

SINGAPORE

1. GOALS FOR EFFICIENCY IMPROVEMENT

1.1. Overall Energy Efficiency Improvement Goals

In its Sustainable Singapore Blueprint (April 2009), Singapore has set a target of achieving a 35% energy intensity improvement from 2005 levels by 2030. Energy intensity is defined as total energy consumed per dollar of GDP. This is a voluntary and unilaterally implemented goal, which would result in a reduction in Singapore's energy consumption from the business-as-usual level¹.

1.2. Sectoral Energy Efficiency Improvement Goals

Singapore does not have sectoral energy efficiency improvement goals.

1.3. Action Plan for Promoting Energy Efficiency

a) Objectives

Due to Singapore's constraints as a small economy without the natural endowments to utilise renewable energy resources like wind and hydro power, energy efficiency is Singapore's key strategy to mitigate greenhouse gas emissions. Energy efficiency also helps to improve Singapore's economic competitiveness, energy security, and environmental sustainability.

b) Applicable sectors

Energy efficiency is applicable to most sectors of Singapore economy, but emphasis is placed on its top five most energy intensive sectors: power generation, industry, transport, buildings, and households.²

c) Outline

- Power generation

The liberalisation of Singapore's energy market since 2000 has promoted competition in the electricity and gas markets by encouraging investments in more efficient power generation. As such, the use of natural gas for generating electricity has increased rapidly from 28 % in 2001 to 81% in 2009, while fuel oil which was the dominant fuel source for power generation till 2001 at 68%, accounted for 15% in 2009.

Industry is increasingly depoloying co-generation and tri-generation technologies into ongoing and future developmental plans.

Power Grid System

The Energy Market Authority (EMA) has embarked on the Intelligent Energy System (IES) or 'smart grid' pilot project, which would be an important step towards a smarter power grid. The success of the IES pilot project will enable the adoption and roll-out of workable solutions for Singapore's power system, thereby enhancing its efficiency and resilience of Singapore's energy system as a whole. The pilot comprises two phases: Phase 1 which focuses on the development of the enabling smart grid infrastructure has been completed. Phase 2 to test and evaluate smart grid applications for consumers is expected to start in the first half of 2012. For phase 2, about 4,000 smart meters will be installed for commercial and

¹ Ministry of National Development (2009).

² Ministry of National Development (2009); Energy Market Authority (2007).

industrial consumers and households. For commercial and industrial consumers, which make up the bulk of Singapore's electricity consumption, applications to be tested include:

1. A demand response programme where they can work with service companies to reduce their electricity consumption in event of high prices. This will allow them to save on electricity costs when prices are high.
2. Building owners and industrial consumers can install or upgrade their Energy Management System for integration with the IES infrastructure. This will provide them with timely access to information for businesses to optimise and reduce their electricity consumption to achieve better energy efficiency.
3. Time-of-use pricing scheme will be introduced to some commercial and industrial consumers to assess whether pricing signals can encourage reduction in their peak load consumption.

Households participating in this trial will receive convenient in-home display units which will enable them to monitor their energy consumption on a real-time basis to achieve savings in their electricity bills.

- Industry

Energy efficiency in the industrial sector leads to higher productivity and greater profitability. A variety of assistance schemes and grants have been implemented to drive energy efficiency improvements in the industrial sector.

- The Energy Efficiency Improvement Assistance Scheme (EASe)
 - EASe provides up to 50% funding for companies to engage the services of an Energy Services Company to carry out detailed energy assessments of buildings and industrial facilities.
- Grant for Energy Efficient Technologies (GREET)
 - GREET provides co-funding for energy efficiency retrofits, capped at SGD 4 million per project, to encourage owners and operators of industrial facilities to invest in energy efficient equipment or technologies.
- The Investment Allowance (IA) Scheme
 - Administered by the Economic Development Board (EDB), the IA scheme encourages companies to invest in energy efficient equipment. The IA Scheme provides a capital allowance on qualifying equipment costs that allows a deduction against chargeable income. The IA can be awarded for capital expenditures that result in more efficient energy use.
- The Design for Efficiency (DfE) Scheme
 - The DfE Scheme provides up to 80% funding, capped at SGD 600,000, to encourage investors in new facilities in Singapore to integrate energy and resource efficiency improvements into development plans early in the design stage.
- Accelerated Depreciation Allowance Scheme

The Accelerated Depreciation Allowance Scheme allows capital expenditure on qualifying energy efficiency or energy saving equipment to be written off in one year instead of three.

