

SINGAPORE

1. GOALS FOR EFFICIENCY IMPROVEMENT

1.1. Overall Energy Efficiency Improvement Goals

In its Sustainable Singapore Blueprint (2009), Singapore has set a target of achieving a 35% energy intensity improvement 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

All sectors of the economy, namely power generation, industry, transport, buildings, and households²

c) Outlines

- Power generation

The liberalisation of Singapore's energy market since 2000 has promoted competition in the electricity and gas markets by encouraging investments in 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.

Singapore is also promoting greater use of co-generation and tri-generation by integrating the deployment of these technologies into ongoing and future industrial planning.

- Power Grid System

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 IES will provide consumers with more information, choice and control over their electricity usage, thereby improving energy efficiency for Singapore as a whole

- Industry
 - Energy Efficiency National Partnership (EENP)

The EENP is a voluntary programme that seeks to encourage and help companies put in place energy efficiency and productivity improvement projects at the organisational level to reduce energy wastage. The EENP targets companies that are large energy consumers, consuming more than 15GWh per year, as well as companies that are interested in improving their energy efficiency and implementing energy

¹ Ministry of National Development (2009).

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

management practices. The core elements of the EENP include i) the energy management system for companies, ii) learning network to learn and share efficient technologies & iii) national recognition scheme to recognise energy management practices implemented by EENP Partners.

- The Energy Efficiency Improvement Assistance Scheme (EASe)

EASe provides up to 50% funding for companies to carry out detailed energy assessments of buildings and industrial facilities. It is administered by the National Environment Agency (NEA).

- Grant for Energy Efficient Technologies (GREET)

GREET provides up to 50% funding, capped at SGD2 000 000 per project, to encourage owners and operators of industrial facilities to invest in energy efficient equipment or technologies. It is administered by the NEA.

- 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 or SGD 600 000, whichever is lower, for large consumers of energy to conduct design workshops to design more energy efficient facilities. It is administered by the NEA.

- 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. It is administered by the NEA.

- Innovation for Environmental Sustainability (IES) Fund

The IES Fund provides seed funding for companies to undertake innovative environmental projects, including energy efficiency projects that could help to meet the government's goal of environmental sustainability. It is administered by the NEA.

- Transport

Promoting public transport 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.

- 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
- Green Vehicle Rebate to encourage the use of hybrid, CNG and electric vehicles
- Implemented mandatory Fuel Economy Labelling Scheme Euro IV emissions standard for new diesel vehicles registered from 1 October 2006 Euro IV compliance is applicable to green buses, taxis and commercial vehicles
- Test-bedding new technologies such as the Diesel Particulate Filter (DPF), diesel-hybrid buses, electric cars

- Developed 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.
- Encouraging cycling and walking with investments in infrastructure.
- Buildings

Since the introduction of the Ministry of National Development (MND) Research Fund for the Built Environment in December 2006, agencies such as the Building and Construction Authority (BCA) and the NEA have encouraged the development and construction of energy efficient buildings.

- EASe for Buildings

EASe scheme is available to buildings owners and operators.

- 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.

- Building Control Regulations

BCA has established the Code for Environmental Sustainability of Buildings. This Code sets out the minimum environmental sustainability standard for buildings and the administrative requirements. This Code has largely adopted the BCA Green Mark's criteria as the compliance method in assessing the environmental performance of a building.

The following codes and standards under the Code for Environmental Sustainability of Buildings have relevance:

1. Code on Envelope Thermal Performance for Buildings
2. SS530-Code of Practice for Energy Efficiency Standard for Building Services and Equipment
3. SS553-Code of Practice for Air-Conditioning and Mechanical Ventilation in Buildings
4. SSCP38- Code of Practice for Artificial Lighting in Buildings
5. SS531-1-Code of Practice for Lighting of Work Places - Indoor

The Code on Envelope Thermal Performance for Buildings covers:

1. Envelope Thermal Transfer Value (ETTV) for air-conditioned non-residential buildings
2. Roof Thermal Transfer Value (RTTV) for air-conditioned non-residential buildings (with skylight)
3. Residential Envelope Transmittance Value (RETV) for residential buildings

4. Roof insulation for air-conditioned non-residential buildings (without skylight) and residential buildings

- 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 also gone beyond individual buildings to inspire and promote environmental sustainability in parks, districts, rapid transit systems and supporting infrastructure.

