



# THE SINGAPORE GREEN PLAN 2012

2006 Edition

**A CLEAN ENVIRONMENT. WATER FOR ALL.  
TOGETHER, A SUSTAINABLE SINGAPORE.**



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We do not inherit the  
earth from our ancestors...  
we borrow it from our children.

Ancient Proverb

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# MINISTER'S MESSAGE

I am heartened to see so many people giving their views and time generously to the environmental cause and their participation will help the government to come up with more effective policies and programmes.

## **OUR CHANGING ENVIRONMENT**

The recent media stories on environmental disasters such as hurricanes and floods are stark reminders of the transboundary and constantly changing nature of environmental issues. Although no disasters of similar magnitude and physical impact have happened in Singapore, we must not be complacent. It is still very important for us to continue caring for our environmental and water resources and at the same time, be prepared to tackle any challenge that may arise.

## **PROGRESS SINCE 2002**

The Singapore Green Plan 2012 (SGP 2012) is our blueprint towards environmental sustainability. Three years since its launch at the 2002 World Summit on Sustainable Development in Johannesburg, South Africa, we have made good progress towards meeting the targets and in some cases, even exceeding them. The following are some examples:

- Air quality in Singapore has been surpassing the 85% "good" range under the Pollutant Standards Index;
- All our Four National Taps have been turned on and a robust water supply system is now in place;
- Our recycling rates have improved from 45% in 2002 to 49% in 2005, and many recycling programmes are in place to reach out to the public;
- The number of upgraded hawker centres have increased from 10 in 2002 to 47 in 2005, enabling patrons to dine in a more pleasant environment;
- Rehabilitation activities have been carried out in our various nature reserves to help conserve our biodiversity;
- Several high-profile international environmental and water conferences had been held here, further boosting Singapore's reputation as a focal point of environmental and water services.



## THREE-YEARLY REVIEW

In 2005, we carried out the first three-yearly review of the SGP 2012. During the review, many views were heard through the various feedback channels and many hours of enlightened debate also took place during focus group discussions on environmental issues and their possible solutions. There were also an online survey and a public forum where individuals contributed their ideas.

I am heartened to see so many people giving their views and time generously to the environmental cause and their participation will help the government to come up with more effective policies and programmes.

The review has also enabled us to bring potentially serious environmental issues such as Particulate Matter 2.5 and Climate Change to the forefront of national attention. Greater awareness of these issues has facilitated public debate and brought about fresh ideas and solutions. With these ideas and views incorporated into the revised SGP 2012, the sense of ownership of the issues will no doubt be greater.

I am glad to present the revised SGP 2012 which is built upon the contributions of over 17,000 people involved in the review. Their involvement has helped make the SGP 2012 more robust.

The successful implementation of the SGP 2012 programmes requires the continued participation of our People, Private and Public (3P) partners as well as individuals. Only by working together at every level can we face the environmental challenges of tomorrow with confidence.

Dr Yaacob Ibrahim  
**Minister for the Environment and  
Water Resources**







# PRELUDE

New targets and action programmes have been added to give the revised SGP 2012 greater robustness.

This document serves as an updated edition of the Singapore Green Plan 2012, which was released in 2002. It encapsulates the accepted recommendations of the three Focus Groups that were formed in 2005 to undertake a three-yearly review of the SGP 2012. Views from various sources including the online survey, email feedback and opinions garnered at the public exhibition were also considered in the review and preparation of this document.

New targets and action programmes have been added to give the revised SGP 2012 greater robustness. In this revised version, some targets and programmes from the original SGP 2012 have been removed upon their completion while others have been revised to expand their frame of reference. Innovation and Community Participation have been incorporated into the scope of the existing six Action Programme Committees as they form an essential component of many programmes under the revised SGP 2012.

More information on the updated SGP 2012 is available on the website of the Ministry of the Environment and Water Resources (MEWR), Singapore at [www.mewr.gov.sg/sgp2012](http://www.mewr.gov.sg/sgp2012). Readers who want to find out more about the specific programmes and initiatives mentioned can visit the websites of the following statutory boards that oversee them:

National Environment Agency (NEA): [www.nea.gov.sg](http://www.nea.gov.sg)

Public Utilities Board (PUB): [www.pub.gov.sg](http://www.pub.gov.sg)

National Parks Board (NParks): [www.nparks.gov.sg](http://www.nparks.gov.sg)

# EXECUTIVE SUMMARY

The summary has six sections and gives a snapshot of the progress in the six focus areas as well as some of the action programmes.

## AIR AND CLIMATE CHANGE

Despite the occasional smoggy skies from the regional haze, Singapore has on the whole enjoyed good air quality. This happy state of affairs does not happen by accident. It is the result of farsighted vision, meticulous planning and an uncompromising approach in the pursuit of clean air. The result is an overall ambient air quality that is well within the standards of the World Health Organisation (WHO) and the United States Environmental Protection Agency (USEPA).

Prevention, monitoring, enforcement and education encapsulate Singapore's strategy in the management of air pollution. But while this strategy has served us well so far, we are now faced with three major challenges which must be overcome before we can continue enjoying the clean air to which we have grown accustomed. These are:

- Particulate Matter 2.5 (or very fine particulate matter 2.5 microns or smaller) which studies have shown to be linked to numerous cases of respiratory and cardiovascular problems;
- Our vulnerability to transboundary air pollution;
- Global climate change caused by greenhouse gas emissions.

Singapore has been working with its neighbours to tackle transboundary air pollution and will continue to do so. However, the main strategies to address Particulate Matter 2.5 lie in using cleaner fuels and setting more stringent emission standards. As for global climate change, the key lies in using energy more efficiently. This is reflected in the two new targets set in the revised SGP 2012:

- To reduce the ambient PM 2.5 level to within an annual average of  $15\mu\text{g}/\text{Nm}^3$  by 2014
- To improve carbon intensity (i.e.  $\text{CO}_2$  emission per GDP Dollar) by 25% from 1990 level by 2012





Measures are afoot to help achieve these targets. Euro IV emission standards for new diesel vehicles will be introduced in October 2006, to reduce the levels of air pollutants. In addition, we will continue to work together with our industries and review the emission standards of mobile and stationary sources regularly so as to keep up with emerging pollutants.

The national climate change strategy maps out new and existing programmes to promote energy efficiency and to reduce carbon dioxide emissions in the various sectors. It will also help to convince companies that energy-efficient programmes can be win-win solutions that make economic sense and at the same time lower energy consumption and the resulting emissions.

At the same time, we will continue to develop technological advancements in renewable energy through various initiatives such as the Innovation for Environmental Sustainability (IES) fund.

## Summary of Clean Air & Climate Change Targets and Key Thrusts

### Targets

- To maintain the Pollutant Standards Index for ambient air within the 'good' range for 85% of the year, and within the 'moderate' range for remaining 15%.
- To reduce the ambient PM 2.5 level to within an annual average of 15 $\mu\text{g}/\text{Nm}^3$  by 2014.
- To improve carbon intensity (i.e. CO<sub>2</sub> emission per GDP Dollar) by 25% from 1990 level by 2012.

### Key Thrusts and Focus

#### Ambient Air

##### Manage emission from stationary sources

- Review regulatory measures for stationary sources
- Encourage co-regulation of emission from stationary sources by industry

##### Manage emission from mobile sources

- Review regulatory measures for mobile sources
- Encourage co-regulation of emission from mobile sources by industry and consumers

#### Climate Change

##### Promote energy efficiency

- Develop enablers to make consumers more energy efficient/fuel efficient
- Improve energy management practices of businesses

##### Promote use of clean energy

- Promote use of cleaner energy (such as natural gas)

##### Demonstration projects on renewable energy

- Encourage demonstration projects on renewable energy (such as solar and biomass)

## WATER FOR ALL: CONSERVE, VALUE, ENJOY

Singapore currently consumes 1.4 million cubic metres of water a day – a not insignificant volume for a nation of just over 4 million people. As the population grows, the challenge will be to ensure the sustainability of clean water supply. Diversification of our water supply sources, conservation of water and getting the community to value our water resources have been pursued as the means to achieving sustainability.

Singapore has done very well in diversifying its water sources. With its Four National Taps strategy in full flow, it will have enough water to meet its future needs.

The first tap is the supply of water from local catchments. This consists of an integrated system of reservoirs and an extensive drainage system to channel storm water into the reservoirs. The second tap – imported water from Johor – supplements Singapore's needs. So does the third tap – NEWater which is supplied from three plants with a current combined capacity of 21 million gallons per day. The fourth tap – Desalinated Water – has been made affordable by recent technological advances, and the first desalination plant started operations in September 2005.

Securing an adequate supply of water through the Four National Taps strategy is only half the equation. Managing the demand side of water is the other. Thus getting people to cut water consumption through water conservation is vital. Thanks to community outreach initiatives such as the Water Efficient Homes (WEH) programme with its do-it-yourself water saving kits, the domestic per capita consumption has fallen from 165 litres a day in 1999 to 160 litres a day in 2005.



As the population grows, the challenge will be to ensure the sustainability of clean water supply.

### **Water Efficient Homes (WEH) programme**

By December 2005, 68 of the 84 constituencies have launched the **Water Efficient Homes (WEH) programme** where do-it-yourself (DIY) water saving kits consisting of thimbles (to reduce water flow from taps), cistern water saving bags, leaflets on installation procedures and water conservation tips were supplied to the grassroots organisations for distribution to the residents, free-of-charge. Over 750,000 water saving kits have been distributed so far. One in three households has installed the water saving devices which can save up to 5% of their monthly water expenses.



The key to sustaining our water resources lies in getting the community to establish a bond with water. Hence, PUB's "Conserve, Value and Enjoy" message to both community and businesses. By turning reservoirs and waterways into clean and vibrant lifestyle attractions where the public can participate in recreational activities, the community will be drawn to the water and in the process, learn to treasure and care for it.

After reviewing SGP 2012 in 2005, two new targets have been set to ensure clean and sufficient water for Singaporeans:

- (i) Reduce per capita domestic water consumption to 155 litres/day by 2012;

This means setting up a measurable output indicator to quantify the success of water conservation efforts in the domestic sector. Singapore's domestic per capita water consumption compares well with other countries. But it can still be reduced. Various action programmes under revised SGP 2012 will continue to convey the water conservation messages to members of the public

- (ii) Partner the 3P sectors to generate greater awareness of the importance of conserving, valuing and enjoying water and to develop a sense of shared ownership of our water resources.

This reflects the importance of engaging the 3P sectors in managing water demand and keeping water sources clean. More activities at our reservoirs and waterways will also be organized to encourage 3P ownership of our water resources.

## Summary of Water Targets and Key Thrusts

### Targets

- Increase catchment areas from 50% to 67% of Singapore's land surface.
- Increase supply of water from non-conventional sources, such as desalination and water reclamation, to at least 25% of Singapore's water demand.
- Ensure that water quality continues to meet international standards.
- Reduce per capita domestic water consumption to 155 litres/day by 2012.
- Partner the 3P sectors to generate greater awareness of the importance of conserving, valuing and enjoying water and develop a sense of shared ownership of our water resources.

### Key Thrusts and Focus

#### Water for all

- Diversify our water supply through the four National Taps
- Promote greater R&D efforts in water and used water technologies and other areas
- Ensure potable water quality continues to meet international standards

#### Conserve

- Promote the use of water-efficient household fittings and appliances
- Continue to work with the various non-domestic sectors to reduce water consumption

#### Value

- Encourage the community to change their water usage behaviour and habits, and to educate them on the implications of living in water catchment areas
- Inculcate amongst young Singaporeans the mindset of valuing our water resources

#### Enjoy

- Encourage the users of our water resources to take ownership of and enjoy our water resources



## REDUCE, REUSE, RECYCLE

It's hard to imagine Singapore as a land of incineration plants and landfills. Yet not so long ago, we seemed to be headed that way. The amount of waste being disposed had jumped an alarming six-fold over 30 years. At that rate, a new incineration plant would have to be built every 5 to 7 years and a landfill every 25 to 30 years – a frightening prospect for a small, land-scarce island.

But that fate has been averted, thanks to four strategies devised to tackle its solid waste problem:

- reducing the volume of waste through incineration;
- reducing the volume of waste sent to incineration plants through recycling;
- cutting down the volume of waste sent to landfills;
- cutting down the volume of waste generated through waste minimisation.

The results have been encouraging so far. Between 2000 and 2005, Singapore's overall recycling rate rose from 40% to 49%.

Waste growth has also been successfully controlled. With this, the projected lifespan of Semakau Landfill has risen from 25-30 years to 35-40 years, while the need for additional incineration plants has been reduced from one in every 5-7 years to one in every 7-10 years.



Despite these impressive strides, greater effort is needed if we are to achieve sustainable waste management. Come 2012 we target to:

- increase the overall waste recycling rate from 44% to 60%
- extend the lifespan of Semakau Landfill to 50 years, strive for "zero landfill" and close the waste loop.
- reduce the need for new incineration plants to one every 10 to 15 years.

Improving our recycling system and infrastructure will continue to be one of our main thrusts in reducing the amount of waste sent to our landfill. More efforts will also be made to move towards closing the waste loop by improving various initiatives to reduce packaging waste.

## Summary of Waste Management Targets and Key Thrusts

### Targets

- Increase the overall waste recycling rate from 44% to 60% by 2012.
- Extend the lifespan of Semakau Landfill to 50 years, strive “towards zero landfill” and “close the waste loop”.
- Reduce the need for new incineration plants to one every 10-15 years.

### Key Thrusts and Focus

#### Reduce waste at source

- Work with industry to reduce waste
- Reduce excessive usage of plastic bags in the retail sector

#### Get more to participate in recycling

- More recycling programmes
- More publicity for recycling
- Recognition for recycling efforts

#### Build more infrastructural support for recycling

- More recycling bins in public areas
- Greater convenience in depositing recyclables
- Help to set up more recycling facilities

#### Enhance waste industry capability

- Promote innovative technologies to recycle and reduce waste

#### Develop a market for recycled products

- Improve the quality of recycled products
- Promote the use of recycled products



## CONSERVING NATURE

Despite the republic's urbanised setting, nature continues to enjoy a luxuriant niche in Singapore. There are tracts of primary and secondary rainforests in the Bukit Timah and Central Catchment Nature Reserves, while mangroves and mudflats abound in Sungei Buloh Wetland Reserve. Other areas of rich biodiversity such as the Kranji Mangroves and Bukit Batok Nature Area also have diverse habitats for plants and animals.

With the twin demands of economic development and "back-to-nature" recreational activities putting enormous pressure on our natural heritage, the future holds formidable challenges. One of these is the dilemma of competing land use. The Nature Reserves are Singapore's natural heritage and must be protected. Yet the public feels they should not be denied access to them. To meet these competing needs, the National Parks Board (NParks) is guided by the Nature Recreational Masterplan which seeks to accommodate the public's demand while protecting the native flora and fauna. Under the Masterplan, core areas which are richest in biodiversity have been marked out for conservation and research only. Recreational activities take place at the fringe of these areas in order to minimise damage to them.

### Reforestation and Reach Out Programme

All 48 students knew exactly what they had to do – learn all about wetland habitats; produce educational materials; and get their peers to participate in a reforestation exercise near the Outdoor Classroom at Sungei Buloh Wetland Reserve.

That was in August 2004, and over the next 8 months, these participants of the Reforestation & Reach Out programme learnt everything about plants in wetland habitats. They also successfully persuaded 150 of their peers to join in the reforestation effort where they transformed the 0.75 ha plot into distinct habitats with diverse native plants.

Along the way, they came up with creative ways to share nature with others – by developing card games, word puzzles, riddles and a boardgame to make learning fun.

To view the works of the students, visit [www.sbwr.org.sg](http://www.sbwr.org.sg). For information on the Outdoor Classroom and upcoming programmes, call 67941401.



Pivotal to the nature conservation efforts is the amicable partnership between government agencies, non-government organisations, tertiary institutions, private organisations and individuals. An example is the coral reef survey in the southern islands by NParks with the help of the Blue Water Volunteers group. The schools are also important partners in the reforestation of Sungei Buloh Wetland Reserve, Pulau Ubin and Central Nature Reserves.

While new facilities such as the HSBC TreeTop Walk provide access to natural areas with minimal impact on the flora and fauna, a comprehensive network joining major parks is also being developed. These park connectors ensure that parks and open spaces are within easy reach of the community.

More efforts will also be made to raise public awareness of nature areas by exploring additional communication channels to provide useful information to visitors of these areas.

