

Country Profile

SINGAPORE

GENERAL OVERVIEW

Singapore is a city-state with the population of 5.6 million¹ in 2017. Despite its small area and limited natural resources, the economic performance of Singapore is outstanding in the ASEAN region. In 2017, its GDP amounted to USD 326 billion¹. The GDP per capita was at USD 55,788, placing Singapore as number one in the ASEAN. The industrial and service sectors contribute to more than 80% of the GDP. There are four official languages used in Singapore: English, Chinese (Mandarin), Malay, and Tamil.

ENERGY SECTOR

ENERGY POLICIES

The energy policy framework of Singapore sets the following objectives: (i) to promote competitive markets, (ii) to diversify energy supplies, (iii) to improve energy efficiency, (iv) to build energy industry and promote research and development, (v) to promote international cooperation, as well as (vi) to develop whole-of-Government approach.

Singapore aims to be a centre for research and development in Renewable Energy. With its limited natural resources, the country is very dependent on external energy supply. Currently, Singapore electricity around 76% is generated by piped natural gas imported from neighbour countries in particular Malaysia and Indonesia.

National Climate Change Strategy Blueprint (2012) outlined the plan to reduce CO₂ emission by 7-11% by 2020. Energy Conservation Act (ECA) came into force in April 2013. The act combines several conservation legislations from various sectors together. It requires companies with high energy consumption (more than 54 TJ energy-use per annum) as well as companies from certain sectors (manufacturing, energy supply as well as water supply and waste management) to register with the

¹ Department of Statistics Singapore

The best efforts have been undertaken to minimize inconsistencies in data presentation or reference to outdated/invalid information in the ASEAN RE and EE Country Profiles. Due to the rapid development in the region and the high number of sources, it cannot be excluded that reference is made to outdated sources or that new developments have occurred in the respective ASEAN Member States. Therefore, the ASEAN Centre for Energy (ACE) cannot be held responsible for any consequences related to the use of information provided in the Country Profiles.

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National Environmental Agency (NEA) and to implement energy management. This includes appointment of energy manager and annual reports on energy use and emissions. Among the topics to be covered in the Energy Use Report are: types and quantities of energies used for consumption, production, or sale as well as evaluation of energy patterns changes from the previous years.

ENERGY MIX

Due to its limited domestic energy resources, Singapore relies mainly on the external energy supply. Fossil fuel is the major source of energy to the energy mix (**Figure 1**).

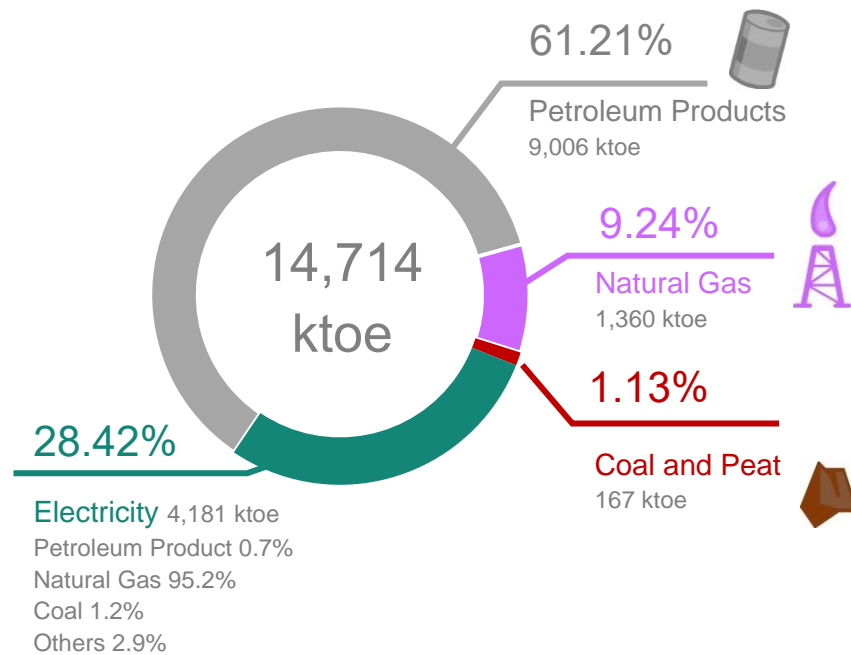


Figure 1: Total Final Energy Consumption in Singapore (2016)

Source: EMA. Singapore Energy Statistics 2018

The situation in the power sector is different from the final energy consumption as the majority of electricity in Singapore is generated from natural gas (95%). The share of conventional fuels in power sector is very high. Only 3% of electricity can be supplied from renewable energy sources (**Figure 2**).

