI would focus mainly on training and capacity building programmes, such as technical symposia, conferences and exchanges, to promote sustainable environmental policies and practices in the Asia region. Both countries will look into harnessing the synergy in the areas of environmental management policies and technologies.

3.4.6 **In summary, the assessment is that the USSFTA will bring a net environmental benefit to Singapore. The FTA will forge closer bilateral exchange and cooperation on environmental matters. At the same time, the increased economic activity from the FTA is not expected to have any negative impact on the environment. Singapore has high environment standards and a strong environmental regulatory regime, adequately equipped to deal with any environmental effect that may result from the USSFTA.**

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3.4.7 Section 4 of this ER report elaborates further on how Singapore manages its scarce resources and ensures that the environment is not compromised by economic growth and development.

## **4 RESOURCE AND ENVIRONMENTAL MANAGEMENT**

### **4.1 Background**

4.1.1 Singapore is a highly urbanised, densely populated and resource-scarce city-state. Notwithstanding this, it has succeeded in developing its industrial base and achieving high economic growth in less than 3 decades. Having recognised the necessity of development without detriment to the environment, programmes were implemented at a very early stage of her industrialisation to protect the environment.

4.1.2 Singapore started its industrialisation in the early 1960's with the development of an industrial estate in Jurong. Initially, the industries in Jurong Industrial Estate were mainly primary product processing and labour-intensive type of industries. By 1970's, however, the industrial base had grown rapidly to include chemical and electronic industries. The industries also started to move away from primary product processing and labour-intensive types to high-value-added ones. By 1980's, Singapore had developed its high value added industries such as software design, precision machine, specialist chemicals, aerospace, research and development, etc. As our industries developed and diversified into specialist chemicals, electronic and metal finishing, an increasing quantity and variety of chemicals were imported, transported, stored and used. In addition, wastes containing toxic substances were generated.

4.1.3 As the industrial base was being developed, there were also parallel developments in the housing, commercial and service sectors. All these developments generated pollution, wastewater and solid waste, which would have caused degradation to the environment if not properly managed.

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4.1.4 To ensure that rapid economic growth and industrialisation were not achieved at the expense of the environment, the Anti-Pollution Unit (APU) under the Prime Minister's Office was formed in 1970 and ENV in 1972 to protect and improve the environment. APU implemented measures to control air pollution whilst ENV provided infrastructure and measures to prevent and control water pollution and manage solid wastes. In 1985, APU took on the additional responsibility of controlling hazardous substances and ENV implemented new programmes to control the disposal of toxic wastes. In 1986, APU was absorbed into ENV and a new set up, the Pollution Control Department (PCD), was created to implement an integrated approach to control air and water pollution, and to manage hazardous substances and toxic industrial wastes.

4.1.5 In recent years, ENV has been further re-structured. ENV now focuses on policy issues and has two statutory boards under its wing to deal with operational issues and the implementation of programmes. The PUB is in charge of the total water cycle: collect, treat and reclaim wastewater as well as collect, treat and supply potable water. The National Environment Agency (NEA) formed on 1 July 2002, focuses on ensuring a clean living environment and a high standard of public health in Singapore.

4.1.6 Besides ENV, PUB and NEA, many other public agencies deal directly or indirectly with different aspects of environment-related matters, including:

- a) MND, URA and NParks deal with use of land and nature conservation matters. They coordinate with MPA on sea space.
- b) MPA deals with pollution of the sea from ships and works closely with the oil and chemical industries, NEA, MINDEF, SCDF, and Airport Emergency Service Division in the event of oil and chemical spills.
- c) AVA works with farmers to educate them on correct application of fertilizers and pesticides to minimise pollution, take care of food health issues and manages trade in plants and animals.
- d) MOT and LTA manage transportation issues that also impact the environment.
- e) MOE and the educational institutions are involved in creating environmental awareness.

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- f) SPRING Singapore contributes through incentive programmes like LETAS, standards on environmental management systems, etc.

## **4.2 Environmental Management Approach**

4.2.1 Singapore strives to balance environmental protection and economic development through close collaborative relationships between its environmental agencies and the key economic development and promotion agencies: the Economic Development Board (EDB), which promotes industries, and the Jurong Town Corporation (JTC), which provides space for industries. Both EDB and JTC understand the environmental requirements for new industrial developments well. Close inter-agency cooperation ensure that the environmental requirements are conveyed to prospective investors in the early stage of planning so that investors could factor them into their economic and technical feasibility studies. Overseas investors also have free access the environmental requirements specified as a Code of Practice on Pollution Control from the Internet.

4.2.2 Comprehensive environmental protection measures based on the key strategies below have been adopted:

- a) Prevention  
Pollution prevention is carried out through proper land use planning, development of environmental infrastructure and provision of pollution control measures.
- b) Enforcement  
Controls are stringently enforced to ensure that pollution control measures are properly maintained and implemented. NEA officers carry out regular surveillance and inspection rounds to make sure that pollution is kept in check. Where pollution does take place, enforcement action is taken promptly.
- c) Monitoring  
Ambient air and water quality are monitored regularly to determine whether the pollution control measures are adequate and whether new pre-emptive measures need to be taken.

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d) Public Education

In addition, programmes are conducted to educate the public on the protection and management of the environment.

4.2.3 Comprehensive pollution control laws, which are enforced stringently, underpin the environment protection measures. The government sets emission standards and discharge limits and leaves it to industries to adopt the best practical means to comply with the emission standards and discharge limits.

4.2.4 NEA works with industry as co-regulatory partners with the aim of achieving responsible care in environmental management. NEA holds dialogue sessions with industry and trade associations and representatives to exchange views and get feedback on policy changes. Examples of dialogue partners are Singapore Chemical Industry Council, American Chamber of Commerce, Institution of Engineers Singapore, Singapore Institute of Architects, Motor Traders Association of Singapore. Some industry groups have leveraged on collective expertise to enhance corporate environmental responsibility. An example is Singapore Chemical Industry Council's "Responsible Care Programme" under which the chemical industry is committed voluntarily to continual improvement in all aspects of health, safety and environmental performance. Also, some 390 companies have internalised their environmental commitments by implementing ISO 14001 certified environmental management systems.

4.2.5 The people sector also does its part. For example, the Singapore Environment Council (SEC) gives out the Singapore Environmental Achievement Award to recognise the efforts of local companies and government agencies to improve the environmental performances of their processes and practices. A myriad of groups, such as SEC, Nature Society (Singapore), Youth Challenge, Habitat Forum, Waterways Watch Society, organise a variety of programmes to make caring for the environment a lifelong interest and commitment for Singaporeans.

## 4.3 **Land**

### 4.3.1 Land Use

4.3.1.1 Singapore has only 682 sq km of land. To manage its scarce land resources well, Singapore has an integrated land planning and management system. The Concept Plan balances multiple land-use

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demands and includes provisions for long-term land uses such as housing, industry, infrastructure, open spaces and nature reserves. The Concept Plan is translated into a detailed medium-term Master Plan, which guides and facilitates development with indication of land uses and development intensities. At the approval stage for development proposals, the development control decisions are guided by the Master Plan and other development control guidelines.

