








3. MITIGATION OF GREENHOUSE GAS EMISSIONS

Singapore's Greenhouse Gas Emissions

3.1. The main contribution to Singapore's greenhouse gas (GHG) emissions is carbon dioxide (CO₂) from the use of energy to meet development and human needs. Singapore's methane emissions are negligible, as Singapore has no agricultural base. We also incinerate all our waste and the little methane emitted from the existing landfill is flared off.

3.2. Singapore's CO₂ emissions in 2005 were 40 Mt, accounting for less than 0.2% of global CO₂ emissions. Table 3.1 shows our 2005 CO₂ emissions from the power generation, industry, transport, buildings and households sectors in terms of both primary and secondary consumption¹.

Table 3.1: Breakdown of CO₂ Contribution in 2005²
Key CO₂ Contributors (2005) (kilo tonnes)

	 Electricity Generation	 Industry	 Transport	 Buildings	 Consumers/ Households	 Others
Primary Consumption (combust fuel)	19,315 (48%)	13,465 (33%)	7,056 (17%)	325 (1%)	216 (1%)	-
Secondary Consumption (use electricity)		8,328 (21%)	930 (2%)	5,910 (15%)	3,415 (8%)	732 (2%)
Overall		21,793 (54%)	7,986 (19%)	6,235 (16%)	3,631 (9%)	732 (2%)

TOTAL CO₂ = 40,377 kilo tonnes

Our National Circumstances

3.3. Singapore is a city-state with limited natural resources. Due to our geographical constraints, we have very little alternative energy sources beyond oil and gas. We lack the natural endowments to tap hydropower or geothermal energy. Based on current technology for wind energy, there is also little scope due to our low wind speeds. The forms of renewable energy

¹ Primary users are those which combust fuel directly while secondary users are those which use the electricity generated from fuel.

² Data from National Environment Agency

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that will be more applicable to Singapore besides waste-to-energy would thus include solar energy and biofuels. However these sources of renewable energy are not yet cost-competitive with conventional fossil fuels. We are thus heavily reliant on fossil fuels to meet our energy needs at present.

3.4. As an export-oriented economy, much of the energy used by our industry is not to make products for local consumption but rather products for export. Singapore's industry sector accounts for about half of Singapore's total energy use in 2005, most of it due to our key exporting industries such as our refining, petrochemical, pharmaceutical and wafer fabrication industries. For instance, Singapore is one of the largest refining centres in the world and the three oil refineries account for about 20% of Singapore's total energy use. These oil refineries support our oil-trading hub, which serves the global market, and an ever-growing petrochemicals industry chain.

3.5. Despite having an export-oriented, energy-intensive economy, Singapore's CO₂ intensity (CO₂ per dollar GDP at 2000 PPP prices) is below the world average, according to the International Energy Agency (IEA). In other words, we produce less carbon in the process of generating each dollar of GDP compared to other countries.