- 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. 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 in 2009 was initiated. 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.

- Public Sector taking the lead

The public sector is taking the lead in moving toward environmental sustainability for its buildings. It aims to demonstrate the associated environmental and economic benefits and set an example for the private sector. New public sector buildings and existing public sector buildings undergoing major retrofitting works with air-conditioned area more than 5,000m² would need to attain Green Mark Platinum rating, and existing public sector buildings with air-conditioned area more than 10,000m² to attain Green Mark Gold^{PLUS} rating by 2020.

- Households

- Mandatory Energy Labelling Scheme

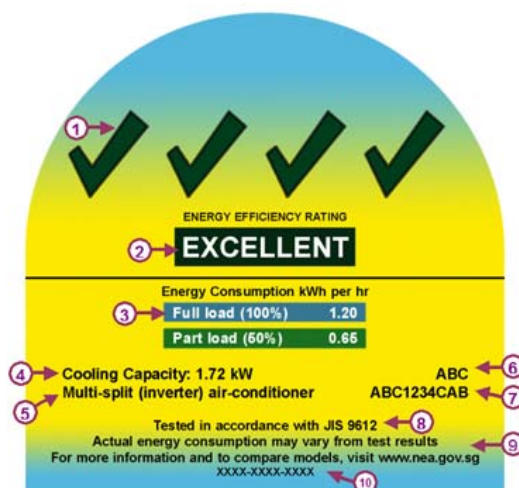
All household refrigerators, air conditioners and clothes dryers that are sold in Singapore must be energy labelled³. Singapore is also evaluating the introduction of minimum energy performance standards (MEPS) for energy-intensive household appliances.

Singapore's Energy Label design and certain aspects of the Energy Labelling Scheme are presented below⁴:

'Registered suppliers supplying registrable goods must affix the Energy Label on the units that they supply in Singapore. The Energy Label shall be affixed only after the National Environment Agency (NEA) has issued the Certificate of Registration (COR) for the model. Retailers are only allowed to display models that have the label affixed on them.'

³ National Climate Change Committee (2009).

⁴ National Environment Agency (2009).



Specifications

Dimensions: 9cm (width) x 9cm (height)

Arc: 9cm (diameter)

Font: Arial, bold, black

Table 1. Features of the rating system

Feature	Air conditioners	Refrigerators	Clothes Dryers
1 Ticks	The number of Ticks shall conform to the Tick Rating system.		
2 Energy Efficiency Rating	The model's relative energy efficiency rating is also expressed in words:		
	Green Ticks	Energy Efficiency Rating	
	0	Low	
	1	Fair	
	2	Good	
	3	Very Good	
	4	Excellent	
3 Energy Consumption	Effective power input x 1h expressed in kWh per hour and rounded to two decimal places. For inverter type air conditioners, the energy consumed at part-load cooling capacity shall also be displayed on the label.	Energy consumption over 24 hours x 365 days expressed in kWh.	Energy consumption per wash expressed in kWh and rounded to two decimal places.
4 Capacity	Full-load cooling capacity expressed in kW and rounded to two decimal places.	Measured total storage volume expressed in litres (L) in whole digits.	Rated capacity expressed in kilograms (Kilogram Kg) and rounded to one decimal places.
5 Type	Type of air conditioners: (a) Casement (b) Window (c) Single Split (non-inverter / inverter) (d) Multi-split Sys (non-inverter/inverter)	Type of refrigerators: • Refrigerator • Refrigerator-freezer	Type of clothes dryers: (a) Air-vented (b) Condenser
6 Brand Name	Brand of air conditioner	Brand of refrigerator	Brand of clothes dryer
7 Model Number	The model number found on the air conditioner nameplate. For multi-split type air conditioners, only the model number of the outdoor unit shall be displayed.	The model number found on the refrigerator's nameplate.	The model number found on the clothes dryer's nameplate .
8 Test Standards	The test standard used as specified here (app.nea.gov.sg/cms/htdocs/article.asp?pid=2843#standards).		
9 Disclaimer	The following disclaimer applies to all appliances: 'Actual energy consumption may vary from test results.'		
10 Registration Number	A unique number found on the registered model's COR, which is issued by NEA upon successful registration of the model.		