## Summary of Conserving Nature Targets and Key Thrusts

### Targets

- **Keep nature areas for as long as possible.**
- **Verify and update information on indigenous flora and fauna through biodiversity surveys.**
- **Establish more parks and green linkages.**
- **Set up a National Biodiversity Reference Centre.**

### Key Thrusts and Focus

#### Conserve nature areas

- Conserve our biodiversity
- Monitor and update our biodiversity information

#### Make parks and nature accessible

- Put in place new parks and park connectors

#### Know our biodiversity

- Promote nature awareness

#### Create a biodiversity hub

- Set up a National Biodiversity Reference Centre (NBRC)
- Collaborate with research institutions



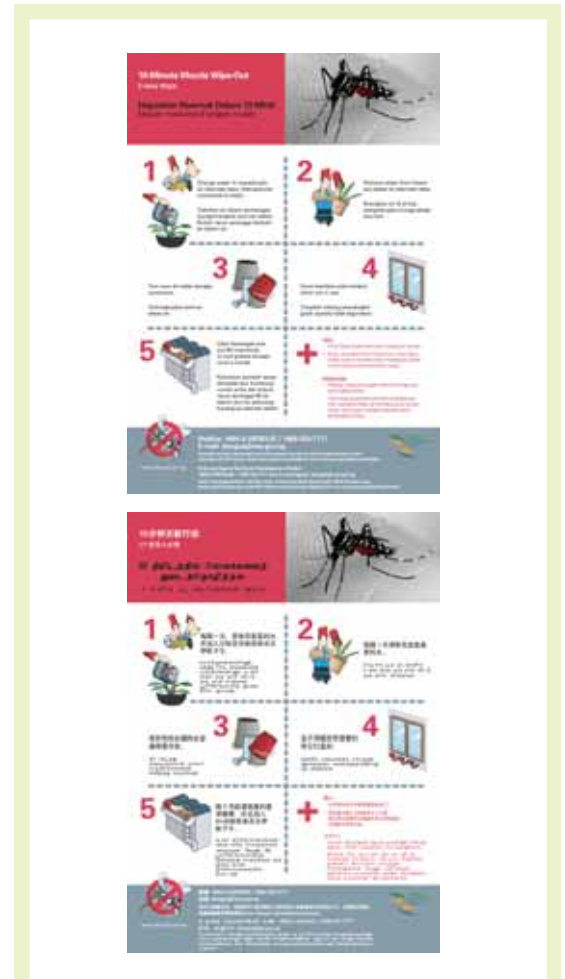
## IMPROVING PUBLIC HEALTH

Like every nation, Singapore can well do without infectious diseases, unsafe food and poor hygiene. Thanks to its innovative programmes and tireless efforts, it has successfully kept these scourges at bay. In the process, it has achieved a proud public health record which it has every intention of maintaining – even if it means never-ending vigilance against vector or food-borne diseases and their deleterious effects.

Much progress has been made since the inception of SGP 2012 three years ago. We have been aggressively denying the Aedes mosquito a breeding place by increasing the number of inspections on premises. We have also been quick to respond to a rise in the number of dengue fever cases in 2005, by getting the community behind us through an educational blitz that teaches the basics in fighting mosquito breeding. We also went after rodents with a vengeance. The successful 'Rat Attack' pilot project in 2004 became the model for sustainable rodent control which we are currently developing.

We also scored big in environmental cleanliness and sanitation. Singaporeans no longer fight shy of coffeeshop toilets because nearly 80% of them had been upgraded by the end of the Toilet Upgrading Programme in 2004.

Looking forward, we can – and must – do more, as the targets of the revised SGP 2012 suggest. Our dengue prevention outreach programmes will continue to focus on households, workers and employers as well as schools. We will also continue to work with our partners to encourage high standards of public hygiene and environmental cleanliness (such as promoting the Happy Toilets Programme). Active research efforts to enhance vector control methods and understanding of vector behaviour will continue.



### Summary of Public Health Targets and Key Thrusts

#### Targets

- Increase community ownership to sustain a high standard of public health.
- Become a leading regional centre in epidemiological surveillance and research on vector-borne diseases.
- Maintain low incidence of vector-borne and food-borne diseases.

#### Key Thrusts and Focus

##### Ownership through improved hygiene habits and practices

- Improve cleanliness and hygiene of public places

##### Control of vectors and prevention of vector-borne diseases

- Improve vector control methods and understand vector behaviour through R&D
- Partner the community to lower occurrences of vector-borne diseases through public education and raising public awareness

##### Monitor and improve Indoor Air Quality (IAQ) in public places

- Upgrade and enhance recommended best practices, and train IAQ personnel and facility managers to improve building management skills
- Survey and conduct research to create a healthy indoor environment

'10-Minute Mozzie Wipeout' pamphlets were distributed to households to educate them on basic measures to take against mosquito breeding



## INTERNATIONAL COOPERATION

While Singapore has achieved an excellent track record in environmental performance, it is keenly aware that many of today's emerging environmental challenges are transboundary in nature and can only be resolved through international cooperation. It is therefore committed to joint efforts at addressing such issues and seeks to enhance the good relations with its partners at bilateral, regional and international levels.

At the international level, Singapore is party to a number of multilateral environmental agreements. For example, on 24 May 2005, it ratified the Stockholm Convention on Persistent Organic Pollutants and acceded to the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. Regionally, issues such as transboundary haze are tackled by collaboration with its neighbours through the ASEAN framework. An example is the hosting of the ASEAN Specialised Meteorological Centre which uses advanced tools and technology to provide weather information and forecast to serve as an early warning system for imminent land or forest fires in the region. Bilaterally, Singapore works with other countries to address common environmental problems through regular dialogue sessions and meetings.

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As a global city, Singapore is also positioning itself as an environmental hub for the exchange of environmental and water technology.

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Indeed, Singapore sees information-sharing and capacity building as a contribution to the environmental cause. Through initiatives such as the Singapore Cooperation Programme, the Third Country Training Programme and the Small Island Developing States Technical Cooperation Programme, it shares its experience and best practices with other developing countries.

As a global city, Singapore is also positioning itself as an environmental hub for the exchange of environmental and water technology. This helps in the development of our local industry by providing opportunities for companies to network and exchange ideas.

Singapore strives to be a venue of choice for staging international environmental events and is also keen to promote research and development in environmental technologies. Through funding assistance and the use of public infrastructure for test-bedding, it hopes to get leading companies and researchers in the environmental and water fields to come here.

Singapore also wishes to promote greater awareness about international environmental issues among the young. It aims to host conferences for youths to discuss environmental sustainability issues, which could be ideal platforms for its youths to network with their counterparts and experts from other countries.



### Lending a Hand

The devastating tsunami disaster of 26 December 2004 galvanised Singaporeans into action and they contributed generously to the victims. Among the contributions was drinking water which was packaged and sent to the tsunami-hit areas. As part of Singapore's reconstruction and aid package, it helped Maldives to build a seawater desalination plant which was handed over to the Maldivian authorities in February 2005.

## Summary of International Environmental Relations Targets and Key Thrusts

### Targets

- Continue to work closely with ASEAN neighbours on common environmental concerns.
- Enhance capacity-building partnerships with other developing countries.
- Intensify collaboration with partners at regional and global levels to tackle environmental challenges.
- Remain committed to international environmental efforts and obligations under international environmental treaties.

### Key Thrusts and Focus

#### Relations enhancement

- Participate in international environmental agreements, and their activities and programmes
- Seek opportunities for greater collaboration with our international partners

#### Capacity building

- Share Singapore's environmental experience to contribute towards global sustainable development.

#### Industry partnership

- Profile Singapore as an attractive venue for water and environmental events

#### Community partnership

- Promote awareness of environmental issues among the youths





# CLEAN AIR ALWAYS

Despite the occasional smoggy skies from the regional haze, Singapore has on the whole enjoyed good air quality. This happy state of affairs is not pre-ordained. It is the result of farsighted vision, meticulous planning and an unwavering adherence to the principle that the health of its citizens is non-negotiable. Thus, from the early days of her industrialisation and urbanisation, the republic has consciously adopted a no-compromise attitude in the pursuit of clean air. The result: an overall ambient air quality that is well within the standards of the World Health Organisation (WHO) and the United States Environmental Protection Agency (USEPA).

Prevention, monitoring, enforcement and education encapsulate Singapore's strategy in the management of air pollution.

- Prevention – All new industrial proposals are referred to the National Environment Agency (NEA) for evaluation at the planning stage to ensure that sufficient pollution control measures are in place from the start.
- Monitoring – Besides monitoring individual polluters, NEA also checks the ambient air quality for signs of pollution so that quick action may be taken to prevent any problem from escalating.
- Enforcement – Moving in step with the force of persuasion are a slew of enforcement actions such as inspections on industrial and trade premises to ensure that environmental regulations are complied with.
- Education – Greater awareness and a sense of ownership of the environment by the public will lead to less pollution and reduce the need for enforcement.

Like any highly urbanised city, emission from motor vehicles in Singapore is a significant source of air pollution. Vehicular emission contributes to ambient concentrations of pollutants such as carbon monoxide, oxides of nitrogen and sulphur, and particulates. In particular, Particulate Matter 2.5 (PM 2.5), which is fine particulate matter 2.5 microns or less in size, is linked to numerous cases of chronic and acute bronchitis, aggravated asthma, and hospital admissions for respiratory and cardiovascular diseases in the US every year. Therefore we have implemented a multi-pronged programme to control emission from motor vehicles. Some measures adopted are as follows:

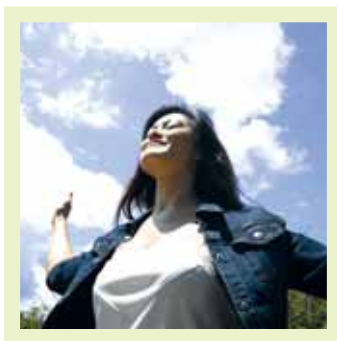
- Set stringent emission standards for the registration of new vehicles;
- Set stringent standards on fuel used, such as diesel with low sulphur content of 0.005% or less by weight, commonly known as Ultra Low Sulphur Diesel (ULSD);
- Require all in-use vehicles to undergo mandatory periodic inspection and pass the smoke emission test;
- Carry out stringent enforcement actions against smoky vehicles on the roads;
- Educate vehicle owners on proper vehicle maintenance to prevent smoke emission.

With the measures in place, we have ensured that our ambient air quality remains safe for our people and in line with the long-term goals of the World Health Organisation (WHO) and the primary air standards of the United States Environmental Protection Agency (USEPA).

Looking ahead, we must overcome three major challenges if we are to continue enjoying the clean air to which we have grown accustomed. The three are:

- **Particulate matter 2.5**

The United States Environmental Protection Agency (USEPA) set the PM 2.5 yardstick to  $15\mu\text{g}/\text{Nm}^3$  and like many other major cities, Singapore ( $21\mu\text{g}/\text{Nm}^3$ ) has not met the USEPA standard for PM 2.5.



- **Vulnerability to transboundary air pollution**

Most Singaporeans still remember the effects of transboundary haze on our air quality in 1994 and 1997. In 1993, ASEAN members set up the ASEAN Specialised Meteorological Centre (ASMC) in Singapore. One of the key roles of the ASMC is to provide relevant weather information and forecast to ASEAN members so as to serve as an early warning to smoke haze over the ASEAN region. In addition, the ASEAN Agreement on Transboundary Haze Pollution is the first such regional arrangement in the world that binds a group of contiguous states to tackle transboundary haze pollution resulting from land and forest fires.

- **Global climate change**

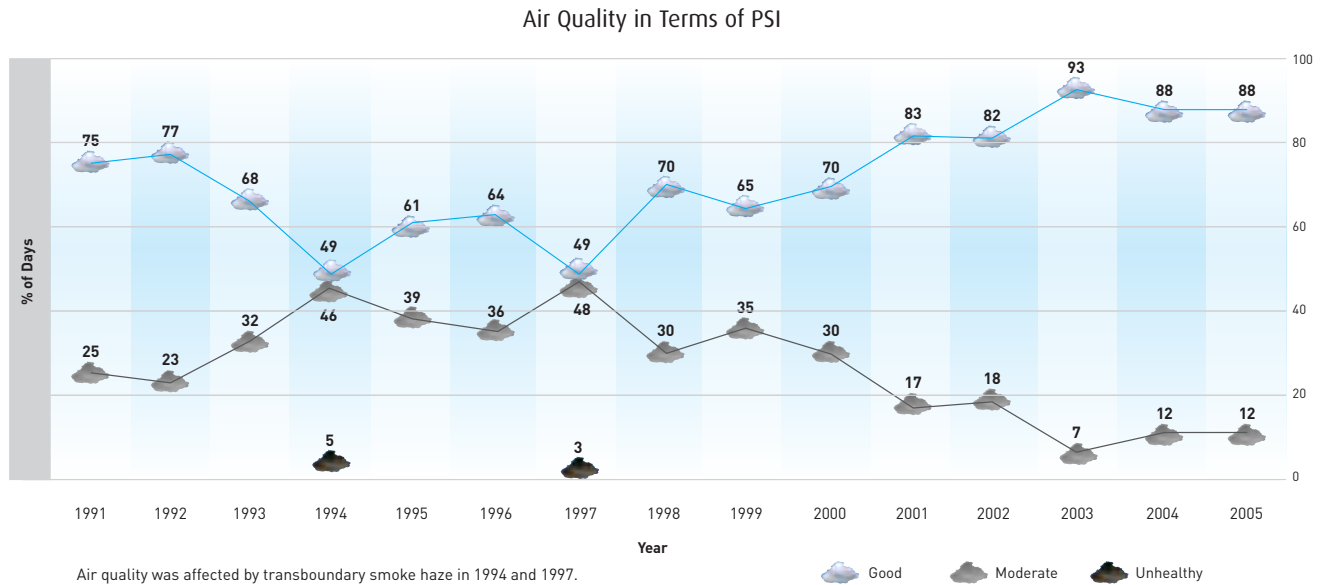
The truth is out. There is now scientific evidence that greenhouse gas emissions, mainly carbon dioxide resulting from human activities, have contributed to climate change. Although Singapore contributes less than 1% of global greenhouse gas emissions, we want to be part of the global effort at ensuring environmental sustainability. Given our export-oriented economy and our limited capacity at exploiting renewable energy, there is a limit on what we can do on absolute carbon dioxide emissions. But we can improve on our carbon intensity<sup>1</sup>. So far, our energy efficiency and clean energy efforts have improved our carbon intensity by 22% between 1990 and 2004. We are committed to further improve this to 25% better than the 1990 level by the year 2012.

<sup>1</sup>Carbon intensity refers to the amount of carbon dioxide emissions per GDP dollar.

## ACHIEVEMENTS

### Good PSI readings over the years

NEA monitors the nation's air quality standards. Thanks to its strict vigilance, Singaporeans have enjoyed good ambient air quality over the years. For overall air quality, we use the Pollutant Standards Index (PSI) developed by the USEPA.



A study of our PSI trend shows that over the years, the levels of the five major pollutants of PM10, sulphur dioxide, carbon monoxide, nitrogen dioxide and ozone are well within USEPA standards (the drop in air quality in 1994 and 1997 was the result of transboundary haze from land and forest fires in the region). In 2005, we achieved 'Good' PSI readings on 88% of the year, while registering 'Moderate' PSI readings for the remaining 12%. We will continue to aim for PSI readings of 'Good' and 'Moderate' for 85% and 15% of the year respectively.

The PSI reporting system had also been improved since February 2005 to cover regional reporting in the North, South, East, West and Central regions of Singapore. This additional reporting kept the public better informed about the air quality in Singapore.

### Energy efficiency and cleaner energy

Singapore puts great store on energy efficiency and there are programmes to drive this forward. These programmes, spearheaded by the National Energy Efficiency Committee (NEEC), encourage energy efficiency in industries, homes, commercial buildings and vehicles. There are four Sub-Committees (Building, Households, Industry and Transportation) and an R&D Workgroup under the NEEC. Currently, representatives from 45 organisations, including government agencies, trade and professional associations and NGOs are involved in the work of various NEEC committees and workgroups.

The NEEC's key thrusts are:

- Promoting energy conservation through the efficient use of energy in the industrial, building, transport and consumer sectors.
- Promoting the use of cleaner energy sources such as natural gas and renewable energy sources.
- Promoting Singapore as a location for the test-bedding of pioneering energy technologies as well as the hub for developing and commercialising clean energy technologies.

Since its inception in April 2001, NEEC has spearheaded programmes such as the energy labelling scheme, the fuel economy labelling scheme, the energy audit scheme, the energy efficiency improvement assistance scheme and the accelerated depreciation allowance. Details of these programmes can be found at [www.neec.gov.sg](http://www.neec.gov.sg).