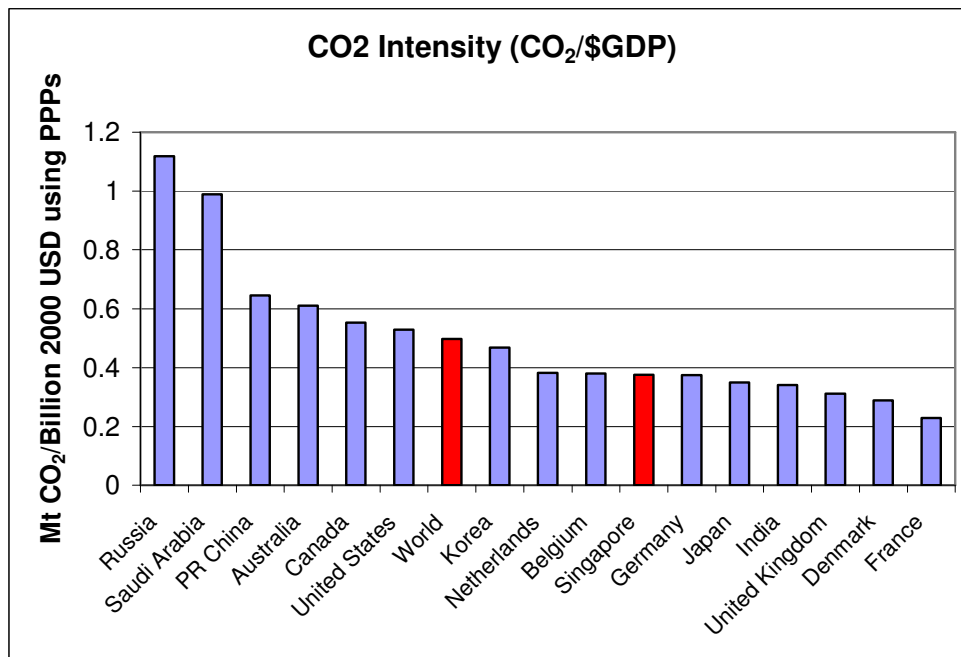


Figure 3.1. Comparison of CO₂ intensity

Source: IEA 2005

3.6. This is partly because about 80% of the electricity we use is generated by natural gas using highly efficient combined cycle technology. The remaining electricity is generated by fuel oil or other renewable energy sources (see Figure 3.1 below).

3.7. In addition, the Singapore government does not subsidise energy prices; hence businesses have an inherent incentive to be energy efficient.

There is also relatively widespread use of public transport in Singapore due to integrated land use planning, the provision of an efficient and reliable public transport system, combined with policies to manage demand and usage of vehicles.

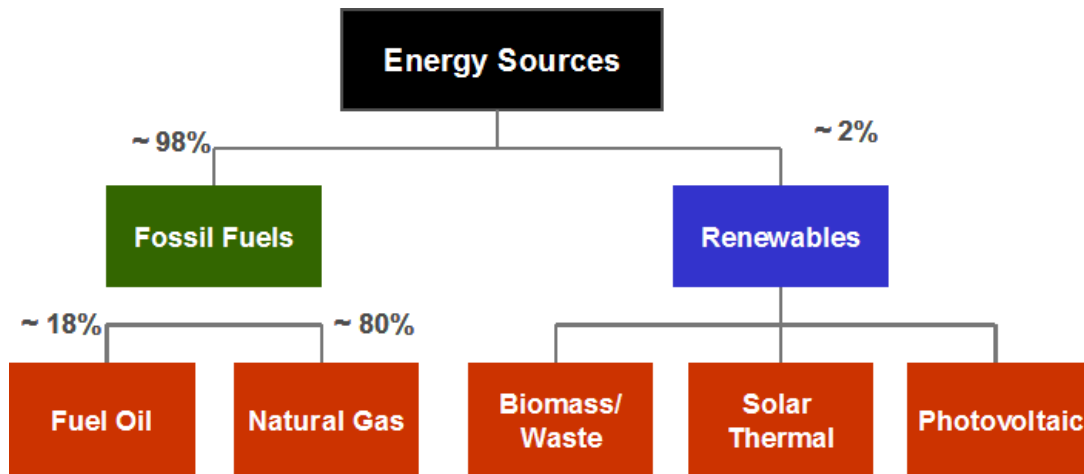
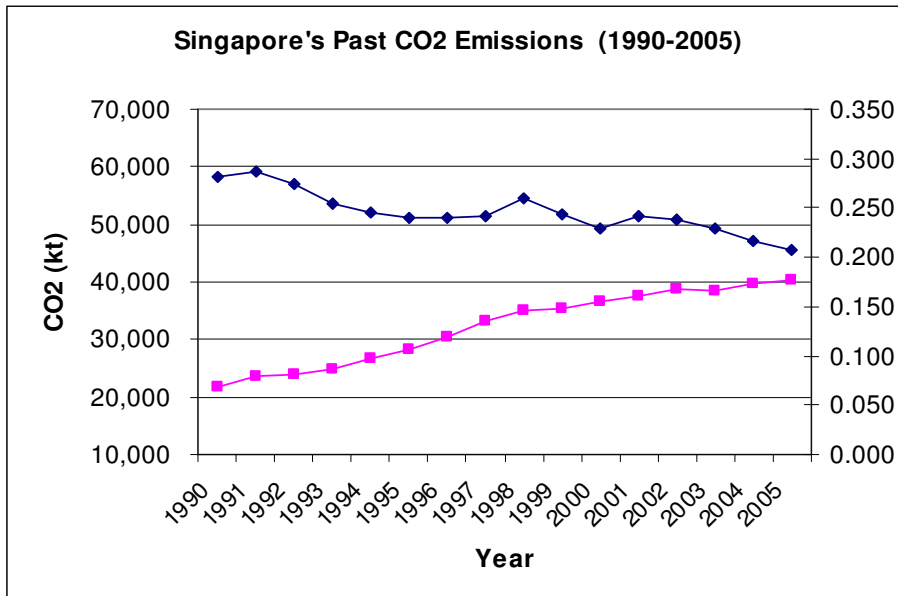


Figure 3.2. Singapore's Energy Sources

Carbon Intensity Improvement

3.8. Our historical absolute CO₂ emissions and CO₂ intensity trends are shown in Figure 3.3 below. By 2006, our carbon intensity reached 30% below 1990 levels, due to a rapid switch to natural gas for power generation and ongoing improvements in energy efficiency. In 2007, the proportion of electricity generated by gas using highly efficient combined cycle turbines in Singapore was already 79%, amongst the highest in the world.