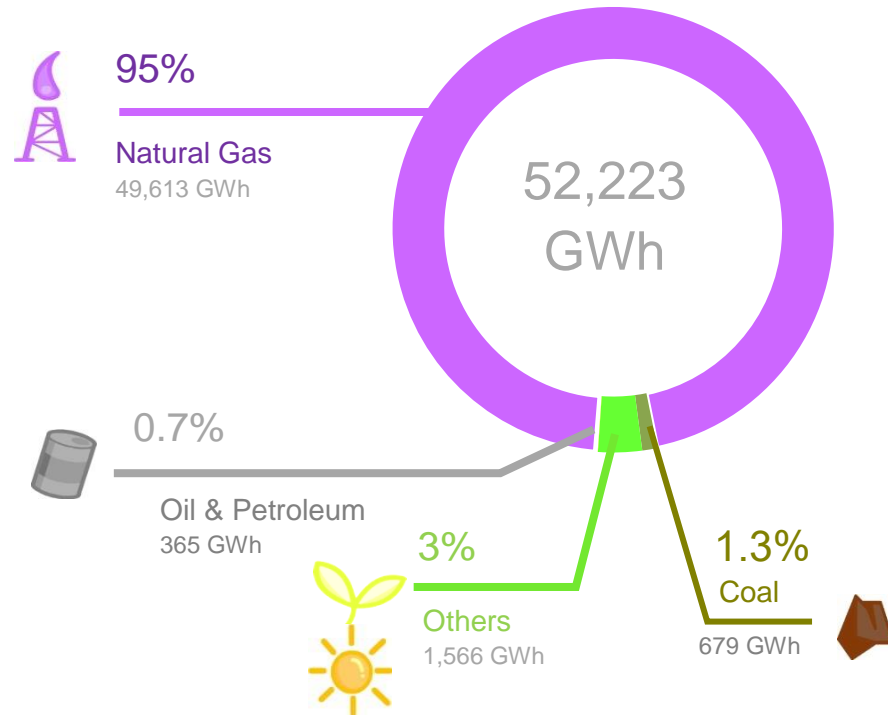


Figure 2: Generation of electricity by source (as of March 2018)

Source: EMA. Singapore Energy Statistics 2018

ELECTRICITY TARIFF & ELECTRIFICATION RATE

Two electricity tariffs systems are currently applied in Singapore that based on the consumer type: residential and commercial/industrial. The tariff for residential users is a flat rate, which denotes that the same tariff per kWh applies to all household regardless of their consumption level. The tariffs for commercial/industrial sector depend on the connecting voltage level and time of use (**Figure 3**). The consumer connected to the high voltage is subject to a lower tariff. Utilization of electricity during off-peak is also charged with lower tariff.

The electricity tariffs are regulated by the Energy Market Authority (EMA). There are four components which contribute to the total electricity tariff: energy cost which is paid to the generation companies, network cost which is paid to the power assets, market support services fee, and market administration and power system operation fee. The tariffs are subject to a quarterly revision.

According to the EMA, Singapore has already achieved 100% electricity access as the whole population is connected to the electricity grid.

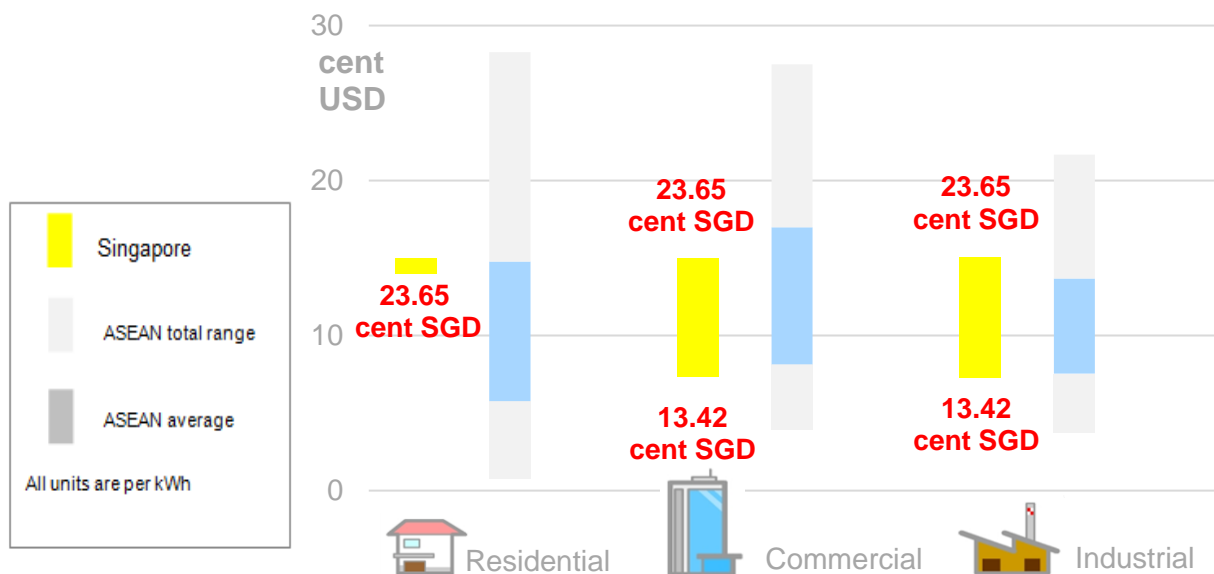


Figure 3: Electricity tariffs in Singapore (as of March 2018)

Source: Singapore Energy Market Authority (EMA)

Note: Conversion rate from SGD (Singapore-Dollar) to USD (US-Dollar) is 0.73 (as of December 2018). Price excluding GST

RENEWABLE ENERGY SECTOR

RENEWABLE ENERGY TARGETS

Due to its geographical constraints, Singapore has a limited renewable energy option. It is considered not feasible to define renewable energy targets from hydro, tidal and wind resources. However, Singapore is located in the tropical Sunbelt with good irradiance that makes solar generation as the greatest potential to be developed.