- **Reducing Standby Power Consumption**
NEA will step up efforts to inform and encourage households to completely switch off appliances that are not in use.
- **Residential Envelope Transmittance Value (RETV) standard**
From 2008 onwards, residential buildings with GFA of 2000 m² must comply with BCA's Residential Envelope Transmittance Value (RETV) standard.
- **Electricity Vending System (EVS)**
The Energy Market Authority (EMA) has developed a prototype EVS as a platform to allow small consumers such as households to choose their electricity retailers. The EVS allows for time-of-use pricing to encourage consumers to shift their load from the more expensive peak periods to the less expensive off-peak periods. The EVS also allows for demand response features whereby consumers can monitor their "live" electricity consumption. The availability of such information empowers consumers to make conscious decisions to track and potentially reduce their electricity usage. The project involving about 400 households has been completed. Building on the results of this project, EMA has embarked on the IES pilot project, where 4,500 consumers including households and businesses will participate (see above for details of the IES pilot).

d) Financial resources and budget allocation

- The Sustainable Energy Fund—SGD 50 million
- The EASe scheme—SGD 10 million
- The Green Mark Incentive Scheme—SGD 20 million.
- The Smart Energy

Other funding in relation to R&D is stated in point 1.6.

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

Programs have inherent methods for monitoring and measuring the effect of measures; other methods include monitoring through surveys.

f) Expected results

Information not available

g) Future task

Extend implementation of energy policy measures and programs

1.4. Institutional Structure

As a statutory board under the MEWR, NEA is the key agency for climate change and energy efficiency. The EMA has expanded its traditional role as a regulator for electricity and gas markets to take on a bigger role as an energy planner, promoter and developer on an economy-wide basis. In addition the Energy Studies Institute (ESI) has been set up at the National University of Singapore (NUS) to promote and develop policy-oriented research in economics, environmental and international relations aspects of energy, as well as contribute to energy dialogue and collaboration in the region.

a) Name of organisation

Energy Efficiency Programme Office (E2PO)

Energy efficiency matters in Singapore are lead by the Energy Efficiency Programme Office (E²PO), formed in 2007.

b) Status of organisation

Multi-Agency Committee co-Chaired by EMA and NEA

The E²PO is a multi-agency committee co-chaired by the Energy Market Authority (EMA) and the National Environmental Agency (NEA).

E²PO is comprises the 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, vi) Infocomm Authority of Singapore (IDA) for ICT, and vii) Agency for Science, Technology and Research (A*STAR) for R&D.

c) Role and responsibility

- Promoting adoption of energy efficient technologies and measures by addressing the market barriers to energy efficiency
- Building capacity to drive and sustain energy efficiency efforts and to develop the local knowledge base and expertise
- Rising awareness to reach out to the public and businesses as to simulate energy efficient behaviour and practices
- Supporting research and development to enhance Singapore's capability in energy efficient technologies.

d) Covered sectors

Power generation, industry, transport, buildings, information/communications, and households

e) Number of staff members

Not applicable

1.5. Information Dissemination, Awareness-raising and Capacity-building**a) Information collection and dissemination programme**

Regarding the E²PO, ministries and agencies collect information concerning the development of energy programs; relevant agencies disseminate information about programs.

b) Awareness-raising program, (e.g., consumer campaign)

A public campaign—10% Energy Challenge—was launched in April 2008 and aims to educate households on ways they can reduce energy consumption at home.

- Outreach Programmes

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 2nd Singapore Green Building Week held in September 2010 which involves three major events – the inaugural SGBC Green Building Conference, WorldGBC International Congress and the Build Eco Xpo Asia forms a crucial part of BCA's public outreach activities to raise awareness on the need to provide a sustainable future for Singapore.

c) Capacity-building (human resource development) programme (training)

- Singapore Certified Energy Manager (SCEM) Programme

The Singapore Certified Energy Manager (SCEM) Programme, developed by the Energy Sustainability Unit of the National University of Singapore (NUS) under the sponsorship of the Economic Development Board's Locally-based Enterprise Advancement Program (LEAP), offers a formal training and certification system in the area of energy management. In support of the SCEM programme is the SCEM Training Grant, a co-funding scheme administered by NEA to develop local expertise and capability in professional energy management. The scheme is targeted at engineers who manage manufacturing facilities and buildings and provide energy services or engineering consulting services.

- ESCO Accreditation Scheme

The NUS ESU administers an Energy Service Companies (ESCOs) Accreditation Scheme. The objective is 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).

- Courses/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 40 executives had been trained for the two 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.