Key:
■ Absolute CO₂ Emissions ◆ CO₂ Intensity (CO₂ emissions per dollar GDP)

Figure 3.3: Singapore's Carbon Dioxide Absolute and Intensity Emissions 1990 – 2005

Our Strategy for Mitigating Greenhouse Gas Emissions

3.9. Countries can reduce their GHG emissions through

- (a) Increasing energy efficiency;
- (b) Using less carbon-intensive fuels; and
- (c) Increasing carbon 'sinks' such as forests.

3.10. Singapore's small size limits the possibility of increasing forest cover domestically. As the Southeast Asian region is home to large areas of tropical rainforest, Singapore supports efforts to preserve and restore these carbon sinks through international, regional, bilateral and national platforms.

3.11. In Singapore, our GHG emissions are mostly a result of the combustion of fossil fuels for energy. Our strategy to mitigate GHG emissions from Singapore is therefore to:

- a) Support efforts to use less carbon-intensive fuels (e.g. natural gas, renewables); and

b) Improve energy efficiency in all sectors of the economy.

3.12. Increasing energy efficiency in Singapore would help to reduce Singapore's CO₂ emissions, improve our air quality, reduce energy costs for companies and consumers, and help to improve our energy security by mitigating our energy demand growth. Energy efficiency is therefore Singapore's key strategy to reduce CO₂ emissions.

Support Efforts to Use Less Carbon-Intensive Fuels

Increased Use of Natural Gas

3.13. Singapore has restructured and liberalised our electricity market. As the government does not subsidise energy prices, generation companies have an inherent incentive to choose the most efficient technology. Within just a few years, the proportion of electricity generated by gas using highly efficient combined cycle turbines in Singapore grew from 19% in 2000 to 79% in 2007 (Table 3.2). This led to significantly lower CO₂ emissions from the power sector, as natural gas emits 40% less CO₂ than fuel oil per unit of electricity generated.

3.14. Efforts are underway for Singapore's first LNG terminal to be ready by 2012. This will support the increased use of natural gas to help meet increases in energy demand.

Table 3.2: Electricity Generated by Natural Gas

	2000	2001	2002	2003	2004	2005	2006	2007
Electricity Generated by Natural Gas	19%	29%	44%	60%	69%	74%	78%	79%

Waste-to-Energy

Singapore is one of the few countries that incinerate almost all their waste. This practice minimises the amount of waste dumped into the landfills and generates electricity in the process. Since Singapore recycles or incinerates almost all its waste, the amount of decomposable waste in the landfills is minimised. As such, Singapore's landfills generate negligible amounts of methane (which is also a GHG), unlike landfills in other countries.

Since 2000, Singapore's waste-to-energy plants have been contributing about 2-3% of our energy supply. At the moment, there are four waste-to-energy plants. By 2009, Singapore will have five such plants when the new Keppel Seghers Tuas Waste-to-Energy Plant begins operations.

Promoting Renewable Energy

3.15. Our efforts in promoting renewable energy such as biomass and solar energy are focused on promoting R&D and test-bedding to improve their performance and cost-effectiveness. These efforts are elaborated in Chapter 4 on competency-building.

3.16. To facilitate the adoption of renewable energy, government agencies are working together to review the policies pertaining to distributed electricity generation using renewable energy sources in Singapore while at the same time ensuring this does not cause disruption to our electricity network. This will serve to encourage take-up of small-sized renewable energy generation systems by companies and individuals.

Improve Energy Efficiency

3.17. Singapore's policy of not subsidising energy costs provides a market incentive for energy consumers to be more energy efficient. This policy, together with our past energy efficiency efforts, has led our energy intensity to improve by 15% between 1990 and 2005. Singapore also supports the APEC³-wide regional aspirational goal of a reduction in energy intensity of at least 25% by 2030 from 2005 levels.

3.18. However, today there are still energy efficiency measures with cost-effective returns that are not implemented due to certain market failures and barriers, some of which are described below:

a) Lack of information

Companies or individuals may be unaware of technologies or actions that could bring about energy savings. There may also be a lack of data on lifetime cost savings and payback periods on energy efficient products or equipment.

b) Lack of capabilities

Many companies may lack the technical expertise to effectively improve energy efficiency.

c) Split incentives

In some cases, the people who are in a position to make decisions to improve energy efficiency are not the ones who benefit from such actions.