- Transport

As the transport sector accounts for a substantial and rapidly growing share of total energy use and carbon emissions, Singapore is promoting the use of public transportation through a series of measures, including investments in new MRT lines and upgrading of existing facilities, central bus planning, bus priority schemes, tightening quality of service standards, and enhancing commuter information. Other measures also include:

- Managing car ownership and usage by reducing vehicle growth rate through the Vehicle Quota System (VQS), refining the Electronic Road Pricing (ERP) system, improving Off-Peak Car and Park & Ride schemes, and further developing Intelligent Transport System (ITS) solutions
- Test-bedding new technologies such as the Diesel Particulate Filter (DPF), diesel-hybrid buses, electric cars
- Developing a Green Framework for Rapid Transit System (RTS). The Green Mark provides a systematic and structured approach in evaluating and rating the environmental performance of RTS for existing and future lines.

- **Buildings**

The Building and Construction Authority, a statutory board under the Ministry of National Development, is spearheading efforts to drive energy efficiency improvements in the building sector. There are regulatory requirements implemented, such as the building envelope thermal performance standard, which has been improvised since 1979 to ensure better energy efficiency performance in buildings. In recent years, energy-related regulations such as minimum energy efficiency for cooling equipment and natural ventilation for all residential buildings have been introduced.

In 2008, BCA established the Building Control (Environmental Sustainability) Regulations. This regulation sets out the minimum environmental sustainability standard for new buildings and the administrative requirements, which was largely adopted from the criteria under the BCA Green Mark Scheme. In 2009, the Singapore Government mandated that all new and existing public sector buildings would be required to meet the Green Mark Platinum and Gold^{PLUS} standards respectively by the year 2020.

- **Green Mark Buildings**

The BCA Green Mark Scheme is a green building rating system launched by the BCA in 2005 to evaluate a building based on its environmental impact performance. From 2008, all new and existing buildings with gross floor area (GFA) above 2000 m² that are undergoing major retrofitting works must meet the Green Mark Certified standard.

BCA has developed the Green Mark for Office Interior and Restaurants to support businesses in driving green initiatives within premises and has worked with other agencies like the Ministry of Education (MOE) to come up with the Green Mark for Existing Schools. BCA has also introduced the Green Mark for Existing Residential Buildings to recognise the eco-conscious efforts and initiatives by the Town Councils and managing agents in reducing the energy consumption and environmental footprint of their buildings.

Suite of Green Mark (GM) schemes that aims to shape the built environment in an integrated manner

GM Schemes - New Buildings

Residential Buildings
Non-Residential Buildings
Landed House
GM Schemes - Existing Buildings
Residential Buildings
Non-Residential Buildings
Schools
GM Schemes - Within Buildings
Office Interiors
Restaurants
GM Schemes - Beyond Buildings
New Parks
Existing Parks
Districts
Infrastructures
Rapid Transit System

➤ **BCA Green Mark Incentive Scheme**

The Green Mark Incentive Scheme was launched in 2006 to encourage building developers to achieve higher Green Mark ratings. New and retrofitted buildings with a GFA above 5000 m² that have achieved ratings of Green Mark Gold and above will be awarded monetary incentives. Due to overwhelming response, the \$20million fund has been fully committed in 2010. To further encourage the private sector to develop buildings that attain higher tier Green Mark ratings (i.e. Green Mark Platinum or Green Mark Gold^{PLUS}), the Green Mark Gross Floor Area Incentive scheme was initiated in 2009. To accelerate the pace of energy efficiency improvement in our buildings, BCA introduced a \$100 million Green Mark Incentive Scheme for Existing buildings (GMIS-EB) in 2009 to encourage building owners to upgrade their existing buildings to be more energy efficient and environmentally friendly. A \$5 million Green Mark Incentive Scheme (Design Prototype) was launched in 2011 to encourage both private and public developers to go beyond Green Mark Platinum rating and achieve 10% better energy efficiency than the level of Green Mark Platinum.

➤ **Pilot Building Retrofit Energy Efficiency Financing (BREEF) Scheme**

To help building owners overcome the first cost barrier, BCA has introduced a new pilot scheme called the Building Retrofit Energy Efficiency Financing (BREEF) where financial institutions provide loans to building owners and energy services companies for them to carry out building energy retrofits. This provides opportunities for financial institutions to diversify retail product lines.