4.3.1.2 The Concept Plan, the Master Plan and development control come under a single agency, the Urban Redevelopment Authority (URA). The URA works closely with various government agencies when preparing and reviewing the Concept Plan and Master Plan. In the process, URA also actively seeks feedback from the public through public exhibitions and on-line via its Internet homepage. This integrated approach ensures consistency, transparency and long-term sustainability with regards to land use.

4.3.1.3 Despite the scarcity of land, Singapore consciously incorporates nature conservation considerations into the planning and development process. Nature Reserves and nature areas are captured in the land use plans. Nature areas with significant biodiversity are identified and will be left untouched for as long as possible. Developments near these areas may be required to carry out ecological studies and propose mitigation measures to minimise the impact of their developments on the environment. In addition, about 4% of Singapore's land area is protected as National Parks or Nature Reserves, safeguarding most of the key representative ecosystems in Singapore.

4.3.1.4 The nature reserves include some 2,900 ha of forests. The forests of Singapore are not exploited and are conserved primarily for ecological, educational, recreational and scientific purposes. The forests in Bukit Timah Nature Reserve and Central Catchment Reserve are species-rich - harbouring 44 species of mammals, 127 species of resident birds, 72 species of reptiles and 25 amphibian species. There are also about 500 ha of mangrove forests in Singapore. In 2001, in a historical milestone for Singapore, the Sungei Buloh Nature Park and the Labrador Nature Area were promoted from nature areas to nature reserves. This brings to four the number of nature reserves accorded legal protection under the National Parks Act.

4.3.1.5 In spite of her equatorial location and dense urbanisation, Singapore has a pleasant park-like ambience as a result of a conscious policy since the 1960s to plant trees and shrubs in urban areas. By 2001,

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some 1.11 million trees and 10.1 million shrubs<sup>3</sup> have been planted in public spaces throughout the island, earning Singapore the name of a Garden City. Open spaces, parks, gardens, street planting and a network of green links are integrated into the urban environment. There are regulations requiring the conservation of mature trees, the setting aside of land as green buffers and the greening of carparks.

#### 4.3.2 Planning Control

4.3.2.1 Development agencies are required by the planning and development control authorities to consult NEA on proposed new developments. The NEA checks the proposals, assesses the adequacy of pollution control measures and ensures that new industrial and residential developments are properly sited and are compatible with the surrounding land use.

4.3.2.2 For new industrial developments, NEA assesses the pollution control measures to ensure that prospective industries will not pose unacceptable health and safety hazards and pollution problems in Singapore. A proposed industry will only be allowed if emissions of pollutants can comply with standards, wastes can be safely managed and properly disposed of, and the factory can be sited in a suitable industrial estate.

4.3.2.3 For industries that use or store hazardous chemicals in bulk quantities, NEA requires them to carry out the following studies to support their applications for industrial sites:

- a) Quantitative Risk Assessment (QRA) Studies
  - i) To identify and quantify hazards and risks related to the transport, use and storage of hazardous chemicals.
  - ii) To determine impact zones due to an accident which will lead to fire, explosion or release of toxic gases.
  - iii) To recommend measures to be incorporated in the design and operation of the plant to keep risks to a low level and to minimise impact zones.
  - iv) To facilitate the development of emergency response plans to deal with all credible accident scenarios.

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<sup>3</sup> As reported in NParks' Annual Report 2001/2002, page 36.

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b) Pollution Control (PC) Studies

- i) To identify the sources of emission of air pollutants, discharge of industrial effluent, generation of wastes and emission of noise.
- ii) To propose measures to reduce pollution and to mitigate adverse pollution impact on surrounding land use.

4.3.2.4 NEA will issue clearance to allocate sites to these industries after the findings and recommendations of the QRA and PC study reports have confirmed that risks are kept within acceptable levels and compliance with pollution control requirements.

4.3.2.5 All these measures have resulted in an orderly development of industrial plants within a good environment.

4.3.3 Solid Waste Management

4.3.3.1 Singapore has a comprehensive refuse collection system that has been fine-tuned over the years. All solid wastes are collected and disposed of daily. Daily collection of refuse is necessary to prevent problems associated with decomposition of organic wastes. The refuse collection service is reliable.

4.3.3.2 Owing to land constraints, Singapore has chosen incineration as the disposal method to help conserve the limited capacity of its sanitary landfill. All incinerable wastes are burnt at four incineration plants. The incineration plants are fitted with flue gas treatment facilities and their emission is monitored closely. Energy is recovered to generate electricity. Scrap metal is also recovered.

4.3.3.3 Singapore's only landfill, the Semakau Offshore Landfill, started operations on 1 April 1999. It covers an area of 350 ha and has a fill-capacity of 63 million cu m. Only incineration ash and non-incinerable waste are disposed of at the landfill.

4.3.3.4 Singapore has given new emphasis to waste minimisation and recycling as a long-term solution to address waste disposal. In 2002, about 45% of the waste are being recycled, mainly by the industry and commercial sectors. The targets are:

- a) Raise overall recycling rate of 60% by 2012.

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- b) Extend the lifespan of Semakau Landfill to 50 years and strive towards "zero landfill".
- c) Reduce the need for incineration plants to one every 10–15 years.

4.3.3.5 ENV and NEA have mapped out three strategies in the new approach of addressing solid waste disposal. They are:

- a) Reduce waste disposed of at incineration plants
- b) Re-use incineration ash to reduce landfill
- c) Reduce waste disposed of directly at landfill

4.3.3.6 The key recycling programmes that have been launched to reduce the waste going to incineration plants are as follows:

a) Domestic - National Recycling Programme (NRP)

- i) In April 2001, the National Recycling Programme (NRP) for the domestic sector was launched whereby the public waste collectors are required under their licence, to provide door-to-door collection of recyclable materials from households.
- ii) Under the programme, residents are given recycling bags or bins to deposit their recyclables such as paper, plastic, bottles, cans, etc. These bags are collected once every fortnight on pre-determined dates. On these pre-determined collection dates, residents place their recycling bags at their doorsteps for collection by the recycling companies.
- iii) The participation rate of the NRP was about 15% at the start and has since gone up to about 33% as at end of 2002. A target to increase participation rate to 50% (i.e. 1 in 2 households) by 2003 has been set.

b) Recycling Bins at Public Places

- i) Recyclable waste such as flyers, newspapers, drink cans and plastic bottles are also generated at public places. To supplement the NRP, recycling bins have been provided

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at public places with high human traffic. Such places include MRT stations, bus interchanges, airport, shopping areas, etc.

- c) Waste Recycling in the Industrial and Commercial Sector
- i) Major waste streams have been identified in the industrial and commercial sectors to increase the recycling rates and hence reduce the amount going to the disposal facilities. The targets set to increase recycling rates for these waste streams, to be achieved by 2012, are as follows:
- Food waste from food factories, food courts, markets, major catering facilities, etc. - from 6% to 30%.
  - Paper/Cardboard from factories, shopping centres, offices, etc. - from 36% to 55%.
  - Wood waste from factories, construction sites, etc. - from 8% to 40%.
  - Plastic waste from factories - from 10% to 35%.
  - Horticultural waste from trees and parks maintenance - from 32% to 70%.
- ii) The plans to meet these targets include providing support and incentives for technology development work to recycle these waste, providing suitable industrial lands to set up recycling facilities, manpower skills development and training, and facilitating market development of recycled products.
- iii) Good progress has been made in the recycling of waste in the industrial and commercial sectors. For example, the electronics industry is an important industry in Singapore and its growth has resulted in an increase in the amount of electronic waste. These wastes are collected and processed by a recycling company that recovers the materials present in the electronic wastes. Wood is another waste stream that has met with good success in recycling. A large amount of the waste wood is either reused to produce wooden crates and pallets or

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processed into recycled wood. Horticultural waste from the maintenance of trees and plants in parks and along roads are recycled into compost. A new recycling facility is being set up to recycle horticultural waste into charcoal.