3.19. To drive future energy efficiency efforts in the various sectors of our economy, the National Environment Agency (NEA), chairs an Energy Efficiency Singapore Programme Office (E²PO) comprising members from EMA, EDB, LTA, BCA and A*STAR. The E²PO has developed a national plan

³ Asia-Pacific Economic Cooperation

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to promote energy efficiency, also known as Energy Efficient Singapore (E² Singapore).

3.20. E² Singapore comprises actions in the following areas:

- a) Promoting the adoption of energy efficient technology and measures by addressing the market barriers to energy efficiency;
- b) Raising awareness to reach out to the public and businesses so as to stimulate energy efficient behaviour and practices;
- c) Building capability to drive and sustain energy efficiency efforts and to develop the local knowledge base and expertise in energy management;
- d) Promoting research & development to enhance Singapore's capability in energy efficient technologies.

3.21. The policies and measures for each sector under areas (a) and (b) are elaborated below. Efforts under areas (c) and (d) are elaborated in Chapter 4 on competency-building.

Sustainable Energy Fund

3.22. To support implementation of the E² Singapore, a Sustainable Energy Fund (SEF) of S\$50 million over 5 years has been established, administered by the E²PO. A portion of the SEF will be used to incentivise energy efficiency improvements in the different sectors such as industry and buildings. The SEF will also be used to fund energy efficiency studies to improve data availability across all sectors.

Power Generation

3.23. The power generation sector is the single largest primary source of carbon dioxide emissions in Singapore, accounting for 48% of our carbon emissions in 2005⁴. Due to market competition in the electricity market, power generation companies (gencos) have an incentive to be energy efficient. Gross efficiency of power generation in Singapore increased from 39% in 2001 to 44% in 2006. Further efforts to help improve the energy efficiency of power generation in Singapore include the use of cogeneration and trigeneration.

Increasing the Use of Cogeneration and Trigeneration

⁴ Primary users are those which combust fuel directly while secondary users are those, which use the electricity generated from fuel.

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3.24. Cogeneration and trigeneration can significantly improve the energy efficiency of generating power and steam (and chilled water in the case of trigeneration). However, a combined demand for electricity and heating (and cooling in the case of trigeneration) is needed for such technologies to be viable.

3.25. To maximise efficiency, government agencies such as the Economic Development Board (EDB) and Jurong Town Corporation will plan industrial land and site facilities with cogeneration and trigeneration in mind, particularly for energy-intensive sectors such as power generation, petrochemicals and pharmaceuticals.

Cogeneration and Trigeneration

In the power generation process, a significant amount of heat produced from fuel combustion is often not captured and is wasted. Cogeneration, or combined heat and power (CHP), refers to capturing both the heat and electricity produced from fuel combustion, which can increase the energy efficiency of power generation from about 50% to more than 75%. The efficiency of a trigeneration plant is even higher, when chilled water is also produced using the waste heat. While cogeneration and trigeneration are more commonly used in industrial facilities, they can also be used by power plants and buildings.

Industry

3.26. The industry sector accounts for about 54% of Singapore's carbon dioxide emissions. Singapore is one of the top oil refining centres and oil trading hubs in the world, and our refineries support an ever-growing petrochemicals industry chain. We also account for 10% of the global market for semiconductor wafer output.

3.27. Improving the energy efficiency of our industries is a win-win strategy as this not only lowers their carbon emissions but renders them more cost-competitive in a high oil price environment. While the processes in our various industries are differentiated, there are common approaches to improving their energy efficiency. Going forward, we will encourage our industries to:

- a) Design their facilities to be efficient;
- b) Use energy efficient equipment;
- c) Have trained personnel who can recognise and implement energy efficient measures.

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3.28. The global concern with climate change also brings with it new business opportunities, such as the export of carbon-efficient technologies to support sustainable development in other countries and the provision of carbon services such as carbon trading. These opportunities match Singapore's environmental, engineering, and financial expertise, and we will work with local industries to seek out such opportunities. This would contribute to global efforts in mitigating climate change. Chapter 4 expands on the efforts to build up our technological and human competencies related to climate change.

Design for Efficiency Scheme

3.29. To help new industrial facilities incorporate energy efficiency considerations at the design stage, NEA will introduce a Design for Efficiency scheme. This pilot scheme will co-fund design workshops for new industrial developments to meet high standards of energy efficiency.