➤ **Public Sector Taking the Lead in Environmental Sustainability (PSTLES)**

The public sector is taking the lead in moving towards environmental sustainability for its buildings. Under this programme, public sector buildings will have to meet energy efficiency targets to reduce energy expenditure. New public sector buildings and existing public sector buildings undergoing

major retrofitting works of an air-conditioned area with more than 5,000m² would need to attain Green Mark Platinum rating, and the existing public sector buildings with air-conditioned area more than 10,000m² are required to attain Green Mark Gold^{PLUS} rating by 2020. To spur environmental sustainability of strategic areas, four key growth areas in Singapore are required to meet Green Mark Platinum or Gold^{PLUS} standards as part of the Government Land Sales requirements.

➤ **Energy Smart Label**

The Energy Smart Building Labelling Programme, developed by the Energy Sustainability Unit (ESU) of the National University of Singapore (NUS) and the NEA, aims to promote energy efficiency and conservation in the buildings sector by according recognition to energy efficient office and hotel buildings, as well as retail malls. Buildings that are in the top 25 percentile in terms of energy efficiency of the total building cohort are awarded with a certificate and an Energy Smart Label. In addition to its energy performance, the building's indoor environmental conditions such as air quality, thermal comfort, ventilation and lighting level are taken into consideration when evaluating a building for the award.

• **Households**

➤ **Mandatory Energy Labelling Scheme**

Under the Environmental Protection and Management Act, all household refrigerators, air conditioners and clothes dryers that are sold in Singapore must be affixed with an Energy Label. Minimum Energy Performance Standards (MEPS) for household refrigerators and air-conditioners were introduced in September 2011 to phase out the most energy inefficient models from the market.

d) Financial resources and budget allocation

- The Sustainable Energy Fund - SGD 28 million
- The EASe scheme - SGD 10 million
- The Green Mark Incentive Scheme for New Buildings - SGD 20 million
- The Green Mark Incentive Scheme for Existing Buildings – SGD 100 million
- GREET – SGD 46.8 million
- EASe – SGD 12.3 million
- The Green Mark Gross Floor Area Incentive Scheme
- The Sustainable Construction (SC) Capability Development Fund - SGD 15 million
- The Green Mark Incentive Scheme for Design Prototype (GMIS-DP) - SGD 5 million
- The Building Retrofit Energy Efficiency Financing (BREEF) Scheme
- The Smart Energy Challenge - SGD 25 million

(Note: Other funding in relation to R&D is stated in point 1.6)

e) Method for monitoring and measuring the effect of the measures

The various energy efficiency measures have differing methods for monitoring and measuring the effect of measures, and are used at the discretion of the government agencies implementing the programmes.

f) Expected results

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g) Future task

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1.4. Institutional Structure

Singapore takes a sectoral, yet integrated approach to energy efficiency. Although energy efficiency spans across many sectors, and government agencies have implemented energy efficiency programmes specific to the area under their purview, the Energy Efficiency Programme Office (E²PO) was established to promote and facilitate the adoption of energy efficiency in Singapore.

E²PO coordinates the energy efficiency efforts between the five biggest energy-consuming sectors – power generation, industries, transport, buildings and households. The E²PO is a multi-agency committee co-chaired by the Energy Market Authority and National Environmental Agency. The key agencies involved are: (i) EMA for power generation; (ii) Singapore Economic Development Board (EDB) for industry; (iii) Land Transport Authority (LTA) for transport; (iv) NEA and Housing Development Board (HDB) for households; (v) Building Construction Authority (BCA) for buildings. Other member agencies include: Infocomm Authority of Singapore (IDA) for ICT; Agency for Science, Technology and Research (A*STAR) for Research & Development; Urban Redevelopment Authority (URA); Jurong Town Corporation (JTC); and the National Research Foundation (NRF).

The E²PO has identified four key thrusts in promoting energy efficiency strategy:

1. **Stimulate demand for energy efficiency** through regulation and standards, incentives and open information.
2. **Develop human and institutional capabilities** by developing local knowledge base and expertise in energy management and collaborating with Institutes of Higher Learning (IHLs)
3. **Promote emerging energy efficient technologies and innovation** through supporting the research development and demonstration of new energy efficient technologies, innovations and business process improvements
4. **Profile and promote energy efficiency internationally** through various platforms such as Singapore International Energy Week (SIEW).

1.5. Outreach and Capacity-building

a) Outreach programmes

- The 10% Energy Challenge was launched in April 2008 to raise the awareness of households on ways they can reduce energy consumption at home through simple energy-saving tips. The campaign also includes raising public awareness in choosing energy efficient air-conditioners, refrigerators and clothes dryers.
- The Energy Efficiency National Partnership (EENP) programme, a key recommendation of the Sustainable Singapore Blueprint, was launched on 29 April 2010 to promote a culture of energy efficiency improvement in industry. The voluntary EENP programme targets companies that are interested in improving their energy efficiency and implementing energy management practices. The EENP comprises three key elements:
 - i) Energy management system,

ii) Learning network, and

iii) Annual EENP Awards – recognise the efforts and achievements of corporations and corporate teams in improving energy efficiency, and aim to encourage corporate EENP Award recipients to share their EE projects and good practices on improving energy efficiency. The inaugural EENP Awards Ceremony was held in conjunction with the National Energy Efficiency Conference (NEEC) 2011 on 24 May 2011.