4.3.3.7 Daily, some 1,800 tonnes of incineration ash is produced as the residue of incinerating 7,000 tonnes of waste each day. This amount of ash is landfilled and constitutes two-thirds by weight of the total waste disposed of at Semakau landfill. Reuse of incineration ash would reduce significantly the amount of waste disposed of at the landfill. The pilot project on the use of incineration bottom ash for road construction has been successfully completed. NEA is facilitating several private companies in exploring the setting up of a plant to process incineration bottom ash into road construction material. If successfully implemented, this will help to divert about 30% of the incineration bottom ash from the landfill, thus conserving the landfill space. NEA is also currently exploring with the university on the use of incineration bottom ash as a material for land reclamation.

4.3.3.8 Non-incinerable waste that is directly disposed of at the landfill constitutes one-third of the total amount of waste disposed of at the landfill. The main fractions of non-incinerable waste are construction and demolition (C&D) waste from construction sites and used copper slag from the marine industries. The 2012 recycling targets set for these two waste streams are as follows:

- a) C&D waste - from 85% to 90%
- b) Used copper slag - from 90% to 95%

4.3.3.9 Currently, 4 C&D waste recycling companies are setting up the facilities to recycle the C&D waste into secondary aggregates and non-structural concrete products. NEA is working closely with the Building & Construction Authority (BCA) and the construction industry to promote more recycling.

4.3.3.10 Used copper slag generated by the marine industries is being recycled at three recycling plants. The processed copper slag is classified into coarse slag for re-use as grit blasting material, and fine slag, which is used to make paving blocks and concrete. One recycling company is exploring other uses of the fine slag, such as road base material for road construction.

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4.3.3.11 By reducing waste disposed of at the incineration plants and landfill, land that would otherwise be needed for building more of such facilities could be saved and the huge expenditure for building these facilities avoided. Equally important, recycling waste helps to conserve resources.

4.3.3.12 One of the key challenges faced in ensuring that recycling is sustainable is to create a demand for the final product. To create a demand for recycled products, resources have to be channelled to develop high quality recycled products at affordable prices and educating end users to use them, perhaps even showing preference for these products as being environmentally friendly. The government provides incentives to develop products and even to market them. Through the Singapore Green Label scheme, recycled products can be identified as being green products.

#### 4.3.4 Hazardous Substances and Toxic Wastes Control

4.3.4.1 As industries developed and diversified into specialist chemicals, electronic and metal finishing, an increasing quantity and variety of chemicals are imported, transported, stored and used. In addition, wastes containing toxic substances are also generated. Singapore takes a "cradle-to-grave" approach towards hazardous substances and toxic waste.

4.3.4.2 To minimise risk from the handling of hazardous substances, industries which use large quantities of such chemicals are sited on off-shore islands or in industrial estates which are located far away from residential estates.

4.3.4.3 Approval is required to transport hazardous substances exceeding specified quantities. Drivers of road tankers and tank containers carrying hazardous chemicals are also required to undergo a training course on safety requirements and precautions, first aid and fire fighting.

4.3.4.4 The control of hazardous substances was implemented under the Poisons (Hazardous Substances) Rules, 1986, a subsidiary legislation of the Poisons Act. When the Environmental Pollution Control Act (EPCA) was enacted in 1999, the same control was transferred to and implemented under the Environmental Pollution Control (Hazardous Substances) Regulations, 1999, which is a subsidiary legislation of the EPCA.

4.3.4.5 Industries are required to install in-house treatment facilities to recycle and reuse their toxic wastes or to treat their toxic wastes for safe disposal. Industries may, however, engage licensed toxic industrial waste

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collectors to collect their wastes for recycling or treatment for safe disposal. The collectors will also have to obtain a transport approval to transport wastes in quantities exceeding the specified amount.

4.3.4.6 The different types of hospital wastes are separately stored in colour coded plastic bags and collected by licensed contractors for disposal by incineration at dedicated high temperature incineration plants. Singapore is developing its bio-chemical industry. Bio-wastes generated from this new industry will be subject to similar treatment as hospital wastes.

4.3.4.7 The Environmental Public Health (Toxic Industrial Waste) Regulations, 1988, a subsidiary legislation of the Environmental Public Health Act, was enacted to control the collection, storage, transportation and disposal of toxic industrial wastes.

4.3.4.8 In October 1996, ENV introduced the Safety Audit Scheme with the aim of spurring industries, which handle and store large quantities of hazardous substances, to systematically identify and rectify weaknesses in their management systems and practices in the handling and use of hazardous substances on a regular basis. Now managed by NEA, this scheme will help reduce hazards and risks to workers, the public and the environment from accidental releases of hazardous substances from these premises. It will also help the management rectify any shortcomings and strengthen existing systems and practices. In 2001, a total of 73 hazardous installations conducted safety audit studies under this scheme.

#### **4.4 Water\_**

##### **4.4.1 Fresh Water**

4.4.1.1 Water is a strategic resource that Singapore has to guard zealously. At present, Singapore's water supply comes from local sources as well as from imports. Water is imported from the State of Johor, Malaysia, governed by two Water Agreements under which the quantities of water drawn from the Johor source are provided for.

4.4.1.2 Potable water is supplied to all parts of Singapore. The quality of potable water is well within the WHO Guidelines for Drinking Water Quality. The average water consumption in 2001 was 1.247 million cu m per day.

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4.4.1.3 Singapore only has a few rivers. Built-up areas are well served by drainage channels to prevent flooding. The network of drains, canals, streams and rivers in the water catchments lead directly or indirectly via storm water collection systems to impounding reservoirs where raw water is stored. Raw water is treated to potable water standards at the waterworks, which are spread throughout the island.

4.4.1.4 Currently, about half of the total land area serves as water catchment areas. The central portion of the main island amounts to about 5.3 % of the land area and serves as our protected water catchments. No development is allowed within this area.

4.4.1.5 The other water catchment areas on the island are unprotected water catchment areas. Developments are allowed within unprotected catchments so long as they comply with the Environmental Pollution Control Act, as well as satisfy all other planning requirements and development control guidelines. Public sewers serve all residential and industrial developments. Only non-pollutive industries are allowed to be sited in these water catchment areas.

4.4.1.6 The total water catchment area will be increased to about two-thirds of the land surface area by 2011 with the building of more estuarine reservoirs constructed out of former tidal rivers to store the water from the enlarged catchment areas.