Texas Instruments Case Study

After participating in design workshops conducted by the non-profit, energy efficiency consultant Rocky Mountain Institute, Texas Instruments (TI) in the USA was able to design a super efficient green wafer chip factory. The factory is expected to cost \$220 million less to build than TI's last wafer chip factory, and to use 20% less electricity and 35% less water usage compared to wafer chip factories built previously.

Source: Breakthrough Design™ Team, from Rocky Mountain Institute

Energy Audits

3.30. In July 2002, an Energy Audit Scheme was introduced for major industrial consumers of energy, such as oil refineries. To date, six major facilities from the petroleum refining and petrochemicals industries have voluntarily signed up to the scheme, committing to carry out energy audits in their premises and formulate action plans to improve their energy efficiency over a period of five to seven years.

3.31. In April 2005, MEWR and NEA launched the \$10 million Energy Efficiency Improvement Assistance Scheme (EASe) to co-fund the cost of energy audits. Under EASe, funding of up to 50% of the cost for energy audits, subject to a cap of \$200,000, will be provided to any Singapore-registered company with a building or manufacturing facility in Singapore. As of end Jan 08, 87 companies in the power, industry and building sectors have obtained grants under EASe to conduct energy audits. The recommended energy efficiency measures from the energy audits are projected to result in annual energy savings of \$23.4 million, energy savings of 296,402 MWh and 150 kt of CO₂ savings per year for the companies, if implemented.

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3.32. EASe will be supported by the Investment Allowance (IA) Scheme. It is a capital allowance of 50% of the capital expenditure on qualifying equipment, that is deductible against chargeable income. The IA can be awarded if the capital expenditure results in greater energy efficiency.

3.33. In addition to the IA scheme, there is a one-year accelerated depreciation allowance for energy efficient equipment and technology. Companies that replace energy-consuming equipment with more energy efficient ones or invest in energy-saving equipment can depreciate the qualifying capital equipment in one year instead of three.

Grant for Energy Efficient Technology

3.34. To further encourage our companies to adopt energy efficient technologies and equipment, NEA will establish a Grant for Energy Efficient Technology. This grant, also known as GREET, will provide funding for companies to offset part of their investment cost for energy efficient equipment.

Awareness-Raising

3.35. To promote the uptake of energy-efficient equipment and implementation of energy efficiency practices, NEA will develop an energy efficiency website that will provide industry with details on the available energy efficiency schemes and energy efficiency case studies.

3.36. To facilitate the sharing of knowledge, expertise and best practices in energy efficiency, NEA together with other agencies such as the Building Construction Authority (BCA) will periodically arrange energy efficiency seminars and workshops that bring together local and overseas experts and various stakeholders (e.g. companies and building owners).

Singapore Certified Energy Manager Training Grant

3.37. NEA will provide a Singapore Certified Energy Manager Training Grant to help equip facility owners and technical staff with the necessary knowledge and skills to manage energy services within their facilities. We will also study the feasibility of making the appointment of energy managers mandatory for large manufacturing and building facilities in the next 3 to 5 years.

Transport

3.38. The transport sector in Singapore accounts for about 19% of greenhouse gas emissions. Improving the energy efficiency of the transport sector is achieved through the following key strategies:

- a) Managing vehicle usage and traffic congestion;
- b) Improving and promoting the use of public transport;
- c) Improving fuel economy; and

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- d) Promoting green vehicles.

Managing Vehicle Usage and Traffic Congestion

3.39. Singaporeans are undoubtedly familiar with the various means of controlling vehicle usage in our city. While implemented in order to manage traffic congestion, these measures have also helped to reduce our energy use as traffic congestion results in fuel wastage. Conversely, smooth flowing traffic allows cars to achieve better fuel economy.

3.40. Car ownership in Singapore is discouraged through the imposition of taxes on vehicle ownership such as the Additional Registration Fee, and through the Certificate of Entitlement (COE) system, which limits the number of vehicles registered. From May 2009, LTA will lower the vehicle population growth rate from the current 3% to 1.5%. This growth rate will be reviewed after 3 years to assess whether a further reduction will be necessary.

3.41. Beyond managing ownership, we have managed vehicle usage in Singapore through integrated land-use planning, congestion control measures such as electronic road pricing (ERP) and our efficient public transport system, which is a much more energy efficient way of moving the masses compared to private cars.

3.42. Other schemes that help to reduce the need for vehicle ownership and usage include the Off-Peak Car scheme and the Park-and-Ride Scheme, which allows drivers to park their cars at a discounted rate at car parks near public transport hubs such as MRT stations or bus interchanges, and to continue their journey by MRT or bus.