NEEC's scope of work will be expanded to help oversee climate change-related efforts of the 3P sectors.

### **Energy labelling scheme**

Under this scheme, getting ticked off is a real pleasure. Targeted at refrigerators and air-conditioners which account for 40%-65% of an average household's electricity bill, appliances under this scheme are given a label displaying the number of ticks it received for energy-efficiency. The more energy-efficient, the more ticks. The scheme makes consumers realise the twin benefits of an energy-efficient appliance – savings on electricity costs and protection of the environment. As of December 2005, 77 refrigerator models and 110 air-conditioner models have been labelled.

### **Fuel economy labelling scheme**

When buying a car, how do you avoid a gas-guzzler? Simple. Just look at the Fuel Economy Labels on the windscreens of the cars in the showroom. This label highlights the fuel economy of the car model and allows fair comparison between different vehicles that display the label. Thanks to this label, motorists can make informed choices when looking for a vehicle that uses fuel efficiently. By the end of December 2005, 99 vehicle models have been registered under the scheme.

### **Generating power more efficiently**

Greater market competition arising from the restructuring of the electricity industry has forced players to look for innovative solutions and use new technologies that will lead to higher energy efficiency all-round. As a result of competition, electricity is increasingly being produced from natural gas-fired combined cycle power plants, as these are more efficient and cost-effective than oil-fired steam plants.

Between 2000 and 2005, electricity produced by natural gas increased from 19% to 74% of the total electricity produced. The overall generation efficiency also rose from 37% to 44% during the same period.

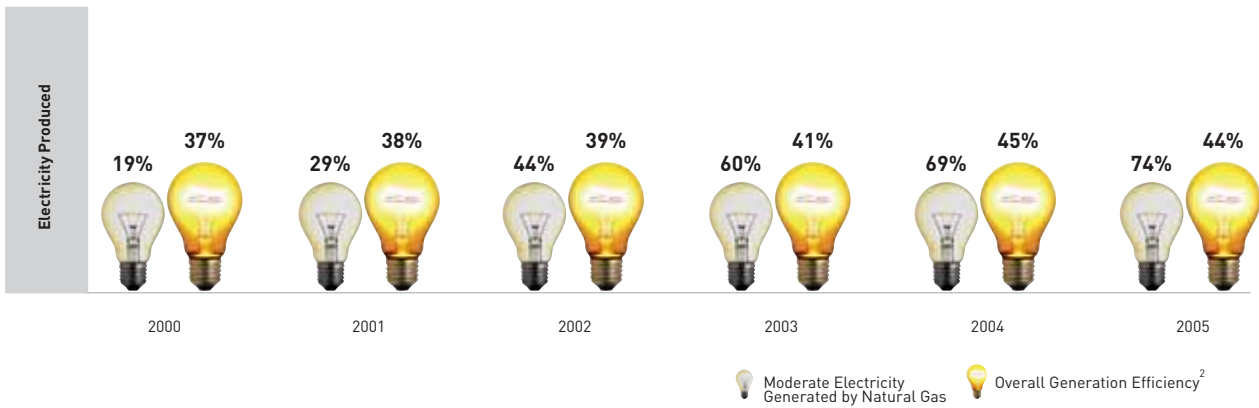


77% of the respondents to the SGP 2012 online survey will consciously look out for air-conditioner and refrigerator models that carry more green ticks (ie more energy efficient) when deciding which model to buy.





## Generating Power More Efficiently



### Senoko Power Ltd

As Singapore's largest electricity producer and retailer, Senoko is keenly aware of its responsibility to the environment. The company pioneered the use of natural gas for electricity generation in 1992.

Senoko also replaced its less efficient oil-fired plant with its high-efficiency, gas-fired Combined Cycle Plant, resulting in a reduction of CO<sub>2</sub> emissions of about 2.5 million tons a year. Against the national CO<sub>2</sub> generation of about 38 million tons a year, it is a significant reduction.

"We have made investments of over \$600 million in the repowering of our old oil-fired electricity generation plant, and the replacement of that with state of the art, highly efficient combined cycle gas turbine technology. It enables us to produce competitively priced electricity for the Singapore economy. But also, from an environmental perspective, it is very important in terms of emissions reduction..."

ROY ADAIR  
Senoko Power CEO



## NEW TARGETS

To better address emerging challenges in the area of clean air and climate change, we have set two new targets under the SGP 2012:

- (i) To reduce the ambient PM 2.5 level to within an annual average of 15µg/Nm<sup>3</sup> by 2014;
- (ii) To improve carbon intensity (i.e CO<sub>2</sub> emission per GDP Dollar) by 25% from 1990 level by 2012.

As PM 2.5 is an emerging health concern, it should be addressed at a national level with the support of our 3P partners. With the implementation of Euro IV emission standards for new diesel vehicles from 1 October 2006 and the co-ordinated efforts of 3P partners in using cleaner energy, we should be able to achieve this target (current USEPA standard for PM 2.5) by 2014.

<sup>2</sup>Overall generation efficiency is measured by the total amount of energy generated from the quantity of fuel used.

# We will continue to work with refineries and power stations to promote the use of clean fuels to reduce emissions of sulphur dioxide and particulate matter.

Climate change was not explicitly addressed in the SGP 2012, so its inclusion in the revised green plan is aimed at bringing the issue to the forefront of national attention. As we do not have sufficient scope to explore renewable sources of energy such as wind energy and hydroelectric energy that do not produce carbon emissions during electricity generation, our ability to cut absolute emissions is limited. Hence, we can only play a meaningful role through our attempt at improving carbon intensity by seeking ways to use energy more efficiently.

## **AMBIENT AIR – KEY THRUSTS AND PROGRAMMES**

The Clean Air & Climate Change Action Programme Committee focuses on the areas of ambient air and climate change. The following are the key thrusts and programmes under Ambient Air.



### **Manage emission from stationary sources**

Since stationary sources such as power stations and oil refineries are the main polluters, it is vital to get them on our side in the fight against air pollution. In recent years, our efforts at co-regulation with our industry partners have gone well, with our partners playing an increasing role in monitoring their emissions, although there is room for greater 3P collaboration.

### **Review regulatory measures for stationary sources**

- We will study the need for more stringent air emission standards periodically.
- We will also discourage power generation companies from using fuel that will result in greater air pollutants than those using fuel oil.

### **Encourage co-regulation of emission from stationary sources by industry**

- We will continue to work with industries such as oil refineries, power stations and companies with scheduled boilers and incinerators to install devices for continuous self-monitoring of their emissions. By doing so, we are guiding the industry towards self-regulation.
- We will continue to work with refineries and power stations to promote the use of clean fuels to reduce emissions of particulate matter and sulphur dioxide.

## Manage emission from mobile sources

Vehicles are the other major source of air pollution, especially those using diesel which contribute to about 50% of the total PM 2.5 emissions. This has become a growing public health concern.

### Review regulatory measures for mobile sources

- Euro IV emission standards for new diesel vehicles will be introduced from 1 October 2006. The results of these new policies will be closely monitored. The emission standards will also be regularly reviewed to keep up with emerging pollutants. To pave the way for Singapore to adopt the Euro IV emission standards for diesel vehicles, we have made it compulsory for all diesel-driven vehicles in Singapore to use only Ultra Low Sulphur Diesel (ULSD) with effect from 1 December 2005. This policy was made after consulting the industry and vehicle fleet owners<sup>3</sup>. The sulphur content in diesel is reduced from 0.05mg/litre to 0.005mg/litre. This reduction will reduce the emission of particulate matter into the atmosphere.
- The Chassis Dynamometer Smoke-Test (CDST) measures the smoke emission from a diesel-driven vehicle under simulated driving conditions. Since 1 September 2000, the CDST has been used to test diesel-driven vehicles booked or reported for smoky emissions. We are looking into the possibility of making CDST testing compulsory for diesel vehicles.

### Encourage co-regulation of emission from mobile sources by industry and consumers

- As green vehicles<sup>4</sup> are less pollutive than conventional petrol-and diesel-driven vehicles, steps have been taken to encourage the use of such vehicles. The Green Vehicle Rebate was extended for another two years till 31 December 2007. We will also review regularly the measures and determine the need for further incentives to lower the upfront costs of Euro IV diesel vehicles so as to encourage quicker replacement of in-service diesel vehicles.
- In 2004, a package was introduced to encourage owners of buses, taxis and other commercial vehicles to make an early switch to either Euro IV diesel vehicles or compressed natural gas (CNG) vehicles before Euro IV standards are implemented on 1 October 2006. Response to the package has been good. Singapore's first commercially-run fleet of 30 Bi-Fuel CNG taxis has been handed over from DaimlerChrysler to Smart Automobile on 12 December 2005. This was a major move by the transport sector to promote a cleaner and greener Singapore. Natural gas operation cuts carbon dioxide emissions by more than 20% compared with petrol operation. The use of natural gas will also reduce the emission of nitrogen oxides (NO<sub>x</sub>) and carbon monoxide (CO). Besides buses and taxis, we are trying to get commercial vehicles such as trucks to use natural gas. We will also enhance the existing infrastructure to make it more convenient for compressed natural gas (CNG) vehicles to refuel.

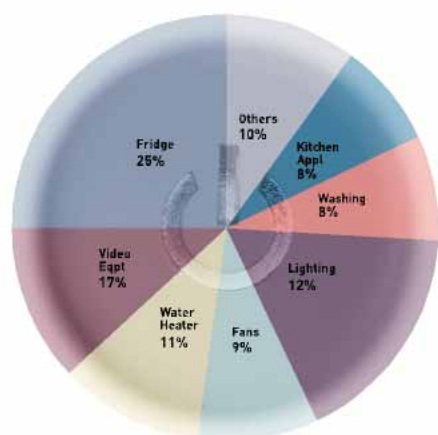
<sup>3</sup> Fleet owners refer to companies that own commercial vehicles such as taxis, lorries, trucks, etc.

<sup>4</sup> Green vehicles refer to Natural Gas Vehicles, Hybrid Vehicles, Electric Vehicles, Liquefied Petroleum Gas Vehicles, Fuel Cell Vehicles.

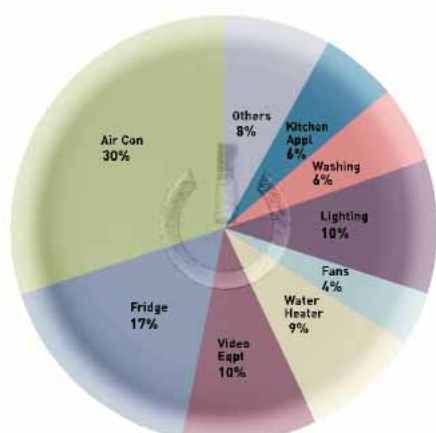


According to the SGP 2012 online survey, a majority felt that the most effective way to reduce diesel vehicle emissions is to give incentives to green vehicles to replace diesel ones.

Breakdown of Electricity Usage of 4-Rm HDB Apt



Without Aircon



With Aircon

A majority of the respondents to the SGP 2012 online survey feel that Singapore should educate the public on how they can play a part in reducing carbon dioxide remissions to address the issue of climate change.

- We will continue to work with our partners to encourage more environmentally-friendly ways of transportation (e.g. cycling, green-car sharing, etc.) as an alternative to private cars.
- We will continue to discourage motorists from using smoky vehicles and motorcycles through education and public campaigns etc. We will get them to adopt stricter maintenance programmes for their vehicles.

## CLIMATE CHANGE – KEY THRUSTS AND PROGRAMMES

After the United Nations established scientific proof that greenhouse gases (GHG) contribute to rising global temperatures and sea levels among other things, climate change is now looked upon as one of the most pressing environmental challenges of the global community.

The issue of climate change should be tackled holistically and the scope of the existing NEEC will be expanded to look into this.

We must also raise the level of public awareness on climate change. This will be done through programmes under the national climate change strategy, which will also recommend strategies to address carbon dioxide emissions in the various sectors including power generation, industry, transport, buildings and consumers. Companies must realise that pro-environment actions have a positive impact on their bottomlines. For example, by being energy-efficient, they are not only championing the environmental cause, they are also reducing their own operational costs (eg electricity expenditure) in the long run.

### Promote energy efficiency

Energy efficiency programmes can be ‘win-win’ solutions that make economic sense and at the same time, lower energy consumption and the resulting CO<sub>2</sub> emissions. A 3P approach is critical to the success of these programmes.

### Develop enablers to make consumers more energy efficient/fuel efficient

- We will look into having minimum efficiency performance standards (MEPS) so that only models of electrical appliances that meet these minimum standards will be allowed into the market.
- We will continue to promote energy labelling and work towards making it compulsory to label air-conditioners and refrigerators as their electricity usage constitutes a high percentage of the household electricity bill.
- We will also promote fuel economy labelling for vehicles and look into the possibility of making it mandatory.

### Improve energy management practices of businesses

- We will also work with building managers and developers to improve energy management practices. These may include disseminating information on energy efficiency performance and encouraging industries to adopt co-generation technology.



## Promote use of clean energy

### Promote use of cleaner energy (such as natural gas)

- We will continue to encourage our industries to switch to natural gas which is a cleaner form of fuel.
- We will promote the use of green vehicles through public and consumer education as well the existing Green Vehicle Rebate scheme.

## Demonstration projects on renewable energy

### Encourage demonstration projects on renewable energy (such as solar and biomass)

- Companies can continue to tap on existing incentive schemes such as the Innovation for Environmental Sustainability (IES) fund to embark on renewable energy projects (e.g. building-integrated photovoltaic).

## Summary of Clean Air & Climate Change Targets and Key Thrusts

### Targets

- To maintain the Pollutant Standards Index for ambient air within the 'good' range for 85% of the year, and within the 'moderate' range for remaining 15%.
- To reduce the ambient PM 2.5 level to within an annual average of  $15\mu\text{g}/\text{Nm}^3$  by 2014.
- To improve carbon intensity (i.e. CO<sub>2</sub> emission per GDP Dollar) by 25% from 1990 level by 2012.

### Key Thrusts and Focus

#### Ambient Air

##### Manage emission from stationary sources

- Review regulatory measures for stationary sources
- Encourage co-regulation of emission from stationary sources by industry

##### Manage emission from mobile sources

- Review regulatory measures for mobile sources
- Encourage co-regulation of emission from mobile sources by industry and consumers

#### Climate Change

##### Promote energy efficiency

- Develop enablers to make consumers more energy efficient/fuel efficient
- Improve energy management practices of businesses

##### Promote use of clean energy

- Promote use of cleaner energy (such as natural gas)

##### Demonstration projects on renewable energy

- Encourage demonstration projects on renewable energy (such as solar and biomass)

# CLEAN WATER ON TAP

Singapore currently consumes 1.4 million cubic metres of water a day – a not insignificant volume for a nation of just over 4 million people. As the population grows, the challenge will be to ensure the sustainability of clean water supply. Diversification of our water supply sources, conservation of water and getting the community to value our water resources have been pursued as the means to achieving sustainability.

## **DIVERSIFYING SUPPLY SOURCES**

Singapore has scored a resounding success as far as diversifying its water supply sources goes. With its Four National Taps Strategy in full flow, it has enough water to meet its future needs.

The first tap is the supply of water from local catchments. This consists of an integrated system of 14 reservoirs and an extensive drainage system to channel storm water into the reservoirs. The Marina Barrage, when completed in late 2007, will turn Marina Basin into Singapore's 15th reservoir with a catchment area of about 10,000 ha (or one-sixth of Singapore's land area). Dams will also be constructed across Sungei Punggol and Sungei Serangoon and when completed in 2009, will create a new catchment area of over 5,000 ha. Collectively, these projects will increase our water catchment areas from 50% to 67% of Singapore's land area by 2009 – fulfilling one of SGP 2012's targets on Clean Water.

The second tap – imported water from Johor – supplements Singapore's needs. So does the third tap – NEWater or high-grade reclaimed water. Thanks to advanced membrane technologies, treated effluent from our water reclamation plants is processed to produce high-grade reclaimed water of drinkable quality. NEWater is supplied from three plants with a combined capacity of 21 million gallons per day. A fourth plant at Ulu Pandan, when completed at the end of 2006, will double the current supply.

Recent technological advances have made Singapore's fourth tap – Desalinated Water, an affordable source. The first desalination plant at Tuas started operations in September 2005 and can supply a maximum of 30 mgd<sup>1</sup> of drinking water. This brings us a step closer to meeting the SGP 2012 target of having non-conventional sources make up at least 25% of our water needs by 2012.