4.4.1.7 Singapore has embarked on major projects to reclaim used water to increase its local water supply. Water reclamation multiplies water supply. For example, reclaiming 25% of used water is equivalent to increasing supply by 33%. From 2003, two plants produce 72,000 cu m per day of high-grade reclaimed water, called NEWater. NEWater is supplied to wafer fabrication plants, industries and commercial buildings for their process and air cooling use. The major use of NEWater is by industries and commercial buildings but a small quantity is for indirect potable use. NEWater undergoes a naturalisation process in the reservoirs and the blended water is then treated at the waterworks for drinking water supply. Singapore has also embarked on the use of desalinated water through a BOO (Build, Own and Operate) Scheme to augment its water supply. A desalination plant to provide 136,000 cu m of desalinated water per day is scheduled to be ready by 2005. By 2011, at least 25% of Singapore's water needs will be met by unconventional sources such as NEWater and desalinated water.

4.4.1.8 Besides managing supply, Singapore also encourages water conservation as a way of life. Since 1981, the Public Utilities Board (PUB)

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has implemented a national water conservation plan to ensure the efficient use of potable water. PUB runs a series of on-going public education and publicity programmes to encourage water conservation. It requires all non-domestic premises to install water saving devices such as constant flow regulators and self-closing delayed action taps and all new premises to install low capacity flushing cisterns. PUB also conducts free water audits for larger water users and encourages industrial users to recycle and reuse water. Water tariffs have been restructured over the last few years and a water conservation tax of 30% of the water tariff is levied on all water users. Heavy domestic users have to pay higher water tariffs/water conservation tax. Right pricing has proven to be an effective demand-side water management tool.

4.4.1.9 With strict pollution control measures to protect indigenous water sources, continuing efforts to secure additional external supplies, use of technology such as membrane-based processes and rigorous measures in water conservation, Singapore's water supply plan is robust and diversified to ensure that there will be enough water to meet all its long-term needs. From the water perspective, Singapore will, therefore, be able to adapt and meet the challenges imposed by development and population growth.

#### 4.4.2 Water Pollution Control and Wastewater

4.4.2.1 The main sources of water pollution in Singapore are domestic wastewater and industrial effluent. The policy of requiring all wastewater from domestic and non-domestic premises to be discharged into sewers has effectively protected our inland water bodies and coastal water from pollution.

4.4.2.2 Industrial wastewater are required by law to be pre-treated to the specified standards before discharge into a sewer or where the public sewer is not available into a watercourse. The laws are:

- a) Sewerage and Drainage (Trade Effluent) Regulations, 1999, on the treatment and discharge of trade effluent into public sewers.
- b) Environmental Pollution Control (Trade Effluent) Regulations, 1999 on the treatment and discharge of trade effluent into a drain or a watercourse.

4.4.2.3 The PUB provides a comprehensive and reliable sewerage reticulation system to ensure that all wastewater in Singapore is collected for treatment. Sewerage infrastructure is put in place to keep pace with new industrial, housing and commercial developments. Today, 100% of our population enjoys modern sanitation and all wastewater are collected for treatment. Singapore has invested heavily in the sewerage reticulation system and water reclamation plants. The comprehensive sewerage system comprises of sewers, pumping mains, pumping installations and Water Reclamation Plants (WRPs).

4.4.2.4 The WRPs recover biogas as energy to power their treatment processes. Stabilised sludge is used as a soil conditioner for tree planting and turfing works. The treated wastewater are either discharged into the sea or further treated for use as industrial water to conserve potable water or processed into NEWater.

4.4.2.5 PUB is developing the Deep Tunnel Sewerage System (DTSS) as the long-term solution to meet Singapore's wastewater collection and treatment needs through the 21<sup>st</sup> Century. It will comprise a network of deep tunnels to intercept sewage flows in the existing sewerage reticulation system, comprising gravity sewers and pumping installations, and to channel sewage flows to two new centralised WRPs. There will be two tunnels. The North Tunnel will stretch to the eastern part of the island and the

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South Tunnel will run to the west. The treated effluent will be reclaimed for further use or discharged through deep-sea outfalls.

4.4.2.6 When ready, the DTSS will free substantial tracts of land for residential and other uses. The implementation of DTSS started in March 1999 and is progressing well. There will, therefore, be no difficulty meeting any potential environmental effects arising from economic and trade effects of the USSFTA from the wastewater treatment point of view.

#### 4.4.3 Ambient Water Quality Monitoring

4.4.3.1 The quality of coastal and inland waters is monitored regularly to ensure that recreational and water quality standards are met and water pollution problems like eutrophication are detected early and controlled. Samples of coastal waters are collected for physical, chemical and bacteriological examinations.

4.4.3.2 The quality of water from streams and collection ponds in water catchments and in reservoirs are monitored closely. Besides pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS) and ammoniacal-nitrogen (NH<sub>3</sub>-N), faecal coliform and metals, the water bodies are also screened regularly for toxic trace contaminants like volatile organic compounds, trihalomethanes, polynuclear aromatic hydrocarbons and pesticides listed in the USEPA Priority Pollutant List.

4.4.3.3 The water in Singapore's inland waters is good and supports aquatic life. The water collected in the reservoirs is good and can be treated to produce drinking water. The coastal waters generally meet the standards for recreational uses.

#### 4.5 **Air**

4.5.1 Air pollution management and energy are closely linked because the main sources of air pollution in Singapore are the burning of fossil fuel for heat generation in industries, electricity generation and transportation. This section discusses:

- a) Energy use in Singapore and preventive measures to avoid air pollution: energy efficiency measures and use of cleaner energy;

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- b) Regulatory measures to control air pollution; and
- c) Ambient air monitoring.

#### 4.5.2 Energy Efficiency and Cleaner Energy

4.5.2.1 Singapore has no indigenous energy supply – no coal, oil, gas, hydro or geothermal energy sources. It also does not have the land to produce biomass as an energy source. Although there appears to be some potential for solar energy, a major technological breakthrough will be needed to harvest solar energy in a cost-effective manner and with minimum space use, as Singapore is a densely built-up city-state with small land and sea areas.

4.5.2.2 Singapore is, therefore, totally dependent on imported oil and natural gas to meet its energy needs. Singapore has been heavily reliant on oil as a fuel. Since 1992, a small part of electricity production is fuelled by natural gas. Prior to 1992, electricity was generated solely with fuel oil.

4.5.2.3 Singapore is pursuing both supply-side and demand-side management measures vigorously to enhance the efficient use of energy. To drive energy conservation efforts, an Inter-Agency Committee on Energy Efficiency (IACEE) was formed by the Ministry of National Development (MND) in 1997. The IACEE was taken over by ENV in 2001 and restructured into the National Energy Efficiency Committee (NEEC) in April 2001. Four Sub-Committees and an R&D Workgroup were formed under the NEEC in September 2001, with 3P (Public, Private and People sectors) participation. The key thrusts of the NEEC are to:

- a) Promote energy conservation through the efficient use of energy in the industrial, building, transportation and consumer sectors;
- b) Promote the use of cleaner energy sources such as natural gas and renewable energy sources; and
- c) Promote Singapore as a location for the pilot test-bedding of pioneering energy technologies and as the hub for development and commercialisation of clean energy technologies.

4.5.2.4 The NEEC seeks to integrate the promotion of energy efficiency with the reduction of pollution and carbon dioxide emissions from

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the use of energy. These efforts will be pursued in a 3P (public, private and people) partnership model. Currently, representatives from 45 organisations, including government agencies, trade and professional associations, and NGOs are involved in the various NEEC committees and workgroups.