3.43. Due to the combined effect of these policies, private vehicle ownership is well controlled, and there is widespread use of public transport in Singapore.

3.44. To manage road congestion, LTA will continue to employ a multi-pronged approach, which includes increasing the carrying capacity of the roads through infrastructure development, harnessing technology to increase throughput, as well as utilising ownership and usage restraint measures like the COE and ERP.

Improving and promoting the use of public transport

3.45. The Government will continue to promote public transport as it is the most efficient form of transport in densely populated and land-scarce Singapore, and aims to make public transport a choice mode to attract more car-owners to consider using it for their daily commute.

3.46. LTA will continue to improve public transport by making significant public transport infrastructure investments and planning the entire system as an integrated whole from the commuters' perspective, with bus and rail

working in close partnership to provide more seamless and convenient transfers. Through these public transport improvements coupled with our vehicle demand management measures, LTA aims to increase the public transport modal share during morning peak-hours from 63% in 2004 to 70% by 2020.

Energy Consumption of Different Forms of Transport

The environmental merits of public transportation can be seen from a comparison of the relative energy use by the different modes of transport. It is estimated that to transport one person, a car carrying only one driver uses 9 times the amount of energy used by a bus, and 12 times the energy used by an MRT train.

Improving Fuel Economy

3.47. The Fuel Economy Labelling Scheme (FELS) was launched as a voluntary programme in 2003 with the aim of providing buyers of passenger cars with fuel economy information at the point of sale. As of end 2007, less than 20% of all vehicle models in the market were participating in FELS. The effectiveness of FELS was limited, as consumers were only able to compare between limited vehicle models that are participating in the FELS.

3.48. To improve the effectiveness of FELS, the government will introduce mandatory fuel economy labelling for passenger cars from 1 April 2009. All automobile retailers will have to display the fuel economy labels of passenger car models at the showroom..

Promoting Green Vehicles

3.49. To encourage the purchase of hybrid and compressed natural gas (CNG) vehicles, a Green Vehicle Rebate (GVR) has been in place since 2001. CNG vehicles also enjoy special tax exemption until 31 Dec 2009. The GVR was further enhanced in Dec 2005, whereby green vehicles can enjoy an Additional Registration Fee (ARF) rebate of 40% of the Open Market Value (OMV) of the car, up from 20%. Since the enhancement of the rebate, which is valid until 2009, the number of green vehicles has increased substantially from about 140 in 2005 to more than 1500 by end of 2007. NEA and LTA will continue to encourage more motorists to switch to green vehicles which are cleaner and more fuel-efficient.

Promoting Fuel-Efficient Driving Habits

3.50. Fuel-efficient driving habits, such as avoiding hard braking and acceleration, maintaining the appropriate tyre pressure and reducing idling, can save up to 10% of the fuel without any increase in travel time. These habits also result in safer driving, better comfort, less pollution and less noise.

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The Government will promote such fuel-efficient driving habits to motorists more actively.

Buildings

3.51. The buildings sector contributes about 16% of Singapore's greenhouse gas emissions. Most of the electricity used by buildings in Singapore is for air-conditioning (40-50%), mechanical ventilation (about 20%) and lighting (15-20%). Results from energy audits co-funded by NEA have shown that there is room for the energy efficiency of buildings in Singapore to improve.

Building Regulations

3.52. Although a green building may cost more to build, they are more cost effective over the life cycle of the building, and energy savings of 20 – 30% are possible. To promote the construction of energy efficient green buildings in Singapore, all new buildings and existing ones that undergo major retrofitting will be required in April 2008 to meet minimum requirements on environmental sustainability that are equivalent to the Green Mark certified standards.

3.53. Due to the prominence of energy usage due to air-conditioning in Singapore, the BCA established the Envelope Thermal Transfer Value (ETTV), which sets a limit on the amount of heat gained by an air-conditioned building through its roofs, external walls and windows. The ETTV was tightened in January 2004 and will be regularly reviewed.

3.54. As there has been a rise in residential buildings adopting facades with high ETTV (e.g. glass panels), BCA will require new residential buildings with a gross floor area of 2000m² or more to comply with the Residential Envelope Transmittance Value (RETV), in early 2008. This will reduce the energy used for cooling by residential buildings.

3.55. The SS Code of Practice 24 or SS CP 24 also set minimum efficiency requirements for commercial air-conditioners and lighting. NEA led a working group to review CP 24 and announced the Singapore Standard 530 on Energy Efficiency for Building Services and Equipment or SS 530 in January 2007. SS 530 sets minimum energy efficiency standards for building equipment such as air-conditioning equipment, water heaters, electric motors and high efficiency lightings. Air-conditioning chillers in compliance with the new SS 530 will use up to 30% less energy, compared to the requirement in SS CP24.