- To raise public awareness on the importance and benefits of green buildings, BCA has put in place a strong outreach programmes that includes public online portal, roving green building exhibitions and new social media, Facebook. BCA has also partnered the Green Mark Champion, CDL, to hold a BCA-CDL Green Sparks Competition 2010 which brings about fresh ideas and innovation among our youths on retrofitting existing buildings.
- More recently, the 3rd Singapore Green Building Week was held in September 2011 and involved three major events – the International Green Building Conference, the Green Mark Tour and the Build Eco Xpo Asia. This forms a crucial part of BCA's public outreach activities to raise awareness on the need to provide a sustainable future for Singapore.

a) Capacity building

➤ Singapore Certified Energy Manager (SCEM) Programme & Training Grant

The Singapore Certified Energy Manager (SCEM) Programme offers a formal training and certification system in the area of energy management. A training grant is available to support the training of local engineers and improve capability in professional energy management. The programme targets engineers who manage manufacturing facilities and buildings and provide energy services or engineering consulting services.

- The National Energy Efficiency Conference (NEEC), a key event of the EENP, brings together energy efficiency experts and industry energy professionals to provide thought leadership on energy efficiency and share best practices and success case stories. The inaugural NEEC 2011 was held on 24 and 25 May 2011.
- ESCO Accreditation Scheme

The Energy Services Companies (ESCOs) Accreditation Scheme was introduced to enhance the professionalism and quality of energy services offered.

- Green Mark Specialist Certification Programmes

BCA has focused training programmes aimed at equipping professionals with new skills, to deepen their professional skills and expertise in the area of environmental sustainability. These include the Certification courses for Green Mark Managers (GMM), Green Mark Facilities Managers and Green Mark Professionals (GMP).

BCA has recently introduced a Certificate Course on “Measurement & Verification of Central Chilled-Water Plant Efficiency” to equip participants with the knowledge and skills required to implement Measurement and Verification (M&V) measures in central chilled-water plants in conformance with Green Mark version 4 and the relevant international standards.

- Executive Development and Degree Programmes on Sustainable Design and Operations

As part of BCA Academy's continuous effort to facilitate the development of a pool of 'green' specialists highly skilled in sustainable design and development leadership capabilities, the Academy tied up with the University of Nottingham to roll out a Master of Science in Sustainable Building Design programme in 2009. The two-year part-time is the first of its kind in Singapore, focusing on developing cross-disciplinary professional skills as well as analysis and decision-making skills.

The BCA Academy has also partnered with the University College London (UCL) to launch the Master of Science degree in Facility and Environment Management earlier this year. This two-year part-time MSc programme will equip the building professionals with the skills, knowledge and tools to operate, maintain, manage and improve the performance of green buildings over their economic lifespan.

Apart from postgraduate degrees, BCA has signed a tripartite agreement with UniSIM and Singapore Polytechnic to jointly offer the Bachelor of Science in Facility and Events Management Programme. This is a four-year part-time honours degree programme launched in 2010 targeted to train working adults in the facilities and events management field who wish to upgrade from diploma to degree level.

To help industry leaders and managers to keep abreast with the trends, innovation and technology development globally in other countries, the Academy has also forged partnerships with various well-known institutions to offer short intensive executive development programmes. One example is the 6-day Carnegie Mellon University-BCA Executive Development Programme on Leadership in Environmental Sustainability; it has received good response since its launch in April 2009. Conducted at the Carnegie Mellon University annually, this programme aims to accelerate the development of executives in green stewardship roles that will steer Singapore's built environment towards the next level of environmental sustainability. About 540 executives had been trained for the three intakes.

In addition, the Academy has collaborated with the Stuttgart University of Applied Sciences in Germany for the HFT Stuttgart-BCA Executive Development Programme on Innovations in Sustainable Design and Technology in 2010. This programme is designed to provide a strategic platform for leading building professionals in the area of green building design and technology.

1.6. Research and Development in Energy Efficiency and Conservation

In 2007, the Ministry of National Development (MND) Research Fund established a \$50 million research fund for the Built Environment to support R&D efforts in green building technologies and energy efficiency.