4.5.2.5 The NEEC's programmes cover the consumer, industry, transportation and building sectors. The NEEC R&D Workgroup facilitates and promotes R&D in tertiary institutions and the private sector, so as to complement the NEEC's effort in developing the energy technology industry.

4.5.2.6 In recent years, Singapore has looked actively into increasing the use of natural gas, which produces less carbon dioxide. The effort to switch to natural gas is mainly constrained by the availability of secure and reliable gas supplies. Much progress has since been made with companies securing the supply of some 625 million standard cubic feet per day. Supply is being stepped up from second quarter of 2001 through 2008. The companies are trying to determine the size of the Singapore market and attempting to bring in sufficient gas to meet the demand.

4.5.2.7 The power generation sector is responding well to the call to switch from fuel oil to natural gas (NG) and using combined cycle generation technology (CCGT). Such switching would increase electricity generation efficiency from about 35-40% to 45-50%. The progress made by the four main power plants is as follows:

- a) Power Senoko has converted part of its existing generation system to CCGT and switched to NG from fuel oil. It is currently in the process of converting additional generation system to CCGT and using NG.
- b) Power Seraya is in the process of installing CCGT and using NG.
- c) Sembawang Utilities Terminal (SUT), a co-generation plant on Jurong Island, is using NG to produce electricity and steam.
- d) The new stage of the Tuas power station will also use NG.

4.5.2.8 The energy industry has been liberalised to promote competition and to ensure that the industry remains efficient as the overall

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capacity grows over time. The rationale is that competition will effectively lead industry players to find innovative, least-cost solutions and make optimal use of new technologies, and leading to higher efficiency all round.

4.5.2.9 In the consumer sector, the NEEC's efforts are currently targeted at raising awareness among consumers of efficiency issues for household appliances. The NEEC launched the energy labelling initiative on 20 April 2002 at an Earth Day celebration event. The initiative covers refrigerators and air-conditioners as these appliances account for up to 65% of the household monthly utility bill. Under this voluntary, self-declaratory scheme, targeted appliances will be affixed with an Energy Label, which provides information on energy performance in terms of energy consumption and an efficiency class. To-date, fourteen major manufacturers and distributors of refrigerators and air-conditioners have registered to be users of the Energy Label and 32 models have been registered. The NEEC is currently studying the introduction of energy labelling for washing machines.

4.5.2.10 The NEEC has developed an Energy Audit scheme for major industrial consumers of energy, such as oil refineries and petrochemical plants. It was officially launched in July 2002. The scheme aims to improve the level of energy efficiency of major industrial consumers (which typically consume more than 10,000 TJ annually) and is introduced on a voluntary basis. To-date, three major energy consumers have voluntarily joined the scheme. The scheme will be extended to 46 other companies which consume from 10 TJ to 10,000 TJ.

4.5.2.11 An Energy Efficient Building Award organised by the Building Construction Authority (BCA), seeks to promote energy efficiency in buildings and to accord recognition to building owners, architects and engineers who have integrated energy efficiency into the design of the buildings. The winners of the award represented Singapore in the ASEAN Building Energy Efficiency Best Practices Award in 2002 and emerged as winners in several categories. The results were as follows:

- a) New and Existing Building Category
  - i) Changi General Hospital - 1st prize
  - ii) MOE Building – Runner-up
  
- b) Retrofitted Building Category
  - i) Shangri-La Hotel – 1st prize
  - ii) Alexandra Hospital – Runner-up

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- c) Special Submission Category
  - i) DSTA Building

4.5.2.12 The existing building envelope and roof Overall Thermal Transfer Value (OTTV) regulations (1979) has been revised and will be replaced by the Envelope Thermal Transfer Value or ETTV, taking into consideration the local weather conditions. Items specified in the regulations related to energy efficiency are:

- a) Maximum thermal transmittance for roofs
- b) Provision of data logging facilities
- c) Maximum lighting load density
- d) Indoor design condition for air-conditioned spaces

4.5.2.13 The building sector accounts for 32% of the total electricity consumption in Singapore. Public sector buildings account for 24% of this, accounting for almost 8% of the total consumption. Hence, improvement in the level of energy efficiency of public sector buildings would not only have a significant impact on national performance, it serves also as role models for energy efficiency measures. In 2002, BCA conducted its second annual banding exercise of some 444 public sector buildings, which evaluated the energy efficiency of these buildings annually and ranked them into 3 banded groups. By benchmarking these buildings against each other, the management of the respective buildings would be better able to assess their relative consumption and take necessary measures to improve their performance.

4.5.2.14 BCA, in collaboration with the National University of Singapore, is developing an Energy Efficiency Index (EEI) for various buildings types. The EEI may in future be used to identify buildings with poor energy performance for mandatory energy audits and improvement projects.

4.5.2.15 The Housing Development Board (HDB) has incorporated energy efficiency into the design of public housing. Measures include the orientation of public housing buildings to minimise exposure to the western sun, sun shades to reduce radiation into homes, and the promotion of the use of gas heaters in new flats.

4.5.2.16 The Vehicle Quota System was implemented by the Land Transport Authority (LTA) on 1 May 1990 to regulate the growth of the vehicle population. The number of new vehicles allowed for registration is

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pre-determined annually, taking into account the prevailing traffic conditions and the number of vehicles taken off the roads permanently, whilst the market determines the price of owning a vehicle.

4.5.2.17 Electronic Road Pricing is considered an effective measure in curtailing vehicle usage. Vehicles are fitted with an in-vehicle unit and road usage is charged when the vehicle passes under overhead gantries located along roads with heavy vehicular traffic. This encourages drivers to car-pool or use public transport.

4.5.2.18 Financial Incentives for alternative fuel vehicles have also been introduced. The following rebates are applicable for the registration and use of electric, hybrid and natural gas powered cars:

- a) Rebate equivalent to 20% of the car's Open Market Value (OMV) that can be used to offset the fees and taxes payable at registration;
- b) Road tax rebate of 10% for hybrid cars; and
- c) Road tax rebate of 20% for electric cars.

4.5.2.19 The following incentives are applicable to bus and taxi operators:

- a) A rebate of 20% of a NG taxi's OMV and a rebate of 5% of a NG bus' OMV can be used to offset the fees and taxes payable at registration on top of an annual road tax rebate of 20% for NGVs;
- b) Natural gas taxis de-registered in less than 5 years after registration will have the PARF (Preferential Additional Registration Fee) rebate capped at 125% of OMV; and
- c) Certificate of Entitlement (COE) exempted natural gas buses on Jurong Island for Singapore Bus Service Pte Ltd (SBS) with the existing COE-paid buses deployed for scheduled services elsewhere.

4.5.2.20 The above rebates are applicable for three years (2 January 2001 to 31 December 2003) and will be reviewed thereafter. The Government is giving these rebates to help lower the cost differential between electric/hybrid cars and conventional cars as electric and hybrid

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cars are less pollutive but cost significantly more. The rebates are aimed at encouraging motorists to consider buying electric and hybrid cars instead of conventional gasoline-powered cars.

4.5.2.21 Solar thermal energy has found use in hot-water applications in hotels and major food catering facilities. Photovoltaic cells have currently limited usage in Singapore due to the extensive cloud cover and the high capital cost. Efforts are underway to establish test-bedding opportunities for photovoltaic technology in some new developments.