<sup>1</sup>Mgd: million gallons per day



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“Effective water management is one of Singapore’s key national strategic priorities and the country has taken a catalysing role in water resources management in the region.”

**PROFESSOR LASZLO SOMLYODY**  
President, International Water Association

## CONSERVATION OF WATER

Securing an adequate supply of water through our Four National Taps Strategy is only half the equation. Managing the demand side of water is the other. The news is good on this front. Our domestic per capita consumption has fallen from 165 litres a day in 1999 to 160 litres a day in 2005, thanks to a combination of community outreach initiatives such as the Water Efficient Homes (WEH) programme, and measures like installing water thimbles and low-capacity flushing cisterns in new HDB flats.



### Conserving Water

By December 2005, 68 of the 84 constituencies have launched the Water Efficient Homes (WEH) programme where do-it-yourself (DIY) water saving kits consisting of thimbles (to reduce water flow from taps), cistern water saving bags, leaflets on installation procedures and water conservation tips were sent to the grassroots organisations for distribution to the residents free-of-charge. Over 750,000 water saving kits have been distributed so far. One in three households has installed the water saving devices which can save up to 5% of their monthly water expenses.

The Water Efficient Buildings (WEB) programme offers cost-effective solutions to the non-domestic customers (such as industrial and commercial buildings) to lower their water consumption and hence operating costs. In 2004, 512 buildings have achieved the WEB status i.e. they have successfully reduced water consumption levels within their premises. As at December 2005, an additional 231 buildings achieved the WEB status.

More information on these programmes as well as good water conservation practices can be found on [www.pub.gov.sg](http://www.pub.gov.sg)

## BONDING WITH WATER

While stiff penalties may have a deterrent effect on would-be polluters, the key to clean water lies in getting the community to establish a bond with water. Get the people on your side and half the battle is won. PUB's "Conserve, Value and Enjoy" message is thus meant to get both community and businesses to help keep our water catchments clean. Indeed, with two-thirds of Singapore set to become water catchment areas by 2009, the battle for the hearts and minds of the people has never been more urgent.

### Active, Beautiful and Clean (ABC) Waters Programme

To get every Singaporean to conserve, value and enjoy water, the Public Utilities Board has launched the ABC Waters Programme with these objectives in mind:

- (i) Turning reservoirs and waterways into clean and vibrant lifestyle attractions where the public can participate in recreational activities. The community will then be drawn to the water and in the process, learn to treasure it;
- (ii) Integrating all activities in the catchments, reservoirs and waterways under the ABC Waters programme to achieve better synergy (such as the co-ordination of future water activities in the Marina Basin).

Under the programme, new initiatives such as the beautifying of waterways will be implemented to encourage activities in and around the waters. These initiatives will complement existing programmes.

### Our Waters Programme

In August 2005, Our Waters Programme was launched to get our 3P partners to adopt waterways or reservoirs for at least two years and care for them through clean-ups or the development and maintenance of amenities around them. By December 2005, 16 organisations have responded to the call.

"I look forward to organising water-related activities, like canoeing and cleaning the river. This way, we reduce the pollution, so that the river can be used by everyone."

KONRAD TENG  
St Andrews Secondary School







### **Opening up reservoirs**

Currently, recreational activities are carried out in 8 of the 14 reservoirs. They include canoeing, kayaking, sport fishing, radio control sailing and dragon boat racing. Major international sporting events were also held at our reservoirs such as the Wakeboard World Cup in 2004 and 2005 at Bedok Reservoir.

Two kayaking rental centres, Paddle Lodge and Paddlez Inc were opened in March and June 2005 respectively. The Paddle Lodge at MacRitchie Reservoir is operated by the Singapore Canoe Federation while the Paddlez Inc at Bedok Reservoir is run by the People's Association.

### **Concept plans for Bedok and MacRitchie Reservoirs**

For public feedback on the introduction of more activities at the reservoirs, a two-month public consultation on the recreational activities concept plans for Bedok and MacRitchie Reservoirs took place between October and December 2004. Over 2,000 responses were received, with 80% giving the thumbs up for more recreational activities at the reservoirs. The Bedok Reservoir concept plan, unveiled during the Clean and Green Week in November 2005, is also being implemented.

### **Others**

Besides the PUB, non-profit organisations such as the Waterways Watch Society (WWS), a volunteer group that monitors the waterways, have also been playing their part. WWS has actively participated in several Water Efficient Homes exhibitions and has been actively patrolling the Singapore and Kallang Rivers, fishing out flotsam and rubbish along the way.

PUB has also launched its mascot Water Wally to spread its messages to the public in a lively and interactive way.

## **NEW TARGETS**

After reviewing SGP 2012 in 2005, two new targets have been set to ensure clean and sufficient water for Singaporeans:

- (i) Reduce per capita domestic water consumption to 155 litres/day by 2012;

This means setting up a measurable output indicator to quantify the success of water conservation efforts in the domestic sector. Singapore's domestic per capita water consumption is one of the world's lowest but it can be further reduced. The target of 155 litres per day is arrived at after taking into account that we achieved a 3 litres per day reduction from 1999 to 2004.

- (ii) Partner the 3P sectors to generate greater awareness of the importance of conserving, valuing and enjoying water and to develop a sense of shared ownership of our water resources.

This reflects the importance of engaging the 3P sectors in managing water demand and keeping water sources clean.

## KEY THRUSTS AND PROGRAMMES

To ensure an efficient, adequate and sustainable supply of water, we must promote greater R&D in water and used water technologies. Successful cases include the Membrane Bio-Reactor and the Variable Salinity Plant, which are being developed for pilot-testing.

### Water for all

- Beyond the 4 National Taps  
With the turning on of the fourth tap in 2005, we will move beyond the Four National Taps strategy to focus on achieving quality, reliability, security and efficiency of water supply as well as the environmental beauty around the water bodies.
- Water Quality Management  
The standard of potable water cannot be compromised. To ensure its high quality, water will be monitored from source to tap through an Integrated Water Quality Management Plan. This includes putting in place a comprehensive water quality monitoring programme, and special focus on water quality security, source control monitoring and R&D efforts on water quality.
- Water Quality Management of Catchments  
Besides focusing on the water quality of our supply network, greater attention will be placed on activities upstream to ensure that our catchments are not polluted. PUB has formed a surveillance team for more thorough checks on catchments and waterways, and to educate the public, factory and construction workers on proper practices to be adopted. Enforcement officers will also look out for the indiscriminate discharge of sullage/washing water from eateries, shophouses and landed properties into drains.
- Control on Trade Effluent  
Trade effluent from industries must adhere to prescribed standards before they can be discharged into a sewer or watercourse. Regular surveillance is carried out to check for compliance with pollution control requirements and discharge standards. The revised trade effluent standards came into force on 1 May 2005 for new industries, although existing industries were given a two-year grace period to comply.



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To ensure an efficient, adequate and sustainable supply of water, we must promote greater R&D in water and used water technologies. Successful cases include the Membrane Bio-Reactor and the Variable Salinity Plant, which are being developed for pilot-testing.

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- Erosion and sediment control measures  
The Brown to Clear (B2C) Programme addresses the problem of silt pollution in watercourses as a result of stormwater runoff from construction sites. Under this programme, we are working with the construction industry to raise awareness among its members and also get them to adopt Earth Control Measures (ECM) at worksites to reduce the silt discharges into the watercourses.

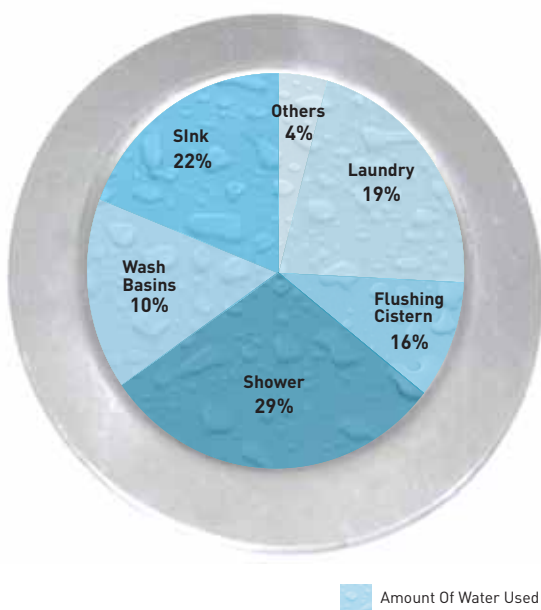
So far, 13 agencies such as the Land Transport Authority, the Singapore Land Authority and the Housing and Development Board have incorporated ECM requirements in their contracts. Institution of Engineers (IES) and Association of Consulting Engineers Singapore (ACES) have also started courses on ECM for professional engineers and qualified persons.

- Reduction of flotsam  
To reduce the amount of litter and flotsam in our rivers and canals, additional float-booms and gratings will be installed and litter-prone drains will be covered up.
- Environment management  
We will be adopting a more holistic approach in our development projects, especially the coastal developments, to conduct Environmental Impact Assessments (EIA) and studies on biodiversity, hydraulic modelling and water quality prior to commencing the development work.

### Conserve water

- Domestic Sector  
The mandatory installation of low capacity flushing cisterns (LCFCs) in new premises including HDB flats, MUP flats and premises undergoing renovations since the 1990s has helped reduce the domestic water consumption. LCFCs use about 3.5 litres to 4.5 litres per flush compared to normal cisterns, which use about 9 litres per flush. In addition, we will look into the feasibility of making it compulsory for all premises to install dual-flush low capacity flushing cisterns by 2009.

Water Consumption Pattern In Singapore Households



95% of the respondents to the SGP 2012 online survey supports compulsory water-efficient labels on washing machines so that they are better informed of their water consumption when making a purchase.

Water usage in the laundry business is one big splash, accounting for 19% of the total domestic consumption. This is because some washing machines are used at less than full load capacity while others are not water-efficient. We will consider developing water efficient labels for water saving devices and washing machines by the end of 2006. At the same time, we will also promote the use of water-efficient washing machines.

We will also continue to encourage Town Councils, Community Development Councils and Management Agents to adopt good water conservation measures in order to reduce common area water usage e.g. washing corridors and cleaning swimming pools.

- **Non-Domestic sector**

The construction industry accounts for a significant 6% of the total non-domestic water consumption. Currently, construction site owners must ensure that the flow rates of the water fittings within the construction sites comply with PUB's standards. We will also encourage the industry to use NEWater as an alternative to potable water where possible.

As for the hospitality, manufacturing and commercial sectors, we will continue to get them to optimise water usage and to switch to NEWater for non-potable uses such as in industrial processes, washing and cooling towers.

### **Value water**

The Government on its own cannot keep our waterways and catchments clean. We need the co-operation of the community and we aim to do that by encouraging them to change their water usage habits, and educate them on the implications of living in water catchment areas. The 'value our water' message will be disseminated to the community through publicity materials and the mass media. In schools, the young will learn how to care for our water resources via the school curriculum, the schools' clean-up programmes and excursions to facilities such as the NEWater Visitor Centre. The foreign workforce will not be left out, and we will work with MOM, maid agencies and industry associations to impart proper water usage to the workers.

To encourage greater community ownership of water resources, we will encourage more commercial organisations, community groups and schools to adopt water courses and rivers under "Our Waters" programme.

### **Enjoy water**

Now that more recreational and sporting activities are taking place in reservoirs and waterways, it is imperative that users recognise the importance of keeping them clean. Thus, a Code of Conduct on the proper use of these waterbodies will be introduced.

Only 21% of the respondents in the SGP 2012 online survey have never visited our reservoirs.





The tagline, “Water for All: Conserve, Value, Enjoy” will also be highlighted on publicity materials of all events held at reservoirs.

Under the ABC Waters Programme, we will implement the concept plans for Bedok and MacRitchie Reservoirs to put in place the facilities needed for recreational activities in these reservoirs. In addition, we will look into the possibility of beautifying other waterways such as Kallang River, so as to develop them into new community spaces for the public. We will also work with various 3P partners (e.g. National sports associations, event organisers, grassroots, schools) to encourage more recreational activities and water events (e.g. sports day, family day) at the various reservoirs.

With the scheduled completion of the Marina Barrage and the creation of the Marina Reservoir, we will work with URA and other stakeholders in the planning, management and co-ordination of water-based activities in the reservoir to inject vibrancy into the bay area without damaging the quality of the water.





## Summary of Water Targets and Key Thrusts

### Targets

- Increase catchment areas from 50% to 67% of Singapore's land surface.
- Increase supply of water from non-conventional sources, such as desalination and water reclamation, to at least 25% of Singapore's water demand.
- Ensure that water quality continues to meet international standards.
- Reduce per capita domestic water consumption to 155 litres/day by 2012.
- Partner the 3P sectors to generate greater awareness of the importance of conserving, valuing and enjoying water and develop a sense of shared ownership of our water resources.

### Key Thrusts and Focus

#### Water for all

- Diversify our water supply through the four National Taps
- Promote greater R&D efforts in water and used water technologies and other areas
- Ensure potable water quality continues to meet international standards

#### Conserve

- Promote the use of water-efficient household fittings and appliances
- Continue to work with the various non-domestic sectors to reduce water consumption

#### Value

- Encourage the community to change their water usage behaviour and habits, and to educate them on the implications of living in water catchment areas
- Inculcate amongst young Singaporeans the mindset of valuing our water resources

#### Enjoy

- Encourage the users of our water resources to take ownership of and enjoy our water resources

# REDUCE, REUSE, RECYCLE

It's hard to imagine Singapore as a land of incineration plants and landfills. Yet not so long ago, the signs were pointing that way. The amount of waste being disposed had jumped six-fold over 30 years – from 1,300 tons a day in 1970 to 7,600 tons a day in 2000. At this rate, a new incineration plant would have to be built every 5 to 7 years and a 350 hectare landfill every 25-30 years – a frightening prospect for a small, land-scarce island.

But that fate was averted, thanks to four strategies devised to tackle its solid waste problem:

- reducing the volume of waste through incineration;
- reducing the volume of waste sent to incineration plants through recycling;
- cutting down the volume of waste sent to the landfills;
- cutting down the volume of waste generated through waste minimisation.

The results are beginning to show. Between 2000 and 2005, Singapore's overall recycling rate<sup>1</sup> rose from 40% to 49%.

Waste growth has also been successfully controlled, with the amount being disposed falling from 7,600 tons a day in 2000 to 7,000 tons a day in 2005. With this, the projected lifespan of Semakau Landfill has risen from 25-30 years to 40 years, while the need for additional incineration plants has been reduced from the current one every 5 to 7 years, to one every 7 to 10 years.

## INCINERATING WASTE

Most of the waste that is not recycled is sent for incineration. This reduces waste to its minimum possible volume and conserves our limited landfill capacity.

All incinerable waste, which forms 90% of the total waste disposed of, is burnt at one of four incineration plants on the island. Non-incinerable waste, together with incineration ash from the plants, is disposed of at Semakau Landfill, an offshore dumping ground.

<sup>1</sup> Recycling rate refers to total amount of waste recycled as a percentage of the total amount of waste generated.





A fifth incineration plant is in the pipeline and the contract for its building has been awarded to Keppel Seghers Engineering Singapore Pte Ltd (KSES), a wholly-owned subsidiary of Keppel Corporation Ltd, under a Public-Private Partnership arrangement. Scheduled for completion by 2009, it will replace the Ulu Pandan Incineration Plant, which was commissioned in 1979.



#### **Semakau, The Pristine Landfill**

Out at sea about 8 kilometres from mainland Singapore, a mangrove-clad island is the site of Singapore's only large-scale legal dumping ground. Semakau Landfill started operations in 1999 when the last landfill on the mainland was filled up. At 350 hectares, Semakau has a capacity of 63 million cubic metres and an expected lifespan of 40 years at the current rate of usage.

The landfill space was created by enclosing Pulau Semakau and a small adjacent island, Pulau Sakeng with a rock-armoured sand bund. The bund is lined with a thick plastic industrial membrane and a layer of marine clay to prevent refuse from causing leaching into the sea.