Building Labels

3.56. Building labels provide an incentive for developers to build energy-efficient, environmentally-friendly buildings. BCA introduced the Green Mark in January 2005 to recognise new buildings designed with environmentally-

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friendly features. Buildings are awarded Certified, Gold, Gold^{PLUS} or Platinum rating depending on the points scored on a set of criteria including energy and water efficiency. From 2008 onwards, all new buildings and existing buildings undergoing major retrofitting works with gross floor area above 2000m² must meet the Green Mark Certified standard.

3.57. The Energy Smart Building Labelling Scheme was launched in Dec 2005 to accord recognition for existing office buildings with good energy performance. NEA and the Energy Sustainability Unit (NUS) have extended the Energy Smart Buildings Scheme to the hotel sector in early 2007. In the future, the label will be expanded to other building types including shopping complexes and hospitals.

A Green Mark Platinum Building - National Library Building

The National Library Building, which won the Green Mark Platinum Award and the Energy Smart Label, has several design features that keep the temperatures inside as low as possible to save energy. These include the use of computer modeling to optimise the building orientation and to maximise the use of daylight and natural ventilation, sunshades to shield against solar heat gain, and the use of light sensors that dims or switches off the lights when there is sufficient natural lighting. About two thirds of the building façade are double-glazed to minimize the heat transfer. There is also extensive landscaping, sky terraces and roof gardens to lower local ambient temperature.

An Energy Smart Hotel - Regent Hotel

The Regent Singapore used to rely on diesel boilers to produce hot water at a cost of \$29,000 a month. In 2006, a new heat recovery system was implemented. This system uses a small capacity chiller that also acts as a heat pump to produce hot water. They are now enjoying savings of \$500,000 annually. This Energy Smart hotel has also switched to a higher-efficiency lighting system as well as LEDs without compromising light quality. Besides being an Energy Smart hotel, The Regent Singapore has also won the ASEAN Green Hotel Award in 2008.

Incentives for Energy Efficient Design and Green Building Design Guide

3.58. To incentivise building developers to achieve the higher awards of Green Mark, MND established the \$20 million Green Mark Incentive Scheme in 2006. Under this scheme, new and retrofitted buildings that achieve the Green Mark Gold ward will be given a cash incentive of up to \$3 per m² of GFA. Those that achieve the Green Mark Platinum Award can enjoy an incentive of up to \$6 per m² of GFA.

3.59. BCA has released a free Green Building Design Guide for air-conditioned buildings compiling the design features of buildings that have achieved Green Mark, to disseminate information on environmentally sustainable building designs as well as ways to improve energy efficiency.

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Building managers will also be encouraged to select energy-efficient appliances and operate buildings efficiently. The energy efficiency website that NEA will develop will also cover energy efficiency equipment and practices applicable to buildings.

Grant to Upgrade Building Envelopes

3.60. BCA is also introducing a new grant to encourage existing buildings to upgrade their building envelopes. The grant will help offset the cost of upgrading façade features to improve the overall energy efficiency of the building. For a start, \$9 million has been set aside to fund these grants.

Promoting Energy Audits and Energy Efficiency Measures

3.61. The Energy Efficiency Improvement Assistance Scheme (EASe) scheme, accelerated depreciation scheme and grant for energy efficient equipment and systems described in the power generation section also applies to buildings.

Government Taking the Lead

3.62. The public sector is a significant energy consumer in the buildings sector, accounting for approximately 19% of the electricity consumption of non-residential buildings in Singapore. To take a leadership role by improving the energy efficiency in its buildings, all public sector agencies have incorporated Green Mark certification into the procurement and design process for new and retrofitted Government buildings and schools since April 2007. All large air-conditioned Government office buildings as well as polytechnics and ITEs, will also undergo energy audits by FY 2010.

Households

3.63. The households sector represents about 10% of total energy use, with the bulk of energy consumption being used for air-conditioners and refrigerators, followed by appliances such as consumer electronics (e.g. TVs, DVD players, computers), lighting and water heating.

Mandatory Energy Labelling

3.64. Mandatory energy labelling informs consumers of the energy efficiencies of different models of an appliance, thereby helping them choose a more energy efficient model. Starting from 1 Jan 2008, all air-conditioners and refrigerators sold in Singapore have to carry an energy label. Together, the air-conditioner and the refrigerator make up about 50% of the average household electricity bill. The Mandatory Energy Labelling Scheme will be extended to clothes dryers by April 2009, and we will consider extending the scheme to other appliances including household lightings and water heaters by 2010.