4.5.2.22 NEA and EDB are looking into other clean and renewable sources of energy such as hydrogen. There has been much interest in the development of fuel cells and examples of such initiatives are as follows:

- a) DaimlerChrysler will test-bed some seven fuel cell cars from 2004 once the refuelling infrastructure is in place. EDB plans to turn Singapore into a leader in the field of alternative energy technology.
- b) BP (Singapore) has signed a letter-of-intent with EDB to develop a hydrogen refuelling infrastructure in Singapore. BP has plans to set up 1 or 2 hydrogen pumps at existing stations by 2003 and these would be among the first in the world.

4.5.2.23 ENV launched the Accelerated Depreciation Scheme for energy efficient and energy saving equipment in 1998 to incentivise energy efficient designs and technologies. NEA has taken over the administration of the scheme. The scheme allows companies to depreciate in one year the following types of equipment, instead of the usual three: -

- a) Energy efficient equipment and technology
- b) Highly efficient pollution control equipment
- c) Replacement of old diesel driven goods vehicle and buses

#### 4.5.3 Air Pollution Control

4.5.3.1 Industries and electricity generation plants are required to install pollution control equipment to comply with the emission standards specified in the Environmental Pollution Control (Air Impurities) Regulations 2000. To minimise the emission of sulphur dioxide into the air, the sulphur content in

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fuels used by industries is limited to not more than 1% by weight. Industries sited near urban areas are required to use cleaner fuel, such as diesel with 0.05% or less in sulphur content, town gas or natural gas.

4.5.3.2 From January 1997, industries have to monitor their exhaust emissions regularly through source emission tests and take remedial measures where necessary to comply with the air emission standards. In 2001, 171 industries were required to conduct the source emission tests.

4.5.3.3 The use of open fires in trade and industrial premises for the disposal of wastes has been banned since 1973.

4.5.3.4 Motor vehicles are the other major source of air pollution. Unleaded petrol was introduced in January 1991 and the use of leaded petrol was completely phased out on 1 July 98. Since July 1991, all new cars imported into Singapore must be able to use unleaded petrol. The availability of unleaded petrol paved the way for stricter emission standards, which can only be complied with through the use of catalytic converters. The current emissions standards for registration of petrol-driven vehicles, the EC Directive 96/69/EEC (EURO II), were introduced on 1 January 2001.

4.5.3.5 Emission standards for motorcycles and scooters have also been introduced. From 1 October 1991, all new motorcycles and scooters are required to comply with the emission standards specified in the United States Code of Federal Regulations (40 CFR 86.410-80) before they are registered for use in Singapore. From 1 July 2003, the current emission standards for motorcycles and scooters will be replaced by 97/24/EC.

4.5.3.6 Since 1 March 1999, the sulphur in automotive diesel has been reduced from 0.3% by weight to 0.05% by weight. Smoke emission from diesel-driven vehicles is harmful as fine particulate matter has significant health impact on people. The lowering of the sulphur content in diesel paved the way for the adoption of more stringent vehicle emission standards, that is, the EURO II standards which came into force on 1 January 2001.

4.5.3.7 In addition, all in-use vehicles are required to undergo mandatory periodic inspections. These vehicles are tested for exhaust emission for compliance with the emission standards. This is to ensure the proper maintenance of engines and efficacy of catalytic converters.

4.5.3.8 The control of vehicular emissions is under the Environmental Pollution Control (Vehicular Emissions) Regulations, 1999, which is a subsidiary legislation of the Environmental Pollution Control Act (EPCA).

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4.5.3.9 Vehicular emissions will be tightened in tandem with technological developments to keep their impact on ambient air quality in check.

#### 4.5.4 Ambient Air Quality Monitoring

4.5.4.1 The quality of ambient air quality is monitored by a telemetric air quality monitoring and management system. Air monitoring stations were strategically located in different parts of the island to accurately capture the air quality situation. Some stations monitor general ambient air quality while the rest monitor roadside air pollution levels. The roadside stations help NEA to track the vehicular emission control programmes. Sulphur dioxide, nitrogen oxides, ozone, inhalable particulate matter (PM10), carbon monoxide and hydrocarbons are monitored continuously.

4.5.4.2 Ambient air pollutant levels have generally been low and within the levels established by the USEPA and the WHO. The daily Pollutant Standards Index (PSI), an air quality index system developed by the USEPA, has consistently stayed in the 'good' and 'moderate' range. The only times when the PSI exceeded the 'moderate' range occurred when air quality was affected by transboundary smoke haze from land and plantation fires in the neighbouring countries. In 1997, PSI exceeded 100 for 12 days due to smoke haze.

4.5.4.3 In 2002, PSI was in the good range for 82% of the days and moderate range for the other 18 % of the days. Singapore aims to have 85% of the days with PSI in the good range and the remaining days with PSI in the moderate range when not affected by transboundary smoke haze incursion.

## **5 ROLES IN GLOBAL ENVIRONMENT**

### **5.1 International and Regional Efforts**

5.1.1 Being part of the global community, the efforts that Singapore makes to keep its own house in order also contribute to the global environment. Singapore is also active in the international arena. Its proactive policy towards international environmental co-operation has enabled Singapore to fulfil its role as an environmentally responsible member of the regional and global communities.

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5.1.2 Singapore is a party to the following Multilateral Environmental Agreements (MEAs):

<b>MEA</b>	<b>Date of Accession</b>
Vienna Convention for the Protection of the Ozone Layer	5 Jan 89
Montreal Protocol on the Phasing out of Ozone-depleting Substance	5 Jan 89
1990 London Amendment to Montreal Protocol	2 Mar 93
1992 Copenhagen Amendment to Montreal Protocol	22 Sep 00
1997 Montreal Amendment to Montreal Protocol	22 Sep 00
Basel Convention On The Control Of Transboundary Movements Of Hazardous Wastes And Their Disposal	2 Jan 96
United Nations Framework Convention on Climate Change (UNFCCC)	29 May 97
Convention on Biological Diversity (CBD)	8 Dec 95
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	30 Nov 86
UN Convention on Law of the Sea (UNCLOS)	17 Nov 94
International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)*	Nov 90
Convention to Combat Desertification (CCD)	26 Apr 99
ASEAN Agreement on Transboundary Haze Pollution	13 Jan 03

\*Singapore has acceded to Annex I, II, III and V, and ratified Annex VI on 10 Aug 2000. It is currently considering ratification of Annex IV.

5.1.3 On sustainable development, Singapore's participation at the 1992 UN Conference on Environment and Development (UNCED) enabled the international community to better appreciate its constraints as a small country. At the conference, Singapore also won admiration for its ability to manage its environment despite being a highly urbanised city-state. As a further commitment on global environmental issues, Singapore's Prime Minister joined the other Heads of Government from Brazil, Germany and South Africa to launch the Four Nations Global Initiative on Sustainable Development at the 19<sup>th</sup> United Nations General Assembly (UNGA) Special Session on Sustainable Development in 1997. The Global Initiative was well received by the international community.