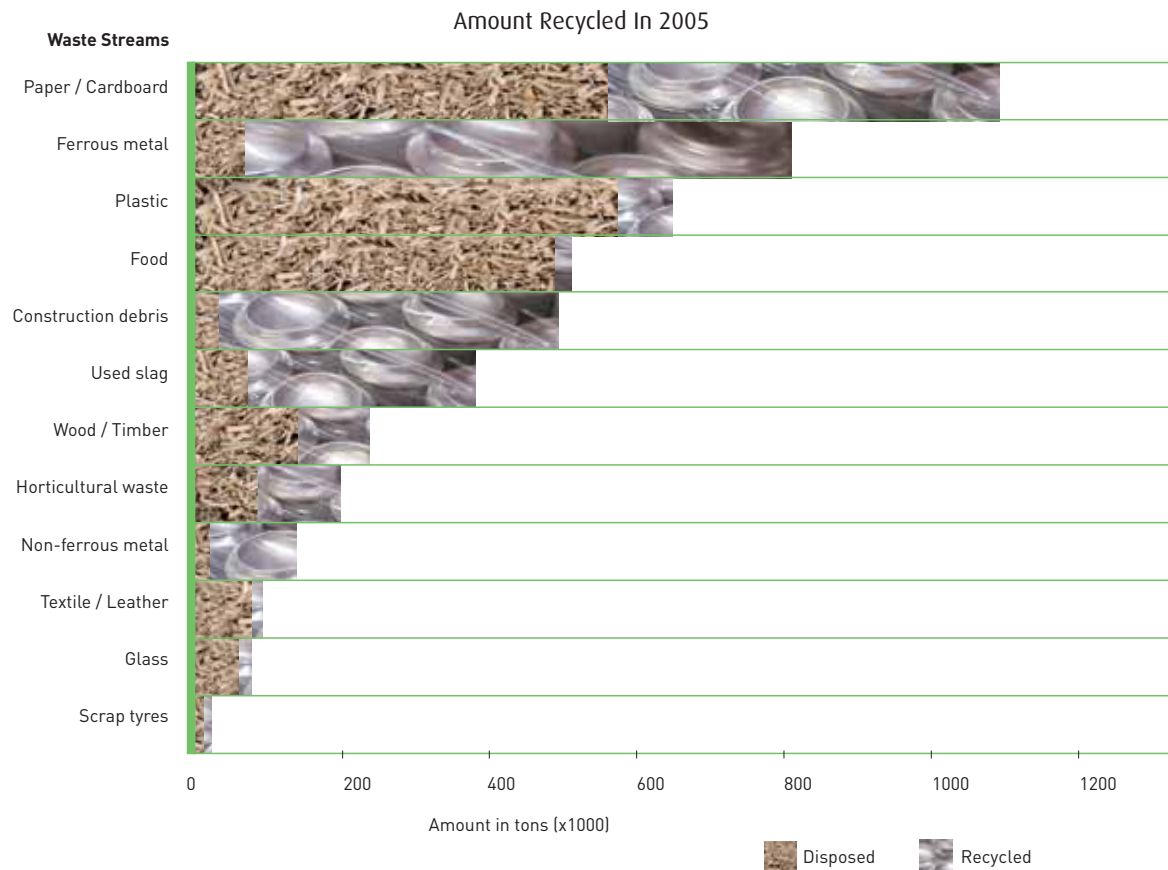
Semakau Landfill is no smelly dump. The air is fresh and there is thriving wild life, thanks to the pro-environmental and conservation measures taken. During its construction, efforts were made to preserve the existing mangroves while growing new ones to replace those affected by the development. Biodiversity surveys have revealed a rich variety of flora and fauna on the island.

Educational trips to the landfill have been regularly organised. The public can also book fishing trips there with the Sport Fishing Association of Singapore, or join Nature Society Singapore's bird-watching sessions.

### **RECYCLING UP = WASTE DOWN**

Recycling is one sure way to cut down the amount of waste headed for Semakau Landfill or the incineration plants. Although Singapore's recycling rate was a creditable 49% in 2005, we aim to make it 60% by 2012.

This chart shows the recycling rates by waste streams in 2005.



The National Recycling Programme (NRP) was launched in April 2001 to bring the means to recycle nearer to consumers. Under this programme, all residents in HDB estates and landed properties have to do is put their recyclables in bags or crates and leave them outside their homes for collection every fortnight. By December 2005, 56% of all Singapore households have taken part in the NRP. By 2007, things will be even more convenient. Bins will be placed in common areas of HDB estates for residents to deposit their recyclables any time they like.



NEA also works to provide recycling facilities in condominiums, schools, offices, shopping malls and industrial estates. Condominiums having recycling facilities increased from 14% in 2002 to 43% in December 2005, while the number of schools having recycling corners went up from 2% to 78% in the same period, and the figures are still going up.

“It is critical that we nurture our students to care for our environment. Everything we do counts. It can be as simple as getting our students to recycle their plastic mineral bottles after drinking.”

**CHIA YEW LOON**

Head Of Department, Nan Hua High School



Recycling programmes have also attained greater outreach. All 21 JTC flatted factories have introduced recycling programmes.

Through national campaigns such as Recycling Day, and Clean and Green Week, people's awareness about recycling is maintained. NEA also works closely with NGOs like the Singapore Environment Council (SEC) and with industry associations such as Waste Management and Recycling Association of Singapore (WMRAS) to bring partners and sponsors on board for these programmes.

To help grow the recycling industry, NEA has set up initiatives like the \$20 million Innovation for Environmental Sustainability (IES) scheme to fund the testing of those technologies with commercial value. For example, GPac Technology (S) Pte Ltd developed the technology to recycle wood waste into recycled pallets and corner boards with IES funding.

In December 2004, another company KK Asia Pte Ltd introduced its One Stop Plastic Recycling Operation to buy back post-consumer plastic wastes.



#### **KK Asia**

In December 2004, KK Asia Pte Ltd opened Singapore's first one-stop plastic recycling plant. This plant is one of the largest in South-east Asia to recycle both post-industrial and post-consumer plastic wastes into reusable resin pellets.

Plastics recycled range from the humble polyethylene terephthalate PET (eg mineral plastic drink bottle), polyethylene PE (eg plastic bags) and polypropylene PP (eg containers) to engineering plastics such as polybutylene terephthalate PBT. The plastic wastes are crushed, cleaned and processed into resins and flakes which are the raw materials for plastic products like textile fibres, milk crates and shopping bags.

KK Asia won the Enterprise 50 Awards in 2005 in recognition of its innovation and enterprise.

## **REDUCING THE VOLUME OF WASTE AT LANDFILLS**

Recycling non-incinerable waste is critical to successful waste management. One example of non-incinerable waste is construction and demolition waste. When construction and demolition waste is processed to make non-structural concrete products like road kerbs, there will be a corresponding fall in the volume of waste at the landfill. In 2005, we achieved a recycling rate of 94% for construction and demolition waste.

### GPac Technology

GPac Technology (S) Pte Ltd (GPac), a home-grown firm, has come up with a technology to manufacture pallets and corner boards, widely used in storage and transportation of goods, from horticulture and wood waste.

Pallets and corner boards are usually made from virgin wood or plastic. GPac uses wood fibre from used wooden pallets, crates and other waste wood. The fibre is treated with a glue-like substance at a very high temperature until it is 'liquefied'. The 'liquefied' wood is poured into moulds to produce the pallets, which is a good alternative to pallets and corner boards made from virgin wood.



## REDUCING THE VOLUME OF WASTE GENERATED

Moving upstream, it is also vital to reduce the volume of waste generated. This can be done by reducing excess packaging, using less plastic bags as well as reduce unnecessary usage and wastage of items.

### TARGETS

To achieve sustainable waste management in Singapore, we need to:

- (a) increase the overall waste recycling rate from 44% to 60% by 2012;
- (b) extend the lifespan of Semakau Landfill to 50 years, strive "towards zero landfill" and "close the waste loop" ["Close the waste loop" is added to emphasise the need to move upstream to influence producers in their choice of materials and design so as to minimise waste volume and facilitate the recycling of used products later on. It also highlights the need to produce good quality recycled products that are acceptable to users];
- (c) reduce the need for new incineration plants to one every 10 to 15 years.



## KEY THRUSTS AND PROGRAMMES

### Reduce waste at source

Any progress made in recycling will be swiftly dissipated if there is rampant generation of waste. The key to successful waste management therefore lies in reducing waste at its source.

- Working with industry to reduce waste  
We are working with the various industry partners and associations to promote the reduction of packaging waste, as well as waste from food factories and industrial estates. We are also looking into the possibility of introducing a voluntary scheme for producers and retailers so that excess packaging material such as multi layers of plastic wrapping, will be reduced to a minimum.

### What is "Extended Producer Responsibility"?

Over the last two decades, OECD (Organisation for Economic Cooperation and Development) countries have watched with growing concern the rise in volume of post-consumer wastes. This is exacerbated by the soaring costs of waste management and the sentiments against the building of landfills and incinerators.

As a result, countries such as Netherlands, Germany and Japan have come up with policies aimed at reducing the volume of industrial and household waste and minimising the environmental risks associated with poor management of end-of-life products. One of these policies focused on producer responsibility, better known as Extended Producer Responsibility (EPR).

EPR is an environmental policy tool that holds producers accountable for the social costs of waste management, over and above their traditional accountabilities for worker and consumer safety etc. There are various ways to implement EPR, ranging from fully voluntary (e.g. the New Zealand Packaging Covenant), fully mandatory (e.g. the Green Dot Programme in Germany), to a mix of both e.g. Australia's packaging covenant.

So far, OECD countries have adopted EPR for packaging waste, electronic and electrical equipment, batteries, bottles and end-of-life vehicles.



93% of the respondents in the SGP 2012 online survey support measures to reduce the use of plastic bags.

- Reducing excessive usage of plastic bags in the retail sector  
We will continue to work with major retailers and supermarkets to curb excessive distribution of plastic bags and to explain to the public the rationale for it. Cashiers and managers of major retailers will be educated on waste minimisation, especially on the distribution of plastic bags at checkout counters. We will also work with major retailers and supermarkets to initiate a campaign in 2006, to urge the public to bring their own re-usable shopping bags when they make purchases, thus reducing the need to use new plastic bags each time.

We will continue to work with major retailers and supermarkets to curb excessive distribution of plastic bags and to explain to the public the rationale for it. Cashiers and managers of major retailers will be educated on waste minimisation, especially on the distribution of plastic bags at checkout counters.

## Get more to participate in recycling

With limited space for landfills, recycling has become a crucial component of Singapore's environmental sustainability strategy. We will continue to promote recycling and make it easier for Singaporeans to do so.

- **More recycling programmes**

- Currently, households, schools and industrial estates have access to recycling facilities. Going forward, we will facilitate the implementation of recycling programmes, such as provision of recycling bins and communication of environmental messages, in SMEs, hotels and public places including community centres.

- **More publicity for recycling**

- We will conduct road shows and workshops as well as use the mass media to disseminate the recycling message.

- **Recognition for recycling efforts**

- We will continue to organise annual recycling competitions and give recognition to organisations and schools for their recycling efforts.



In the SGP 2012 online survey, the respondents cite inconvenience as the main reason for not participating in recycling.

## Build more infrastructural support for recycling

In urging more people to take part in recycling, we must provide them with the necessary infrastructural support.

- **More recycling bins in public areas**

- We are adding more bins to the existing 5,700 in public areas like food outlets, convenience stores, supermarkets.

- **Greater convenience in depositing recyclables**

- By 2007, all HDB estates will be provided with centralised recycling bins for residents to deposit their recyclables on the ground floor. There will be one set of bins within every 5 HDB blocks which will be placed in common areas such as linkways, carparks and playgrounds that are convenient to residents.



#### **Help to set up more recycling facilities**

- We are helping recycling companies to set up their operations in Singapore. A food waste recycling plant is in the pipeline.

#### **Enhance waste industry capability**

We are also helping to enhance the capabilities of the waste industry so that they can recycle more types of waste more efficiently.

#### **Promote innovative technologies to recycle and reduce waste**

- We are working with industry to carry out projects such as the recycling of incineration bottom ash, and scrap tyres.
- We will continue to provide funding support for innovative projects that contribute to Singapore's environmental sustainability through the Innovation for Environmental Sustainability (IES) fund.

#### **Develop a market for recycled products**

To make recycling viable, we must help ensure that there is a ready market for the recycled products.

#### **Improve the quality of recycled products**

- We are working with our partners like the Singapore Environment Council on labelling schemes which acknowledge products that meet recognised environmental standards, e.g. the Singapore Green Labelling Scheme.

#### **Promote the use of recycled products**

- We are also promoting the use of recycled products such as recycled paper and compost through programmes such as Eco-office. We also facilitate the linkups between the suppliers and potential users of recycled products.

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We are also helping to enhance the capabilities of the waste industry so that they can recycle more types of waste more efficiently.

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## Summary of Waste Management Targets and Key Thrusts

### Targets

- Increase the overall waste recycling rate from 44% to 60% by 2012.
- Extend the lifespan of Semakau Landfill to 50 years, strive “towards zero landfill” and “close the waste loop”.
- Reduce the need for new incineration plants to one every 10-15 years.

### Key Thrusts and Focus

#### Reduce waste at source

- Work with industry to reduce waste
- Reduce excessive usage of plastic bags in the retail sector

#### Get more to participate in recycling

- More recycling programmes
- More publicity for recycling
- Recognition for recycling efforts

#### Build more infrastructural support for recycling

- More recycling bins in public areas
- Greater convenience in depositing recyclables
- Help to set up more recycling facilities

#### Enhance waste industry capability

- Promote innovative technologies to recycle and reduce waste

#### Develop a market for recycled products

- Improve the quality of recycled products
- Promote the use of recycled products

# CONSERVING NATURE

Despite the republic's urbanised setting, nature continues to enjoy a luxuriant niche in Singapore with tracts of primary and secondary rainforests in the Bukit Timah and Central Catchment Nature Reserves, mangroves and mudflats in Sungei Buloh Wetland Reserve, and rocky shore habitats in the Labrador Nature Reserve. Other areas of rich biodiversity, such as the Kranji Mangroves, Bukit Batok Nature Area, Sentosa Nature Area and Sisters Islands Nature Area, also have diverse habitats for plants and animals.

With the twin demands of economic development and "back-to-nature" recreational activities putting enormous pressure on our natural heritage, the future holds many challenges. These include finding innovative ways to integrate greenery with our urban landscape and conserving our flora and fauna while providing nature based recreation in a sustainable manner.

## **ACHIEVEMENTS**

### **Make parks and nature accessible**

In 2005, the National Parks Board (NParks) developed 17.5 hectares of new parks and 7.4 km of park connectors. They include Buona Vista Park, and the Sembawang, Bedok and Hillview Park Connectors. This brings the total area of parks and park connectors to 1,924 hectares and 70 km respectively.

New ways to access our natural areas have also been completed. They include the HSBC TreeTop Walk, Changi Boardwalk and the Kent Ridge Canopy Walk which enable people to enjoy nature in safety and comfort. From its opening in November 2004 to December 2005, over 280,000 people have visited the HSBC TreeTop Walk.







### **Make Nature Reserves More Accessible**

A major challenge for land-scarce Singapore is the dilemma of competing land use. The Nature Reserves are Singapore's natural heritage and must be protected. Yet the public feels that they should not be denied access to these reserves. To meet these competing needs, NParks is guided by the Nature Reserves Recreational Masterplan which seeks to accommodate the public's demand while protecting the native flora and fauna.

Under the Masterplan, core areas which are richest in biodiversity have been marked out for conservation and research only. These core areas were identified in 1997 after a comprehensive five year Nature Reserves Survey. The MacRitchie Forest, Bukit Timah Forest, and Nee Soon Freshwater Swamp, with 85% of the native flora and fauna, are top priority for conservation.

Recreational amenities and activities take place at the fringe of these core areas in order to minimise any impact to them. In addition, access to the fringe areas is carefully managed. An example is the meticulously designed HSBC TreeTop Walk, the free-standing suspension bridge connecting the two highest points in MacRitchie (Bukit Peirce and Bukit Kalang) which offers nature lovers a bird's eye view of the plants and animals under the forest canopy.

To minimise damage to the flora and fauna, restrictions were placed on the use of heavy machinery during the bridge's construction. Besides providing Singaporeans with another avenue of nature recreation, the HSBC TreeTop Walk gives researchers access to the forest canopy, an area where they previously could not reach.

### **Conserve nature areas**

In addition to the gazetting of the four Nature Reserves in the Master Plan, 18 Nature Areas were listed in the Special and Detailed Controls Plans (which accompany the Master Plan). Should there be plans to develop these areas, special consideration must be given to the existing biodiversity there.

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“Exploring nature is like playing a new piano piece. Every new venture brings new experiences, challenges, emotions and wonders. Moreover, it's a joy to get people to appreciate nature's own music.”