Overseas Practice and Public Perception

Nearly all developed countries and many developing countries have mandatory labelling schemes for refrigerators and air-conditioners, and many extend these schemes to other home appliances. Savings in operating costs through the use of energy-efficient appliances often more than offset higher purchase prices.

In a poll conducted by NEA in 2005, 80% of the respondents (132 out of a total 164) indicated that they found the energy labels useful in comparing the electricity consumption of different models and in confirming that the model that they have selected is energy efficient. In an online survey conducted by MEWR in 2005, some 93% of the respondents supported mandating energy labelling.

Minimum Energy Performance Standards

3.65. Minimum energy performance standards (MEPS) are a complementary tool to mandatory labelling. Performance standards ensure that all models of an appliance sold in a country meet a basic level of energy efficiency and eliminate inefficient appliances from the market. Such standards are already in place in many countries, particularly for energy-intensive appliances. Going forward, based on the results of mandatory labelling, NEA will look into imposing Minimum Energy Performance Standards on household air-conditioners and fridges over the next 2 to 3 years.

Electricity Vending System

3.66. EMA is studying the feasibility of a scheme called the Electricity Vending System (EVS). The EVS enables consumers to buy electricity from any electricity retailer and allows consumers to monitor their electricity consumption figures by the half-hour. By being more aware of electricity use patterns, consumers can reduce their electricity bills through more prudent use of electricity.

Electricity Consumption Tracking Device

3.67. NEA is also looking into introducing an electricity consumption tracking device that not only displays electricity consumption in dollar terms but also tracks the electricity usage of key energy intensive household appliances such as air conditioners.

Public Awareness Programme

3.68. The Climate Change Awareness Programme (CCAP) was launched in April 2006 by the Singapore Environment Council and supported by NEA.

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It aims to raise awareness among households and motorists on how simple and relatively painless changes in daily habits can save money, save energy and help to address climate change. Moving forward, NEA will enhance the public awareness efforts to encourage households and motorists to move from awareness to adopting these simple energy efficiency habits and reducing their energy consumption.

Simple Energy-Saving Habits At Home*

1. Use a fan instead of an air-conditioner. Save about \$50 a month or \$600 a year**.
2. If you use an air-conditioner, set the temperature as high as comfortable. For every degree raised, save \$20 a year***.
3. Switch off appliances at the power socket. Do not leave them on standby. Save \$50 a year****.
4. Buy energy efficient light bulbs (e.g. compact fluorescent lamps) instead of incandescent light bulbs or halogen torchieres. Using a compact fluorescent lamp (7W) instead of an incandescent bulb (40W) can save about \$15 per bulb per year.
5. Buy an energy efficient appliance by checking the energy labels. The more ticks it has, the more energy efficient it is. A 4-tick air-conditioner saves you about \$350 in electricity bills a year compared to a 1-tick model***, and a 4-tick refrigerator saves you about \$100 a year over a 1-tick model*****.

**Based on electricity tariff of about \$0.2262 per unit (kWh).*

***Comparing electricity used by a single-split, 1000W air-conditioner and a 75W electric fan.*

****Assuming a single-split, 1000W air-conditioner used 365 days a year.*

*****Assuming 35W of standby power in a home.*

******Assuming a 400 litre refrigerator.*

Summary

3.69. A summary of the policies and measures currently being implemented or considered under the E² Singapore plan are in Table 3.3 below.

Table 3.3: Summary of Policies and Measures in E² Singapore

	Power Generation	Industry	Buildings	Transport	Households
Promote adoption of energy efficient technology and measures	Clean Development Mechanism				
	\$10 million EASe Scheme Accelerated depreciation allowance Investment allowance				
	Promote cogeneration and trigeneration via industrial land planning and facility siting	Design for Efficiency scheme Grant for Energy Efficient Technologies	Building regulations Government take the lead Energy Smart Mandating Green Mark certified \$20 million Green Mark Incentive Scheme Grant to upgrade Building Envelopes Residential building standards	Manage vehicle usage and traffic congestion Improving and promoting the use of public transport Fuel economy labelling Green Vehicle Rebate Promoting Fuel-Efficient Driving Habits	Mandatory labelling Minimum energy performance standards Electricity Vending System Electricity consumption tracking device
Research & development, and Capability-building	Innovation for Environmental Sustainability fund				
			Green buildings R&D fund		
	Energy service company accreditation scheme Singapore Certified Energy Manager programme and Training Grant				
Raise awareness	Energy efficiency seminars and workshops Energy efficiency website Public awareness programme				