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5.1.4 Singapore's efforts were further enhanced by its participation in the World Summit on Sustainable Development held in Johannesburg in September 2002 and its active involvement in the sub-regional, regional and international preparatory process leading to the Summit. Singapore's commitment to sustaining a quality environment as it continues to pursue social and economic progress is manifested in the Singapore Green Plan 2012, which was circulated to the international audience at the Summit.

5.1.5 Singapore works closely with its ASEAN neighbours on environmental issues of common concern:

- a) During Singapore's chairmanship of the ASEAN Senior Officials on the Environment (ASOEN) from 1996 to 1999, it guided the grouping to complete:
  - i) The ASEAN Strategic Plan of Action (SPA) on the Environment.
  - ii) ASEAN's set of common strategies and environmental programmes for the next six years towards realising the Hanoi Plan of Action (HPA). The HPA:
    - covered areas such as land/forest fires and transboundary haze, coastal and marine environment, nature conservation and biodiversity, and multilateral environmental issues, and
    - is the first of a series of medium-term action plans with measurable targets to achieve the ASEAN Vision 2020 which envisioned, among other things, a clean and green ASEAN with fully established mechanisms for sustainable development to ensure the protection of the region's environment, the sustainability of its natural resources and the high quality of life of its people.
- b) Singapore played a significant role in the formulation and conclusion of the ASEAN Agreement on Transboundary Haze Pollution and was among the first few countries to ratify this Agreement. This agreement is a major milestone in ASEAN cooperation on the environment.

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- c) ASEAN is reviewing the 1985 ASEAN Agreement on the Conservation of Nature and Natural Resources to ensure that it is in line with relevant multilateral environmental agreements such as the Convention on Biological Diversity, Convention to Combat Desertification and Convention on International Trade in Endangered Species of Wild Fauna and Flora.

5.1.6 Bilaterally, the Malaysia-Singapore Joint Committee on the Environment (MSJCE) provides a forum for senior officials of both countries to discuss environmental issues of mutual concern and to carry out joint programmes to improve the living environment of their populations. Successful MSJCE activities include:

- a) implementing a programme to jointly monitor the water quality in the Straits of Johor;
- b) introducing joint enforcement measures to control emission of vehicles entering the two countries; and
- c) conducting exercises to deal with spillage of hazardous chemicals on one of the two bridges that link the two countries.

## **5.2 Singapore's Efforts for Selected MEAs**

5.2.1 Singapore participates actively in the various fora under each MEA and also takes its obligations very seriously. This section discusses some of Singapore's efforts.

### **5.2.2 Montreal Protocol**

5.2.2.1 Singapore is a signatory to the Montreal Protocol (MP), and is classified as a "developing country" under Article 5 of the Protocol. Some members of the US public has expressed the following views regarding the MP:

- a) Singapore has not phased out production of CFCs.
- b) Singapore has exported newly produced CFCs although it is only permitted to export used or recycled CFCs.
- c) Singapore does not recover all used CFCs.

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- d) Large amounts of used CFCs from developed countries are transshipped through Singapore.

5.2.2.2 These concerns appear to be misplaced and may have arose because of a lack of understanding of the actual situation. As Singapore does not produce CFCs, concerns over production and export of newly produced CFCs should not arise. The MP only encourages but does not require all Parties to recover and recycle used CFCs. Recovery and recycling of CFCs in Singapore are voluntary and market-driven. In the early years of phasing out CFCs, there were recovery and recycling of CFCs. However, as Singapore has banned the import of CFCs and is no longer dependent on CFCs, there is little demand for used CFCs. Today, CFCs are no longer recovered and recycled in Singapore.

5.2.2.3 Transshipped used CFCs do not enter into Singapore's domestic channels of commerce. Under the MP, the onus of control lies with the importer (i.e. the final destination of the controlled substance) and exporter (i.e. the country of origin). The exporter has to ensure that the importer is a Party to the MP and has not indicated to the MP Secretariat that it does not want to receive used CFCs. Importers must ensure that their domestic policies meet their MP obligations.

5.2.2.4 As a party to the MP, Singapore is committed to and has implemented domestic policies and strategies to comply with its obligations. Singapore has already banned the import of CFCs for local consumption since 1996. Singapore phased out the consumption of halons and CFCs well ahead of the schedule set for developing countries. In recognition of Singapore's success in implementing the Montreal Protocol, the United Nations Environment Program (UNEP) presented Singapore with an Outstanding National Ozone Unit Award in September 1997. Legislation are also in place to ensure that trading in ODS takes place only with parties to the MP and in accordance to the rules stipulated by the MP.

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5.2.2.5 Measures taken by Singapore are summarized in the table below.

<b>Date</b>	<b>Measures</b>
5 Oct 1989	Quota Allocation System implemented for Chlorofluorocarbons (CFCs).
5 Feb 1991	Prohibit the import and manufacture of non-pharmaceutical aerosol products and polystyrene sheets/products containing controlled CFCs.
1 Jan 1992	(a) Prohibit the use of Halon 1301 for new fire-protection systems. (b) Prohibit the import of Halon 2402.
1 Jan 1994	Prohibit the import of Halon 1211 and Halon 1301.
1 Jan 1993	Prohibit the import of new air-conditioning and refrigeration equipment using CFC 11 and CFC 12.
15 Apr 1994	Prohibit the import of fire-extinguishers filled with Halon 1211.
1 Jan 1995	All new cars must be equipped with non-CFC air-conditioning systems.
1 Apr 1995	Prohibit the import of HBFCs.
1 Jan 1996	Prohibit the import of CFCs, carbon tetrachloride and 1,1,1-trichloroethane (methyl chloroform).

### 5.2.3 CITES

5.2.3.1 Singapore is a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The Agri-Food and Veterinary Authority (AVA) administers and enforces the Endangered Species (Import and Export) Act, which was enacted to give effect to CITES. AVA regulates the import and export of wildlife protected under CITES through the issuance of CITES permits or certificates and approval of trade declarations. Both live wildlife specimens and their derivative (e.g. skin, ivory, bone, meat, etc) are subject to CITES controls.

5.2.3.2 Singapore's Endangered Species (Import and Export) Act (ESA) and its Schedules are constantly reviewed and updated to ensure that they meet CITES requirements. In a CITES national legislation project, this legislation was in fact assessed by the CITES Secretariat to meet all

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the requirements of CITES and has been accorded a 'category one' status. The legislation is now undergoing a review to ensure that its various enforcement powers and penalties remain effective in addressing the operational matters of CITES implementation in Singapore.

5.2.3.3 AVA enforces CITES through regular inspection of wildlife consignments at Customs checkpoints, premises, local farms, as well as checks on shops retailing animals, birds and fish. AVA works closely with Customs and Police in the enforcement of the Convention.

5.2.3.4 AVA as Singapore's CITES Management Authority also regulates the import and transshipment of animal and animal products viz. the Animals and Birds Act. Whenever the AVA receives reliable intelligence on smuggled endangered species, including such transshipments through Singapore, the AVA will undertake the necessary investigations. For example in June 2002, the AVA successfully intercepted a shipment of 6 tonnes of ivory that was being transhipped through Singapore. Another example was the seizure of more than 900 live snakes that were also passing through Singapore in September 2002.