**MS JACQUELINE LAU**  
Undergraduate

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NParks also carries out reforestation in Sungei Buloh Wetland Reserve, Pulau Ubin and Central Nature Reserves. With the help of the volunteers, community, schools and private companies, NParks have reforested 71.6 hectares of land since 2004.

NParks has started to work with stakeholders on the Plant Conservation Strategy. Under this programme to conserve and propagate rare and endangered indigenous plants, 102 species of native plants, comprising seeds, seedlings, saplings, cuttings and fruits have been cultivated. These species include *Dolichandrone spathacea* (with 1000 saplings planted in Telok Blangah, 50 in Pulau Ubin and 50 in Sungei Buloh) and *Bruguiera sexangula* (with 61 saplings planted at Pasir Ris Park mangrove and 20 in Pulau Ubin).

Sisters Islands are captured in the Special and Detailed Controls Plans as a Marine Nature Area. NParks, working with the Blue Waters Volunteers, monitors the health of the coral reef there.

### **Know our biodiversity**

Corporate sponsorship, has provided the funds to implement educational and outreach projects. These programmes were carried out by volunteers and students at Sungei Buloh Wetland Reserve, Bukit Timah and Central Catchment Reserves and Pulau Ubin.

### **Reforestation and Reach Out Programme**

All 48 students knew exactly what they had to do – learn all about wetland habitats; produce educational materials; and get their peers to participate in a reforestation exercise near the Outdoor Classroom at Sungei Buloh Wetland Reserve.

That was in August 2004, and over the next 8 months, these participants of the Reforestation & Reach Out programme learnt everything about plants in wetland habitats. They also successfully persuaded 150 of their peers to join in the reforestation effort where they transformed the 0.75 ha plot into distinct habitats with diverse native plants.

Along the way, they came up with creative ways to share nature with others – by developing card games, word puzzles, riddles and a boardgame to make learning fun.

"Being part of this team of young nature ambassadors has made me more determined to continue walking down this road of nature conservation in Singapore" said Ada Yen, 16, of Naval Base Secondary School.

At the Project Celebration event on 23 April 2005, Mr Kohei Yamada from Toyota, the programme's sponsor said, "Here at Sungei Buloh Wetland Reserve, the Outdoor Classroom facilitates outdoor learning through exploring the various habitats and engaging in educational games."

To view the works of the students, visit [www.sbwr.org.sg](http://www.sbwr.org.sg). For information on the Outdoor Classroom and upcoming programmes, call 67941401.





Together with the Blue Water Volunteers, NParks has also conducted coral reef surveys in the southern islands of Pulau Jong, Pulau Hantu, Pulau Semakau and Kusu Island. Findings from these surveys are being managed by NParks, and will eventually form part of the database at the National Biodiversity Reference Centre. Similar biodiversity surveys have also been conducted in places like Punggol, Seletar Airbase, Bidadari Cemetery, Tuas and Khatib Bongsu.

#### **Create a biodiversity hub**

Collaboration amongst public agencies, academic institutions, non-government organisations and individuals has led to greater sharing of information and expertise in the management of biodiversity-rich areas. An example of such collaboration is the management of visitors to Chek Jawa, and the formulation of its masterplan for amenities.

### **REVISED TARGET**

While existing targets remain relevant, one of them has been expanded. The target – "To Put in Place New Parks and Park Connectors" has been enlarged to read "To Establish More Parks and Green Linkages". This takes into account other "green corridors" developments, such as the proposed Bukit Timah Nature Reserve and the Central Catchment Nature Reserve ecological link.

### **KEY THRUSTS AND PROGRAMMES**

#### **Conserve nature areas**

NParks and the relevant agencies will continue to rehabilitate, enhance and manage our indigenous ecosystems. This includes identification of areas that require rehabilitation, negotiation for sponsorship and co-ordination of volunteers to carry out the work.



Under the SGP 2012 online survey, an overwhelming majority agrees that conserving our natural heritage is important.



#### **Make parks and nature accessible**

The development of park connectors will be stepped up so that the public will find it even easier to get to parks and nature areas. Users can now cycle or walk from Pasir Ris Park to Bedok Reservoir Park to East Coast Park. Currently more park connectors are being developed and in 10 years' time, Singapore residents can enjoy 170km of park connectors linking up parks and gardens all over the island. In addition, a feasibility study on the ecological link between the Bukit Timah and Central Catchment Nature Reserves is being conducted.

Together with the Public Utilities Board, NParks will be looking to re-landscape water bodies like reservoirs, rivers and canals through means such as planting trees and flowers in the surrounding areas as well as to liven things up through activities that are compatible with the surrounding environment.

### **Know our biodiversity**

The community will be more aware of nature's importance through initiatives like exhibitions, road shows and the publication of a "Nature Map". The Red Data Book on endangered plants and animals in Singapore will also be updated. This book will enable students and researchers etc to appreciate and better understand the conservation status of our indigenous plants and animals.

Community Development Centres and other grassroots organisations will be invited to participate in reforestation, educational and outreach activities in our parks as well as during annual events such as Clean and Green Week.

### **Create a biodiversity hub**

The soon-to-be-set-up National Biodiversity Reference Centre will provide one-stop information on biodiversity for researchers, students, teachers and the public. A comprehensive website on our biodiversity and their status, a platform for the public to discuss rare plant and animal sightings, and collaborative projects on biodiversity involving volunteers, non-government organisations and research institutions are being planned.

## **Summary of Conserving Nature Targets and Key Thrusts**

### **Targets**

- **Keep nature areas for as long as possible.**
- **Verify and update information on indigenous flora and fauna through biodiversity surveys.**
- **Establish more parks and green linkages.**
- **Set up a National Biodiversity Reference Centre.**

### **Key Thrusts and Focus**

#### **Conserve nature areas**

- Conserve our biodiversity
- Monitor and update our biodiversity information

#### **Make parks and nature accessible**

- Put in place new parks and park connectors

#### **Know our biodiversity**

- Promote nature awareness

#### **Create a biodiversity hub**

- Set up a National Biodiversity Reference Centre (NBRC)
- Collaborate with research institutions

# A HEALTHY LIVING ENVIRONMENT

A country's sustainability does not depend only on what it has – it depends also on what it does not. Infectious diseases, unsafe food and poor hygiene are what it can well do without. In this regard, Singapore spares no effort or expenses in keeping these scourges at bay. Through our public health efforts, we have made Singapore clean and hygienic, and have plans in place to ensure that this pristine image is maintained for years to come.

Hence we maintain a constant vigil over the state of our public health and are always equipped to respond swiftly to outbreaks of vector-borne (diseases spread by animals or insects to humans) and food-borne diseases.

Such vigilance has served us well. Vector-borne (e.g malaria, leptospirosis) and food-borne (e.g dysentery, cholera) diseases seldom rear their ugly heads, and when they do, are quickly eradicated. As a small country with a high population density and an urbanised setting, Singapore knows that complacency carries a high price. The rise in the number of dengue fever cases in Singapore and the region in recent years is a timely reminder that we must never let our guard down.

## ACHIEVEMENTS

### Vector control

While the ability to react swiftly to disease outbreaks is vital, it is equally important to take a proactive approach because it pre-empt the problem. To this end, the National Environment Agency (NEA) has a number of key preventive strategies:

- Prevent vector breeding;
- Reduce the population of vectors such as mosquitoes and rodents;
- Surveillance of existing and emerging vector-borne diseases;
- Conduct extensive research to improve vector control strategies; and
- Engage the community and professional bodies in our vector control efforts.

### Mosquito-borne diseases

Dengue fever/dengue haemorrhagic fever is still the primary vector-borne disease causing considerable public health concern in Singapore. It is transmitted by Aedes mosquitoes which breed in stagnant water commonly found in man-made containers such as flower pots.





Over the last two years, NEA has gone on the offensive to rid the Aedes mosquito of its breeding habitats with the number of premises inspected rising from 55,000 a month in 2004 to 59,000 in 2005.

Technology has also played an important role in the anti-dengue effort. Information obtained from the Geographical Information System enables the operations teams to target trouble spots and interrupt dengue transmission. A central command centre is in place to ensure that the information is coordinated and quickly disseminated to the operations teams on the ground.

The community has come out firmly on our side. To prevent mosquito breeding, NEA launched the 'Mozzie Attack' programme in April 2004 together with grassroots organisations and Community Development Councils (CDCs). By June 2005, the country's 84 Citizens' Consultative Committees (CCCs) had their own 'Mozzie Attack' programmes, where volunteers organised exhibitions, door-to-door visits and talks to spread the message to residents. The number of dengue prevention volunteers also doubled to over 4,000 in 2005 from the 2,000 in the previous year.

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“People don't realise the seriousness of dengue until they get it. Education is very important. That is why I've been going from house to house in my neighbourhood for the past six years, telling people about mosquito breeding and how they can prevent it.”

CYNTHIA TEO, 40  
Dengue Prevention Ambassador with NEA

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In September 2005, the Government launched 'Campaign Against Dengue' to raise awareness and rally people behind the anti-dengue fight. Every household received the '10-Minute Mozzie Wipeout' pamphlet on basic measures to take against mosquito breeding.

These pamphlets also reached shipyard workers, construction workers, factory workers and foreign domestic workers (with the support of our 3P Partners such as the National Trades Union Congress, Singapore Contractors Association Limited, and Ministry of Manpower). NEA also worked with teachers to reach out to students from pre-school to tertiary institution level.

In addition, carpet-combing operations<sup>1</sup> in over 10,000 HDB blocks and private estates in the country's 84 constituencies saw the eradication of more than 1,000 mosquito breeding sites and the identification of 8,500 potential breeding spots. The operations were supported by

<sup>1</sup>The NEA carried out a series of carpet-combing operations in September and October 2005 where many volunteers were mobilised to search and destroy potential mosquito breeding sites in public areas.



volunteers from the Public Utilities Board (PUB), Land Transport Authority (LTA), Singapore Civil Defence Force (SCDF), Singapore Soka Association (SSA), Singapore Pest Management Association (SPMA), Housing Development Board (HDB), Town Councils, Altwater Jakob Pte Ltd, FME Onyx Pte Ltd, SembWaste Pte Ltd, Sembawang Air Base, and German European School.

The blitzkrieg had its desired effect. The number of dengue cases per week fell from a high of 713 in September 2005 to 62 in January 2006.

### **Rodent-borne diseases**

The rat, another vector that thrives on poor housekeeping and improper disposal of food waste, was the next target. With their ability to spread diseases like salmonellosis, and leptospirosis, NEA was taking no chances in denying rodents food and nesting places.

In 2004, NEA launched the 'Rat Attack' pilot project to encourage personal and community ownership of the environment amongst Singaporeans. Five sites and Town Councils participated in this pilot project and at the end of it, all achieved perfect scores of "zero burrows" where no rat burrows were found during the period of the pilot project. Based on this project, a model for sustainable rodent control in all Town Councils is being institutionalised, with the 2-year programme starting in 2005.

### **Research on vectors and their diseases**

If research is a key weapon in the battle against vectors, then the Environmental Health Institute (EHI) is the sharp end of that spearhead. Since its inception in April 2002, EHI's research on cost-effective disease prevention and control measures has reaped significant results. One of them is the successful development of "Saliva Early Dengue Diagnostic Tool". It won the third prize in the PS21 Excel Convention in 2005 and is currently being commercialised. Another tool developed is "PCR for early detection of Dengue". The protocol has been shared with local hospitals for their laboratory diagnosis. EHI is also filing patent for a test that was developed to determine the virus serotype that caused past dengue fevers.

New tools for vector control and monitoring are constantly being developed and refined at the institute. One example is the Gravitrap, one of several patents EHI has filed since its inception. This is an improved version of the Ovitrap. However, the Gravitrap which captures adult females in addition to larvae, is user-friendly, and is relatively inexpensive to produce. Testing of larvicides, such as environmentally friendly Bti, and adulticides used in mosquito control, were carried out both in the laboratory and in the field. Results have been shared with pest control companies to guide their choice of chemicals.

With its relocation to the Biopolis in 2005, EHI is now equipped with laboratories of Biosafety Level 3 and Arthropod Containment Level 2. The former allows surveillance of viruses such as West Nile and Japanese Encephalitis<sup>2</sup>, while the latter enables research that helps us to understand the interaction between viruses and mosquito vectors.

<sup>2</sup>West Nile and Japanese Encephalitis are transmitted by mosquito vectors.



In the recent SGP 2012 online survey, about 81% of the respondents want to be involved in the fight against mosquito breeding that can cause dengue.

## FOOD HYGIENE AND CONTROL

With over 16,000 eateries in this food-loving country, NEA's stringent monitoring of hygiene standards makes eminent sense. Its measures at encouraging good food hygiene practices at food outlets include stringent licensing<sup>3</sup> (regular inspections, rigorous enforcement and extensive public education). These have led to a generally low incidence of food-borne diseases here.

### Foodshop Grading System

Every foodshop is graded according to the merits of its housekeeping, cleanliness, pest infestation, food hygiene as well as the personal hygiene of its handlers. Although the grade does not reflect how palatable the food is, it indicates the standard of its hygiene and allows customers to decide if they should eat there.



Latching on the success of this grading system, the NEA subsequently introduced the Straight A's Programme. Through this self-regulating programme, NEA works with food court and canteen managers to enhance food hygiene standards at air-conditioned food courts and school canteens. This programme is a self-check system of regular audits and reviews for stall operators to track their own performance.

### Hawker Centres Upgrading Programme

The Hawker Centres Upgrading Programme (HUP) is a 10-year scheme (launched in 2001 and scheduled to be completed by 2010) to provide upgrading for the 109 hawker centres in Singapore without destroying their unique character. These upgrading works include re-tiling, enlarging stalls, improving toilets and refuse bin centres, as well as overhauling ventilation, electrical, exhaust and plumbing systems. So far, these have resulted in 47 (as at 31 December 2005) cleaner, brighter, airier and better-maintained hawker centres.

## SANITATION AND HYGIENE

To keep the country clean and green, various initiatives have been implemented.

### Environmental Cleanliness

A comprehensive public cleansing system ensures that streets, sidewalks and other public places are kept clean. For some years now, NEA has been using mechanical road and pavement sweeping machines to clean the streets and sidewalks.

In terms of public education, NEA launched the "Singapore, Litter-Free" campaign in 2002 to encourage event participants to keep the site litter-free by disposing litter into bins. Large-scale public events with this litter-free message include the National Day Parade, World of Music and Dance (WOMAD), and Singapore River Regatta.

<sup>3</sup>Foodshop licence applicants need to meet certain guidelines including fulfilling the eligibility criteria and health requirements etc before a foodshop licence application is approved.

# Its measures at encouraging good food hygiene practices at food outlets include stringent licensing (regular inspections, rigorous enforcement and extensive public education).

This campaign also reaches the young through primary schools, 119 of which have pledged their participation in the programme.

Finally, NEA has an enforcement regime to take action against a small minority who continue to litter despite every advice.

## **Public toilets**

The cleanliness of public toilets is another area of focus. Extensive public education efforts over the years culminated in 2002 with the launch of the Toilet Upgrading Programme (TUP) which gave over 800 coffeeshops the opportunity to upgrade their toilets, with NEA providing a maximum subsidy of \$5,000.

By the end of the TUP in 2004, a total of 476 coffeeshops had participated in the programme, while another 329 coffeeshop owners had upgraded their toilets at their own expense. This means that 805 or nearly 80% of public toilets in coffeeshops had been upgraded, and the upshot of this is cleaner toilets that are no longer shunned by the public.

Initiated and launched by the Restroom Association of Singapore (RAS) in 2003, the Happy Toilets Programme is a recognition scheme that aims to raise the standards of public toilets by awarding three- to five-star ratings to public toilets that have met the criteria of design, cleanliness and daily maintenance.

This programme has since been extended to schools. The Happy Toilet School Education programme, besides rating school toilets, also inculcate in our young social responsibility and personal hygiene through teachings in the etiquette of toilet use.

## **NEW TARGETS**

The key targets in the SGP 2012 on Public Health have been revised as follows:

- (i) Increase community ownership to sustain a high standard of public health.
- (ii) Singapore to become a leading regional centre in epidemiological surveillance and research on vector-borne diseases.
- (iii) Maintain low incidence of vector-borne and food-borne diseases.

## KEY THRUSTS AND PROGRAMMES

### Ownership through improved hygiene habits and practices

- **'Campaign against dengue', '10-minute Mozzie Wipeout'**

Since mid-September 2005, NEA has worked with several 3P partners (e.g People's Association, Ministry of Manpower and National Trades Union Congress), to reach out to:

- residents in HDB households, landed homes and condominium estates
- JTC and HDB industrial tenants
- shipyard, construction and foreign domestic workers
- students from pre-schools, primary, secondary, junior college and tertiary institutions

NEA will continue to target our dengue prevention outreach programmes at households, workers and employers as well as schools. This will help to instil commitment to good habits and develop a sense of community ownership.