- Seminars and conferences

In addition to the formal training provided under the SCEM programme, the E²PO organises numerous seminars and conferences to bring together stakeholders and experts in the field of energy efficiency to share knowledge and expertise in effective energy management.

1.6. Research and Development in Energy Efficiency and Conservation

To harness multi-disciplinary research and development capabilities, Singapore has 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.

In addition, as part of the inaugural Smart Energy Challenge (SEC)⁵, launched in November 2009, EMA awarded Singapore-based companies a total of up to \$10 million to fund & support the development of new energy technologies and solutions including improving energy efficiency.

The Ministry of National Development (MND) Research Fund for the Built Environment to encourage and support applied research and development, includes energy efficiency. The \$50 million MND Research Fund for the Built Environment to support R&D efforts in green building technologies and energy efficiency was launched in January 2007.

The Innovation for Environmental Sustainability (IES) projects include:

- Seed funding for industry-led projects, including energy efficiency projects that could contribute to the long-term environmental sustainability of Singapore; responsible agency: NEA; financial resources: SGD 20 million
- R&D, including that for energy efficiency that will raise the quality of life and make Singapore a distinctive global city; responsible agency: BCA; financial resources: SGD 50 million
- Basic and applied research projects which pursue innovative and novel ideas in the clean energy space, including energy efficiency. Responsible agency: EDB; financial resources: SGD 50 million
- Technical trials on new sustainable transport initiatives, including the setup of vehicle emission test laboratory, diesel particulate filter, diesel-hybrid bus, and electric vehicle charging infrastructure. Responsible agency: LTA; financial resources: SGD 17 million.

The Singapore Initiative in New Energy Technologies (SINERGY) Centre set up by the Agency for Science, Technology and Research (A*STAR) conducts research, development and demonstration of new and innovative energy technologies, and supports the development of these technologies from research to successful introduction in the marketplace.

The Energy Research Institute (ERI@N) recently set up at Nanyang Technological University (NTU) will act as a think tank for scientists to assemble and exchange ideas across scientific disciplines. Up to six research centres will be set up under the Institute, including the Centre for Sustainable Energy Research, which focuses on the study of fuel cells and wind and tidal energy, aimed at improving energy efficiency besides other energy-related issues.

⁵ 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.

2. MEASURES FOR ENERGY EFFICIENCY IMPROVEMENTS

2.1. Government Laws, Decrees, Acts

Energy efficiency is governed through a number of regulatory measures (see section 2.2).

2.2. Regulatory Measures

EPMA:

- Environmental Protection and Management Act (EMPA)
- 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.

LTA:

- Vehicle Quota System (VQS) (see section 1.3 for details)
- Off-Peak Car scheme
- Electronic Road Pricing (ERP).

BCA:

- Building Control Act
- Building Control (Environmental Sustainability) Regulations 2008
- Code for Environmental Sustainability of Buildings 2nd Edition
- Code on Envelope Thermal Performance for Buildings
- BCA Green Mark Scheme – New Buildings [mandatory]

2.3. Voluntary Measures

These include buildings under the BCA Green Mark Scheme, public sector energy audits, and other measures (see section 1.3 for details). Also including labels such as the Green Label Scheme (SEC), Singapore carbon Label (SEC), Green Product-Appliances Label (SGBC), Green Office Label (SEC).

2.4. Financial Measures Taken by the Government

2.4.1. Tax Scheme

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

2.4.2. Low-Interest Loans

Information not available

2.4.3. Subsidies and Budgetary Measures

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 (see section 1.3 for details)

2.5. Energy Pricing

Energy prices in Singapore are determined by the price of energy at the regional and global market. 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.

2.6. Other Efforts for Energy Efficiency Improvements

2.6.1. Cooperation with Non-Governmental Organisations (NGOs)

- Sustainable Energy Association of Singapore (SEAS) for the Singapore Certified Energy Manager Programme
- Singapore Environmental Council (SEC) for the 10% Energy Challenge
- NEA is a member of the Renewable Energy and Energy Efficiency Partnership (REEEP)

2.6.2. Cooperation through Bilateral, Regional and Multilateral Schemes

Singapore is a member of regional cooperation and forums on energy such as the Energy Efficiency Sub-sector Network of ASEAN, APEC, and EAS Energy Cooperation Task Force.

2.6.3. 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 EE technologies and policies, share and exchange information in EE, including other aspects of sustainable development.

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