5.2.3.5 In addition, AVA administers the Wild Animals and Birds Act which prohibits the capture and export of native fauna in Singapore. This Act also stipulates the requirement for a licence to keep wild animals. Licenses will not be issued for some wild animals such as wild cats, monkeys, birds of prey, crocodiles, snakes, iguanas, endangered tortoises, and frogs.

5.2.3.6 The USSFTA will further strengthen the customs cooperation between both countries to prevent, deter and enforce against the smuggling of endangered species. The USSFTA will establish a mechanism to allow for information exchange, improved risk profiling and targeted enforcement action by both sides.

## 5.2.4 Basel Convention

5.2.4.1 Singapore acceded to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, on 2 January 1996. The Basel Convention spells out that any export, import or transit (or transshipment) of hazardous wastes in a country requires that country's environmental authority's approval prior to the movement of the hazardous wastes to that country.

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5.2.4.2 The Hazardous Waste (Control of Export, Import and Transit) Act and its Regulations were enacted and came into operation on 16 March 1998. Any transit of hazardous wastes, including lead-acid batteries, whether through a "through Transshipment" (i.e. without a Singapore consignee) or otherwise, requires Singapore's consent. The Act and its Regulations enable Singapore to fulfil her obligations under the Basel Convention. Under the Act and its Regulations, any person who wishes to export, import or transit any hazardous waste listed under the Basel Convention will have to apply for a permit from NEA.

### 5.3 Capacity Building Efforts

5.3.1 Singapore is committed to doing more with members of the global community through joint capacity building programmes. Since 1992, Singapore has, through the Singapore Cooperation Programme (SCP), sponsored training courses and study visits for over 15,000 officials from over 138 developing countries. Agencies and institutions involved in providing SCP environmental training programmes include the Singapore Environment Institute, the Public Utilities Board, the Asia-Pacific Centre for Environmental Law and the National Parks Board. The SCP technical cooperation programmes below have since reached out to hundreds of people from many countries:

a) Singapore Technical Assistance Programme for Sustainable Development (STAPSD) \_

Launched in 1997, the programme covers topics such as environmental management, urban management, water and wastewater engineering, environmental technology and urban transport planning and design. To-date, more than 1,100 officials from 81 developing countries have benefited from the programme.

b) Third Country Training Programme

Singapore collaborates with a developed country, or a regional country or an international organisation to conduct regional training programmes on urban environmental management. Since 1997, 10 training programmes have been conducted in partnership with Japan, Norway, Australia, the World Bank and the Asian Development Bank. Some 200 environmental officials from over 20 Asia-Pacific countries have benefited from these programmes.

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c) Small Island Developing States Technical Cooperation Programme (SIDSTEC)

Launched in 1999, the SIDSTEC is designed to provide training opportunities to 300 government officials from the Small Island Developing States over five years.

5.3.2 Singapore is also proactive in facilitating the transfer of technology and environmental management expertise into the region by staging environmental events through bilateral co-operation with various countries such as Germany and Australia. A good example is the Germany-Singapore Environmental Technology Agency (GSETA), which was established in November 1991. Since then, some 500 participants from the Asia-Pacific region have benefited from twelve regional activities organised by GSETA that covered subjects ranging from waste minimisation, wastewater management, solid waste treatment and disposal to ISO 14000. The latest in the series is the Asia-Pacific Regional Workshop-cum-Exhibition on 'Sustainability in Solid Waste Management' held in October 2002.

5.3.3 Singapore also has a good working relationship with the US on environmental matters. Through the US-Asia Environmental Partnership (US-AEP) programme, Singapore has benefited much from the expertise and experiences of US experts in issues such as management of hazardous chemicals and ambient air quality monitoring. A recent example of our collaboration with the US-AEP was a regional workshop held in Singapore in April 1999 to raise regional awareness on particulate matter and facilitate the exchange of expert knowledge and experiences in the monitoring of PM<sub>2.5</sub>.

5.3.4 Singapore will continue to work closely with countries in the ASEAN region, as well as fellow developing countries farther away. Singapore is also actively seeking to further its role in various partnership initiatives in areas where Singapore is in a position to share and contribute its experience and expertise. Singapore looks forward to working with fellow small island developing states on its Pacific initiative relating to water and sanitation; partnering with the Government of Indonesia and others on good governance in sustainable development; and strengthening the capacity within ASEAN to manage transboundary haze pollution.

## 6 SGP 2012 – A PRO-FUTURE APPROACH

6.1 Singapore is committed to its on-going effort to harmonise economic growth and social progress with environmental protection. The Singapore Green Plan 2012 or SGP 2012, launched in August 2002, is a roadmap to help Singapore achieve environmental sustainability over the next decade. It is available at <http://www.env.gov.sg/sgp2012>.

6.2 SGP 2012 is jointly developed by the 3P partners (Public, Private, People sectors). It reflects the collective commitment of the Singapore Government, businesses and the people to build an enduring Singapore for generations to come. The strategic focus of SGP 2012 is to go beyond environmental performance to achieve environmental sustainability.

6.3 SGP 2012 has three key thrusts. The first is to ensure the innovative and efficient use of scarce resources. Singapore will strive to achieve the following targets for land, water and air in 2012:

- a) Increase recycling rate to 60%; increase the life span of the Pulau Semakau Landfill to 50 years; work towards the day when waste need not be landfilled; and reduce the need for new incineration plants to one in ten to 15 years.
- b) Diversify and increase water supply by increasing catchment areas to two thirds of the land surface area and increase supply from non-conventional water sources, namely desalination and water reclamation, to meet 25% of its water demand.
- c) Strive for good air quality, with PSI in the good range for 85% of the time and in the moderate range for the other 15% of the time through greater use of cleaner energy, higher energy efficiency and adopting best practices in pollution control.

6.4 SGP 2012's "second thrust" is to promote the active participation of all sectors of the population to sustain quality living environment. To strengthen joint ownership of the environment among the 3P sectors, ENV will promote 3P participation in all the major environmental initiatives and step up efforts to increase public awareness, public education.

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6.5 The "third thrust" is for Singapore to do its part for the global environment. Singapore is mindful of the environmental challenges facing the world as a whole and will play a pro-active role in the regional efforts to stamp out transboundary pollution threats and support capacity-building efforts in the international community.

## **7 CONCLUSION**

7.1 An internal study indicates that the USSFTA is expected to raise Singapore's real GDP and trade. Assuming free capital mobility across countries, Singapore's real GDP and exports to the US will increase by 0.95% and 1.5% respectively. Manufacturing value-added will be raised by 0.82% as a result of the USSFTA. Electronics and chemicals sectors will each contribute respective increases of 1.0% and 1.1%.

7.2 The assessment is that the comprehensive environmental system in place and the proactive approach adopted under SGP 2012 are sufficiently robust to meet the expected increase in economic activity generated by the USSFTA.

7.3 Additionally, the USSFTA provides the opportunity to enhance Singapore and US co-operation on environmental matters. Under the FTA, Singapore and the US will work on a Memorandum of Intent (MOI) to advance further technical cooperation on environmental management at the bilateral as well as regional level.

7.4 Public agencies support the conclusion of the US-Singapore Free Trade Agreement and look forward to the enhanced partnership with their respective counterparts in the US.

**This report has been jointly prepared by:**

**MTI, MFA, MND, ENV, AVA, NParks, URA, PUB and NEA**