- **Public toilets**

- To upgrade the standard of public toilets, NEA will continue to work with Restroom Association of Singapore (RAS) to promote:
  - i. Happy Toilets Programme for schools (Childcare, Primary and Secondary levels)
  - ii. Happy Toilets Programme for public toilets (e.g hawker centres)

RAS will also be developing a job redesign programme for toilet cleaners that will empower them to better clean, maintain and manage public toilets. The Happy Toilet Programme benchmarks will be incorporated as the de facto standard.

To develop better programmes to meet the needs of the public, NEA also conducts surveys to assess their behaviour when using public toilets. This will enable the development of new educational materials on areas that need improvement.



- **Environmental cleanliness**

Refraining from littering is central to the concept of environmental ownership. Littering dirties the place, chokes up drains and provides fertile breeding grounds for vectors to breed. Through the joint participation of event organisers and schools, NEA will continue to promote 'Singapore, Litter-free' messages to the masses and students.

## **Control of vectors and prevention of vector-borne diseases**

- **Enhance surveillance to minimise diseases caused by vectors such as mosquitoes and rodents**

NEA will continue to work on specific projects involving mosquito and viral surveillance to detect changes in trend or distribution so as to initiate investigative or control measures before any potential outbreaks. Some programmes include:

- Develop an outdoor index to complement current house index as an indicator of mosquito population<sup>4</sup>.
- Develop an ovitrap and/or gravid trap index as an early warning system for the increase in mosquito population<sup>5</sup>.
- Serotyping of the Dengue virus in patient samples to determine the predominant circulating serotype.

NEA's surveillance work also involves the surveillance of pathogens in rodents and cockroaches<sup>6</sup>.

- **Carry out research to enhance vector control methods and understanding of vector behaviour**

NEA has initiated several projects that seek to understand the *Aedes* vector and to develop new vector control measures. These projects include:

- Further the understanding of mosquito breeding habits in potential outdoor habitats.
- Study the role of *Aedes albopictus* in dengue transmission in Singapore.
- Carry out efficacy and resistance testing on the effectiveness of insecticides for mosquito control.
- Evaluate the effectiveness of local fogging methodology (working in partnership with the Singapore Pest Management Association).

- **Development of early diagnostic tools for vector-borne diseases**

- NEA is commercialising the EHI-developed tool for saliva testing of IgA<sup>7</sup>.

<sup>4</sup> The practice of using House Index (HI) to pre-empt dengue cases may not be sufficient now, due to changes in housing type and sustained good indoor source reduction. Having an outdoor index to measure breeding in sources outside the home, coupled with the use of HI, may give a more accurate reflection of the mosquito breeding situation.

<sup>5</sup> The "Ovitrap" is a device that was designed to trap eggs laid by female *Aedes* mosquitoes, while the newer invention of the 'Gravid trap' is designed to trap not only the eggs, but the female adult as well. A pilot project involving the traditional ovitraps has already started in the Marsiling HDB estate, while production of the "Gravid trap" (lethal ovitrap) for field testing is in progress.

<sup>6</sup> A 'pathogen' is a micro-organism that can cause disease. Rodents and cockroaches are effective vectors of such pathogens.

<sup>7</sup> Taking saliva sample is non-intrusive, and the IgA test is relatively inexpensive. Together, this form of sampling and the test could make it an attractive tool for dengue diagnostics.



- **Carry out epidemiological research to understand factors influencing vector-borne disease transmission**

These epidemiological research projects are designed to provide a better understanding of the possible reasons behind the recent outbreak:

- Seroprevalence study to determine the population exposure to dengue infections (In collaboration with MOH)
- Seroepidemiological study to determine the clinical spectrum of dengue infections (In collaboration with MOH)
- Sequencing and characterisation of Dengue virus

- **Upgrade the professionalism of pest control industry**

NEA has been holding regular dialogue sessions with the Singapore Pest Management Association (SPMA) on the development of a skills-upgrading scheme based on the National Skills Recognition System (NSRS). NEA is working with SPMA to encourage more industry players to send their staff for skills-upgrading under the NSRS. SPMA had since launched an industry-initiated Skills-Upgraded Recognition Scheme which encourages the pest management industry to upgrade their staff through NSRS. As at 15 June 2005, a total of 14 companies have been recognised by SPMA for their active participation in NSRS.

- **'Rat Attack'**

The model of sustainable rodent control in all Town Councils (TCs) is being institutionalised after a successful trial in five TC estates. At the initial stage of this 2-year programme, the pest management companies will conduct a survey to assess the existing level of rodent infestation as well as identify the problems of environmental sanitation and refuse management that contributes to it. This will be followed by a 3-month Attack Phase to reduce the rodent population. A 21-month Maintenance Phase will follow, during which the rodent population will be monitored and control measures will be carried out to ensure that the TC estates remain rodent-free.

- **'Mozzie Attack' Plus**

To complement the 'Mozzie Attack' programme, a new action plan called 'Mozzie Attack' Plus was implemented. This involved professional pest control companies carrying out mosquito control programmes in all Town Councils. These programmes include regular checks on potential mosquito breeding areas and actions such as asking residents to remove stagnant water from containers in their homes.

In addition, Town Councils and Condominium management are encouraged to adopt Technical Reference (TR) 18 in their contracts. This technical reference will help users to develop more cost-effective vector control works and prescribe a framework to assess the performance and competence of their service providers. For example, the technical reference includes a schedule of potential breeding sites and the recommended checking frequency. TR 18 also contains a checklist for TCs to assess the performance of service providers.



## Monitor and improve indoor air quality in public places

- **Review of Indoor Air Quality (IAQ) guidelines**

NEA is participating in a review of the present IAQ Guidelines for Office Premises. Led by MOM and NUS, a Technical Reference or Singapore Standards Code of Practice on IAQ is being developed under SPRING Singapore's Singapore Standards Programme.

NEA will also work with other agencies (e.g MOM, NUS and ASHRAE) to conduct training for IAQ personnel and facility managers to improve their building management skills.

## Summary of Public Health Targets and Key Thrusts

### Targets

- Increase community ownership to sustain a high standard of public health.
- Become a leading regional centre in epidemiological surveillance and research on vector-borne diseases.
- Maintain low incidence of vector-borne and food-borne diseases.

### Key Thrusts and Focus

#### Ownership through improved hygiene habits and practices

- Improve cleanliness and hygiene of public places

#### Control of vectors and prevention of vector-borne diseases

- Improve vector control methods and understand vector behaviour through R&D
- Partner the community to lower occurrences of vector-borne diseases through public education and raising public awareness

#### Monitor and improve Indoor Air Quality (IAQ) in public places

- Upgrade and enhance recommended best practices, and train IAQ personnel and facility managers to improve building management skills
- Survey and conduct research to create a healthy indoor environment

# INTERNATIONAL COOPERATION

Singaporeans enjoy a clean environment and a high standard of public health and the country's excellent track record in managing environmental challenges over the years has earned it numerous international accolades. The Hong Kong-based Political and Economic Risk Consultancy (or PERC) rates Singapore as one of Asia's best environmental performers.

We are keenly aware that many of today's environmental issues are transboundary in nature and can only be resolved through close international cooperation. We are therefore committed to joint efforts at addressing such challenges through activities like participation in international fora and multilateral environmental agreements. We value our relationship with our partners, and will continue to work with them at bilateral, regional and international levels in our pursuit of sustainable development.

As we move to the next phase of the implementation of the Singapore Green Plan (SGP 2012), we will be expanding beyond the existing areas of "Relations Enhancement" and "Capacity Building", to include "Industry Partnership" and "Community Partnership".

## **RELATIONS ENHANCEMENT** **Boosting international cooperation**

### **Multilateral Environmental Agreements**

As a responsible global citizen, Singapore is party to a number of multilateral environmental agreements, on issues such as ozone layer protection, mitigation of climate change, control of hazardous chemicals and wastes, and the preservation of plant and animal life. On 24 May 2005, Singapore ratified the **Stockholm Convention on Persistent Organic Pollutants** and acceded to the **Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade**. These underscored Singapore's commitment towards the sound management of chemicals.









### **Stockholm Convention on Persistent Organic Pollutants**

Persistent organic pollutants (POPs) are chemicals that resist degradation and pose long-term risks to people and wildlife. The Stockholm Convention aims to control the production and use of all manufactured POPs, which are certain highly toxic industrial chemicals and pesticides. It also seeks the continued minimisation and, where possible, the ultimate elimination of POP releases like dioxins and furans, which are by-products of urbanisation.

On its part, Singapore has since 1980 banned the use of POP industrial chemicals and pesticides. Air emission standards have also been introduced under the Environmental Pollution Control (Air Impurities) Regulations 2001 to limit dioxins and furans releases.

### **Rotterdam Convention on 'Prior Informed Consent' Procedure for Certain Hazardous Chemicals and Pesticides in International Trade**

The Rotterdam Convention obliges parties to observe a legally-binding procedure, whereby exporting countries must obtain the 'Prior Informed Consent' of the importing countries before they can export the controlled hazardous chemicals to them. Currently, the Convention regulates 39 hazardous chemicals comprising 28 pesticides and 11 industrial chemicals, some of which are POPs. These chemicals are also subject to controls under Singapore's Environmental Pollution Control Act and its Regulations.



## **Enhancing regional cooperation**

### **ASEAN Transboundary Haze**

At the regional level, Singapore strives to strengthen its environmental collaboration with other countries through the ASEAN framework. These efforts include Singapore's hosting of the ASEAN Specialised Meteorological Centre (ASMC), which uses advanced tools and technology to provide weather information and forecast to serve as an early warning system for imminent land or forest fires in the region. The ASMC Intranet also provides daily updates on the location of hotspots in the region. In addition, Singapore also sends high-resolution satellite pictures and hotspot coordinates to the affected countries to help them locate the fires more effectively. In August 2005, Singapore helped combat the haze by sending aircraft to Indonesia on a cloud seeding mission. A contingent of 54 men, transport vehicles and firefighting equipment were also despatched to fight fires in Riau, Indonesia.

### **Regional Environmentally Sustainable Cities Programme (RESCP)**

To promote capacity building as well as sharing of best practices among ASEAN countries, a workshop on Environmentally Sustainable Cities (ESC) was held in December 2003 in Singapore to develop a



# The Framework addresses challenges to environmental sustainability from a regional perspective in the areas of clean air, clean water and clean land.

“Framework for Environmentally Sustainable Cities in ASEAN”. The Framework addresses challenges to environmental sustainability from a regional perspective in the areas of clean air, clean water and clean land. The Framework also provides recommendations and best practices garnered from the experiences of ASEAN countries, and serves as a basis to promote stronger partnerships amongst governments, the private and people sectors as well as international agencies. This Framework was endorsed by the ASEAN Environment Ministers at the 9th ASEAN Ministerial Meeting on the Environment (AMME) held in Yangon, Myanmar, on 17-18 December 2003.

In October 2004, Singapore, together with the ASEAN Secretariat and several international organisations, organised a conference on Environmentally Sustainable Cities in ASEAN for the participating cities to develop a list of environmental best practices in clean air, clean water and clean land. A workshop was also held in December 2005, in Jakarta, to develop a set of key performance indicators for clean air, clean water and clean land.

## Strengthening bilateral cooperation

At the bilateral level, Singapore works with other countries to address common environmental problems through dialogue sessions, consultations, training programmes and information-sharing. Besides learning from each other, such activities also facilitate the transfer of environmental technology.

An example of Singapore’s close relationship with neighbouring countries is the signing of a Memorandum of Understanding on environmental cooperation with Negara Brunei Darussalam in August 2005. It signifies both countries’ desire to foster closer partnership and cooperation in environmental protection and management.

Singapore also enjoys close relations with its neighbours Malaysia and Indonesia. Exchange of visits with these countries are made on a regular basis to facilitate discussion on various environmental issues.

## Germany-Singapore Environmental Technology Agency

The Germany-Singapore Environmental Technology Agency (GSETA) was set up in 1991 under a bilateral arrangement to facilitate the transfer of environmental expertise from Germany and Europe to the Asia-Pacific region. It is jointly administered by Singapore’s Ministry of the Environment and Water Resources (MEWR) and Germany’s Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). GSETA-organised events have served as a useful platform for Asia-Pacific countries to discuss environmental protection strategies and policies. So far, GSETA has organised 17 regional events on a wide range of environmental issues such as waste minimisation, used water management, solid waste treatment and disposal, and ISO 14000.





### Lending a Hand

The devastating tsunami disaster of 26 December 2004 galvanised Singaporeans into action and they contributed generously to the victims. Among the contributions was drinking water which was packaged and sent to the tsunami-hit areas. As part of Singapore's reconstruction and aid package, it helped Maldives to build a seawater desalination plant which was handed over to the Maldivian authorities in February 2005.

“As a small country, Singapore’s contribution can only be a trickle in the ocean of assistance needed to help reconstruct the affected areas. However, there are areas where we can make an immediate but lasting difference.”

**DR YAACOB IBRAHIM**

Minister for the Environment and Water Resources  
at the handover of the PUB desalination plant to the Maldives 22 Feb 05



The Asia-Pacific regional seminar on “Sustainable Water Management: The Way Forward” is typical of such GSETA events. Held in November 2005, the seminar saw lively participation by some 70 experts, delegates, industry players and government officials from Germany, Singapore and 15 other economies in the Asia-Pacific region.

### CAPACITY BUILDING

Sharing Singapore's experience in environmental problem-solving is a key aspect of the SGP 2012. The republic contributes by holding courses and seminars to facilitate the transfer of environmental knowledge and best practices worldwide. For example, the Singapore Environmental Institute (SEI) has:

- Conducted 23 courses for officers from other countries since its inception in February 2003.
- Trained about 400 government officials from these countries.
- Partnered 8 international organisations such as the United Nations Development Programmes (UNDP), in running programmes for small developing island states

### WaterHub

Set up in December 2004, the Public Utilities Board's WaterHub is part of Singapore's efforts at sharing its expertise on water-related services and technologies with the region. WaterHub functions as an institute where the learning, technological development, and networking of the water industry take place under one roof. WaterHub also brings together local and international water companies, water authorities and public sector agencies for seminars, training courses, symposiums and exhibitions.

## TARGETS

In terms of international cooperation on the environment, Singapore will continue to:

- Work with its ASEAN neighbours on common environmental concerns;
- Enhance its capacity-building partnerships with other developing countries;
- Intensify collaborative efforts with partners at regional and global levels to tackle environmental challenges;
- Stay committed to international environmental efforts and obligations under international environmental treaties.

## KEY THRUSTS AND ACTION PROGRAMMES

### Relations enhancement

#### • International Organisations

Singapore recognises the importance of working closely with international organisations on environmental issues. A case in point is our partnership with the United Nations Environment Programme (UNEP) to host the presentation ceremony of its annual global environmental award – the Champions of the Earth – from 2006 to 2008. The award is presented to outstanding personalities or bodies that have made significant contributions to the global environment. UNEP explained that they chose Singapore as the venue because it is “an inspiration to nations striving to achieve the goal of sustainable development”.

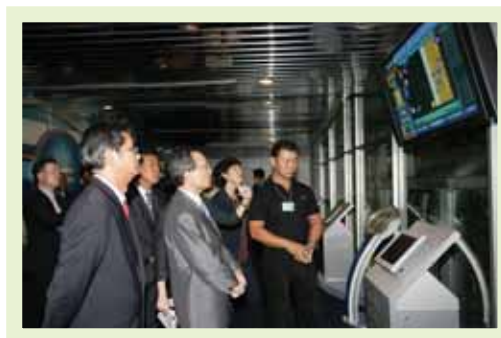
#### • Multilateral Environmental Agreements (MEAs)

Singapore is committed to fulfil its MEA obligations and will continue to support efforts to raise popular awareness of such agreements. For example, Singapore is signatory to the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). To help raise public awareness of CITES, we have plans to host an exhibition on wildlife trade and biodiversity conservation.

#### • ASEAN Initiative on Environmentally Sustainable Cities (AIESC)

Singapore spearheads regional efforts to implement the ASEAN Initiative on Environmentally Sustainable Cities (AIESC), which is a movement for ASEAN participating cities to strive for environmental sustainability. The AIESC replaces the Regional Environmentally Sustainable Cities Programme (RESCP) and was officially launched in September 2005 in Manila. AIESC promotes environmental cooperation and the transfer of expertise among ASEAN cities. Singapore also chairs the ASEAN Working Group on Environmentally Sustainable Cities (AWGESC).