To further harness multi-disciplinary research and development capabilities, Singapore launched a SGD 1 billion 'National Innovation Challenge' as a major new R&D thrust for the next 5 years. The first area for the Challenge is "Energy Resilience for Sustainable Growth" which aims to develop cost-competitive energy solutions for deployment within 20 years to help Singapore improve energy efficiency, reduce carbon emissions and increase energy options.

As part of the inaugural Smart Energy Challenge (SEC)³, launched in November 2009, the Energy Market Authority awarded Singapore-based companies a total of up to \$10 million to

³ Under the \$25 million Energy Research Development Fund (ERDF) which provides financial support for implementation of new and innovative energy solutions that are close to deployment and have the potential to provide impactful and tangible results.

fund & support the development of new energy technologies and solutions in three focus areas – Power Generation, Energy for Transport and Energy Efficiency for Industry.

2. MEASURES FOR ENERGY EFFICIENCY IMPROVEMENTS

2.1. Government Laws, Decrees, Acts

Energy efficiency is governed through a number of regulatory measures.

2.2. Regulatory Measures

Energy Labelling & Standards:

- Environmental Protection and Management Act (EPMA)
- Mandatory energy labelling of household air conditioners and refrigerators in January 2008 (see section 1.3 for details)
- Mandatory fuel economy labelling for passenger and light goods vehicles in April 2009 (see section 1.3 for details)
- Mandatory energy labelling of household clothes dryers in April 2009.
- Minimum Energy Performance Standards for household air conditioners and refrigerators in September 2011

Vehicles:

- Vehicle Quota System (VQS) (see section 1.3 for details)
- Off-Peak Car scheme
- Electronic Road Pricing (ERP)
- Building Green Framework for Rapid Transit System (RTS) which specifically address and evaluate energy concerns and sustainable design efforts for RTS.

Buildings:

- Building Control (Environmental Sustainability) Regulations 2008
- Code for Environmental Sustainability of Buildings 2nd Edition
 - BCA Green Mark Scheme – New Buildings
- Code on Envelope Thermal Performance for Buildings 2008
- Mandatory Higher Green Mark Standard For Government Land Sales Sites In Key Strategic Areas

2.3. Voluntary Measures

Voluntary measures to drive energy efficiency improvements in Singapore include the BCA Green Mark Scheme, Green Label Scheme (SEC), Singapore carbon Label (SEC), Green Building Product Certification Scheme (SGBC), Green Office Label (SEC), public sector energy audits and others (see section 1.3 for details).

Financial Measures Taken by the Government

2.3.1. Tax Scheme

Investment Allowance (IA) Scheme and Accelerated Depreciation Allowance Scheme (see section 1.3 for details)

2.3.2. Low-Interest Loans

NA

2.3.3. Subsidies and Budgetary Measures

Subsidies available are: Energy Efficiency Improvement Assistance Scheme (EASe); Grant for Energy Efficient Technologies; Design for Efficiency (DfE) Scheme; Green Vehicle Rebate; Innovation for Environmental Sustainability (IES) Fund; and Green Vehicle Rebate. (Note: The information was provided in earlier sections.)

2.4. Energy Pricing

As Singapore imports most of its energy, energy prices in Singapore are subject to volatility in regional and global energy prices. Fuels are subject to excise duties and goods and services tax (GST). Taxes and duties make up about 30% of retail fuel price at the pump.

2.5. Other Efforts for Energy Efficiency Improvements

2.5.1. Cooperation with Non-Governmental Organisations (NGOs)

- Sustainable Energy Association of Singapore (SEAS) and the Institution of Engineers Singapore (IES) for the Singapore Certified Energy Manager Programme
- NEA is a member of the Renewable Energy and Energy Efficiency Partnership (REEEP)
- SGBC-BCA Green Individual Award recognises the contributions of professionals and individuals who have been leading the green building movement in Singapore.

2.5.2. Cooperation through Bilateral, Regional and Multilateral Schemes

Singapore actively participates in multilateral fora on energy, such as APEC Energy Working Group, ASEAN, and East Asia Summit (EAS) Energy Cooperation Task Force (ECTF).

2.5.3. Other Cooperation/Efforts for Energy Efficiency Improvements

Cooperation with the International Energy Agency (IEA), Asian Development Bank (ADB) and United Nations Environment Programme (UNEP) – Sustainable Building and Climate Initiative (SBCI) have been initiated to facilitate the transfer of technologies, policies and exchange of best practices in energy efficiency and other aspects of sustainable development.

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