Singapore will also facilitate linkages among ASEAN participating cities and their collaboration with partner countries (China, Japan and the Republic of Korea), ASEAN dialogue partners, and international organisations<sup>1</sup>. The relevant partners will help to identify priority areas for the participating cities and work bilaterally with them to carry out projects in clean air, clean water and clean land. Research efforts are also explored to study the environmental needs of regional cities. AIESC will be implemented through an ASEAN Network on Environmentally Sustainable Cities. (<http://www.aseansec.org/aiesc.htm>). A total of 24 cities in the 10 ASEAN countries are currently participating in the AIESC.



<sup>1</sup>These include organisations such as the US Agency for International Development, the US-Asia Environmental Partnership, United Nations Development Programme, United Nations Environment Programme, Hanns-Seidel Foundation and the Deutsche Gesellschaft für Technische Zusammenarbeit, etc.

Singapore is also keen to promote research and development in environmental technologies. Through programmes such as the use of public infrastructure for test-bedding and funding assistance, Singapore hopes to attract leading companies and researchers in the environmental field.

### Capacity building

- **Singapore Environmental Training Programme (SETP)**

Singapore's sharing of environmental experience with other developing countries is an integral part of its contribution towards global sustainable development. The Singapore Environmental Training Programme (SETP), spearheaded by the Singapore Environmental Institute (SEI), co-ordinates the training programmes of various institutes for overseas participants. In October 2005, a Memorandum of Understanding (MOU) on the SETP was signed which sets the stage for partners of the SETP to collaborate and jointly participate in exhibitions, conferences and seminars on environmental issues.

There are plans in the pipeline for the partners (such as local institutions and government agencies) to develop a new programme in 2006 on Environmental Experiential Learning, which not only showcases NEA's installations such as Hawker Centres, Semakau Landfill, Incineration Plants and Regional Offices, but also the various educational institutions and environmental research laboratories.

Singapore will also continue to share its environmental experience and best practices through initiatives such as the Singapore Cooperation Programme (SCP), the Third Country Training Programme (TCTP) and the Small Island Developing States Technical Cooperation Programme (SIDSTEC).

### Industry partnership

- **Singapore as an environmental and water technology hub**

Singapore strives to be a venue of choice for staging international environmental events. Such events provide the platform for stakeholders to network and forge partnerships. In 2005, Singapore hosted the International Desalination Association's World Congress, the International Water Association's Asia Pacific Group Regional Conference, and the World Hydrogen Technologies Convention. There are also plans to hold a mega environmental conference in Singapore by the end of 2007.

Singapore is also keen to promote research and development in environmental technologies. Through programmes such as the use of public infrastructure for test-bedding and funding assistance, Singapore hopes to attract leading companies and researchers in the environmental field.

These initiatives help to position Singapore as the hub for environmental and water technology in this region.



## Community partnership

### • Engaging the Youths

Singapore also aims to promote greater awareness about international environmental issues among the young. There are plans in 2006 and 2007 for local organisations such as the National Environment Agency and the National Youth Achievement Award Singapore (NYAA) to partner overseas institutions like the UNEP to jointly host conferences for youths to discuss environmental sustainability issues. These events will be the ideal platform for our youths to network with their counterparts and experts from other countries.

## Summary of International Environmental Relations Targets and Key Thrusts

### Targets

- Continue to work closely with ASEAN neighbours on common environmental concerns.
- Enhance capacity-building partnerships with other developing countries.
- Intensify collaboration with partners at regional and global levels to tackle environmental challenges.
- Remain committed to international environmental efforts and obligations under international environmental treaties.

### Key Thrusts and Focus

#### Relations enhancement

- Participate in international environmental agreements, and their activities and programmes
- Seek opportunities for greater collaboration with our international partners

#### Capacity building

- Share Singapore's environmental experience to contribute towards global sustainable development.

#### Industry partnership

- Profile Singapore as an attractive venue for water and environmental events

#### Community partnership

- Promote awareness of environmental issues among the youths





# CONCLUSION

Singapore has achieved good environmental standards that have resulted in a high quality of life for Singaporeans and contributed to our sustainable development. Our clean and green living environment is often cited by people and businesses as a factor that they appreciate most about our country.

The revised SGP 2012 represents a framework that allows us to continue working towards environmental sustainability. It also highlights our long-term commitment to make Singapore a clean and green city where everyone enjoys a quality living environment.

The environment is dynamic, requiring us to constantly adapt our strategies to stay ahead of the challenges. For Singapore which lacks natural resources of any manner, sustainability means being prepared for and putting in place policies and programmes to overcome any new challenges. This includes being at the forefront of experimentation and innovation and leveraging on technology to boost our capabilities. We will continue to learn from the experiences of others and discover innovative solutions for our environmental challenges. Research and innovation will go hand in hand with resource conservation and environmental protection.

Close partnership among the public, private and people (3P) sectors is pivotal to our drive for environmental sustainability. Every individual, organisation and company can make a difference to the environment in the choices and decisions that they make every day. We will tap on the expertise and passion of our 3P sectors for win-win solutions to ensure that the three pillars of sustainable development (economic development, social progress and environmental sustainability) remain robust and strong.

With environmentally-friendly efforts, partnerships, and innovations, we can be confident that tomorrow's generation will continue to enjoy a clean and green environment.

# THE THREE-YEARLY REVIEW OF THE SINGAPORE GREEN PLAN 2012 ANNEX

## (A) BACKGROUND

### Objectives

The three-yearly review of SGP 2012 aims to:

- a) **Re-look and enhance SGP 2012 action programmes**, revise targets where necessary, particularly in the areas of air and climate change, clean land, nature and public health, and water, with active contribution and inputs from key groups of the 3P (people, public and private) sectors;
- b) **Consult at least 5,000 Singaporeans in the review process**, involve especially key groups from the 3P sectors - industry associations, businesses, non-government environmental organisations, government officers of other agencies, academics, interest groups, youths and the community; and
- c) Heighten awareness and understanding of the current and emerging environmental issues concerning Singapore. **Provide opportunities for the key groups to shape major environmental policies.**

### Principles

To fulfill the objectives of the review, four principles guided the review process:

- (1) **Timely, accessible information:** Information was communicated regularly and was easily accessible through sustained media coverage (more than 30 media articles) and a dedicated SGP 2012 website since April 2005. The information shared was also easily understood. At the public forum and exhibition, about 70% of the participants and visitors indicated that they understood the key environmental issues better after attending these events.
- (2) **Inclusive:** To involve as many Singaporeans as possible, a wide range of opportunities was created for key groups to share their views (e.g. Internet survey, public forum, climate change roundtable, focus groups, public exhibition etc). So far, more than 17,000 Singaporeans have participated in the review, far exceeding our target.
- (3) **Representative:** To ensure key groups from the 3P sectors were involved in the process, we carefully selected and appointed three Focus Groups with a total of 60 representatives from these sectors for an in-depth study of environmental issues. We also invited a good balance of 3P sector representatives for the Climate Change roundtable and the public forum.

(4) **Closing the loop:** Consultation was two-way. Through face-to-face platforms like the Focus Groups, Climate Change roundtable and public forum, issues were explained and debated. Participants gained a better understanding of issues; environmental policies could also be improved with ideas from these platforms. Public feedback received from April to August was channeled to the Focus Groups for their consideration, to be included in their final recommendations where appropriate. Where public feedback received through the phone or email required clarification, MEWR would respond and explain the environmental policies or programmes.

## (B) CONSULTATION PLATFORMS

Consultation for the review was extensive in terms of depth and breadth:

- **In-depth consultation** through Focus Groups
- **Widespread consultation** through Internet survey, public forum, climate change roundtable, public exhibition etc

### i) In-depth consultation

Three Focus Groups were formed to study these areas in depth: Air and Climate Change, Water and Clean Land, Nature and Public Health. The three Focus Groups had a good mix of representatives from the people, public and private sectors, who were carefully selected and appointed. Each focus group was co-chaired by a prominent Private sector and a People sector leader, who facilitated the review and discussions. The co-chairpersons of the focus groups are:

<b>Focus groups</b>	<b>Co-chairpersons</b>
Air and Climate Change	<ul style="list-style-type: none"> <li>• Dr Geh Min, Nominated Member of Parliament and President, Nature Society Singapore</li> <li>• Mr Warren Fernandez, Foreign Editor, The Straits Times</li> </ul>
Water	<ul style="list-style-type: none"> <li>• Mr Lee Tzu Yang, Chairman of Shell Companies in Singapore and Vice President, Asia Pacific, Shell Global Solutions and Chairman, Water Network</li> <li>• Mr Eugene Heng, President, Waterways Watch Society</li> </ul>
Clean Land, Nature & Public Health	<ul style="list-style-type: none"> <li>• Mr Heng Chiang Meng, President, Singapore Environment Council</li> <li>• Ms Loh Wai Kiew, then-Chairman, Waste Management and Recycling Association of Singapore (WMRAS) and then-CEO, SembCorp Environmental Management</li> </ul>

A briefing was organised to share objectives and approach of the review with the co-chairpersons so that the focus group discussions could be effectively managed. A team of secretariats including MEWR officials and relevant government officials was appointed to support each Focus Group, to arrange discussions, provide clarifications and additional information for meaningful discussions.

Each of the Focus Groups deliberated over four months on proposals to enhance the action programmes and targets under SGP 2012. The Focus Groups also held separate discussions with industry and interest groups, exchanged views with the public on their interim ideas at a public forum, discussed the issue of climate change at a roundtable for opinion leaders, and studied the public feedback received.

The Focus Groups submitted their recommendations to the SGP2012 Co-ordinating Committee in August 2005 to MEWR. The Ministry studied their recommendations and incorporated those accepted into the revised SGP 2012.

#### ii) **Widespread Consultation**

To involve as many Singaporeans as possible, various opportunities were provided for the public to share their views:

- a. A dedicated **email and hotline** was set up for the public to write in or call with their suggestions and ideas, throughout the review. About 80 responses were received through these channels, all of which were acknowledged. Those requiring clarifications were attended to, while others were directed to the focus groups for their consideration.
- b. An extensive three-month **Internet survey** was carried out. 2,800 responded to at least 60 questions on a range of environmental issues. **The survey results showed strong public support for various initiatives (existing and new) aimed at enhancing our environment.** For example, an overwhelmingly high proportion of respondents supported the idea of making it compulsory for all household appliances to carry energy efficiency labels (93%). A high majority of respondents (94%) agreed that measures should be taken to encourage manufacturers to help reduce the amount of product packaging waste. Key survey results were shared with the public through the media.



- c. A **Climate Change Roundtable** was held on 24 May 2005. It helped to spotlight the issue and provided a platform for key opinion leaders from the industry, academia, green groups and other government agencies to discuss what more Singapore could do to address the problem. A comprehensive national climate change strategy is currently being developed by MEWR.
- d. Preliminary ideas of the focus groups were shared at a **public forum** on 27 July 2005. The forum was chaired by Dr Amy Khor, Government Parliamentary Committee Chairperson for National Development and Environment, with the six co-chairpersons of the Focus Groups as panel members. More than 200 members of the public attended the forum and contributed to a lively debate. This helped to strengthen the focus groups' recommendations and enhance understanding of the issues. About 70% of the participants said they understood the issues better after attending the forum.
- e. A **public exhibition**, "Our Environment Story" was launched by the Minister for the Environment and Water Resources on 28 October 2005. The Exhibition presents Singapore's environment story and key strategies/programmes in the six areas under the SGP 2012, including ideas from the review; and the inspiring, personal environment stories of 38 Singaporeans.

MEWR's staff was at the exhibition to explain the contents to visitors including students. Transcripts of the exhibition were made available in the other three official languages of Mandarin, Malay and Tamil. There were also talks by environmental enthusiasts.

To reach as many people as possible, the exhibition was held in the city district before moving to three locations in the residential areas. The public could share their views online or at the exhibition itself.

MEWR worked closely with the media to ensure sustained coverage of the review process and the exhibition. MEWR's corporate newsletter, Milieu carried regular stories on the review, and also included a 28-page feature on the exhibition in its October 2005 issue.

So far, more than 14,000 people have visited the exhibition, with about 70% saying that they understood the key environmental issues better after seeing it.

## **(C) CLOSING THE LOOP AND EVALUATION**

All feedback received through email, telephone, Internet survey or at the public exhibition itself was promptly acknowledged. Face-to-face platforms (e.g. public forum, Climate Change roundtable, Focus Groups) were found to be effective avenues for two-way discussions and clarifications on environmental issues.

The result is increased awareness and understanding of key environmental issues. In addition, the Focus Groups provided many good suggestions and inputs for improving the targets, strategies and programmes under the SGP 2012.

The review has reinforced the collective ownership of the SGP 2012 by the 3P sectors, which is a critical success factor of the SGP 2012. The SGP 2012 is not a plan that is formulated by the Government alone but one that is developed jointly by its 3P partners and Singaporeans at large. For SGP 2012 to succeed, it will require the continued support and commitment of everyone to implement its programmes and achieve its targets.

## **(D) SUMMARY TIMELINE OF THE REVIEW PROCESS**

<b>Time period</b>	<b>Milestones</b>
22 April 2005	Three Focus Groups formed, to look into three areas: Air & Climate Change, Water and Clean Land, Nature & Public Health. Comprising representatives from the 3P (People, Public and Private) sectors, each group held at least five discussion sessions in four months. They also consulted various industry and interest groups.
24 May 2005	More than 2,800 members of the public gave their feedback in a comprehensive Internet survey conducted over three months, until August 2005.
27 May 2005	Key opinion leaders from industry, commerce and academia met at the first Climate Change Roundtable to discuss what more Singapore can do to address the issue.

- 27 July 2005 200 people took part in a lively public forum and discussed preliminary ideas from the Focus Groups.
- End August 2005 The Focus Groups submitted their final recommendations to the SGP 2012 Co-ordinating Committee, chaired by Mr Tan Yong Soon, Permanent Secretary, Ministry of the Environment and Water Resources (MEWR).
- 28 October 2005 to 4 December 2005 Key environmental strategies and programmes under the SGP 2012 and some key ideas from the review are shared in "Our Environment Story: Singapore Green Plan 2012" Exhibition. The exhibition was launched by the Minister for the Environment and Water Resources, Dr Yaacob Ibrahim. The public can share their views online at the SGP 2012 website or at the exhibition itself.
- March 2006 The SGP2012 is updated, incorporating those Focus Group recommendations supported by the SGP 2012 Co-ordinating Committee and accepted by the Government. The SGP2012 action programme committees, with the relevant government agencies, will look into implementing the revised action programmes.

# ACKNOWLEDGEMENTS

The Ministry of the Environment and Water Resources wishes to thank the following:

- Dr Amy Khor, for chairing the public forum;
- The focus groups for their contributions to the review of the Singapore Green Plan 2012;

<b>Focus Groups</b>	<b>Air and Climate Change</b>	<b>Water</b>	<b>Clean Land, Nature and Public Health</b>
Co-Chairs	Dr Geh Min Mr Warren Fernandez	Mr Eugene Heng Mr Lee Tzu Yang	Mr Heng Chiang Meng Ms Loh Wai Kiew
Members	Mr Ahmad Nizam Mr Chia Hock Jin Mr Edwin Khew A/Prof Euston Quah Mr Howard Shaw Mr Jonathan Law Prof Koh Kheng Lian Mr Kwong Kok Chan Mr Lim Kim Wah Ms Marilyn Lauria Ms Muna Karatschai Mr Oh Lock Soon Ms Rita Soh Dr Stephen K. Wittkopf Dr Teo Ho Pin	Dr Chew Tuan Chiong Mr Chua Chong Jin Mr Darryl David Wilson Mr Eugene Yong Ms Kay Kuok Mr Lee Kok Choy Dr Lee Poh Onn Mr Low Teo Ping Mr Richard Eu Mr Ron Advani Ms Zaibun Siraj	Mr Albert Lim Mr Chia Tze Yee Mr Francis Lee MAJ (Ret) G Surajan Dr Ho Hua Chew Mr Ivan Lim Mr Jack Sim Mr Kevin Loh A/Prof Lim Lan Yuan Mr Michael Tay Dr Ooi Giok Ling Mr Otto Fung Dr Peter Ng Mr Subaraj Rajathurai Dr Tan Kee Wee

as well as the many others who have shared with us their valuable insights and suggestions for the Singapore Green Plan 2012.


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