Singapore aims to become a regional leader in renewable energy research and research development. In 2014, Singapore announced their official target to raise the adoption of solar power up to 350 MWp by 2020 and 1 GWp beyond 2020

INSTALLED CAPACITY OF RENEWABLE ENERGY

Since 2008, the total installed capacity of solar photovoltaic systems has increased rapidly. In Q3 2018, the total installed capacity of solar photovoltaic reached 183.4 MWp. Majority of the PV systems is installed by the non-residential sector (95.1%). The Singapore plan of 350 MWp installed solar photovoltaic by 2020 would be around 5% of the projected peak electricity demand and would be a significant increase from the 19 MWp of installed capacity when the announcement was made. Below figure shows the updated capacity of solar photovoltaic in Q3 2018 (**Figure 4**).

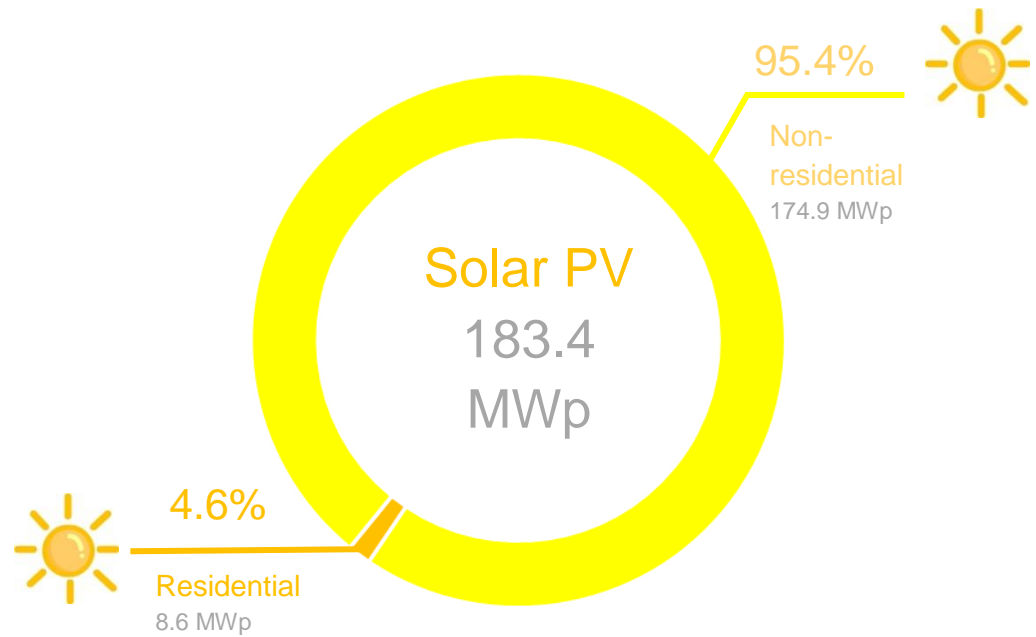


Figure 4: Total installed capacity from grid-connected solar photovoltaic (Q3-2018)

Source: SP Power Grid Ltd in Singapore Energy Statistics 2018

RENEWABLE ENERGY GENERATION

According to the data provided by International Energy Agency, total electricity generated from solar photovoltaic in 2015 is around 64 GWh or almost doubled than total generation in 2014.

RENEWABLE ENERGY MARKET

As a small island and restricted geographical condition, Singapore does not have a decent renewable energy potential except for solar power. Nevertheless, with extensive market experiences in semiconductor industry, photovoltaic is expected to be the main focus of renewable energy market in Singapore. The projected cooperation with Norway's *Renewable Energy Corporation ASA (REC)* plans to build the largest integrated solar manufacturing complex.

According to the EMA, Singapore is not adopting Feed-in Tariff (FIT) system because that mechanism distorts the energy markets and increases costs for consumers. Hence, it is important to price energy correctly and send the right price signals to both consumers and investors.

Instead of subsidies, Singapore has taken proactive steps to introduce regulatory enhancements to facilitate the entry of renewable energy when such technologies become commercially viable. The Government's support for renewables also comes in the form of funding for Research & Development to develop capabilities within the industry

Importantly, the support for research and development of renewable energy technologies is available e.g. *Experimental Power Grid Centre (EPGC)* has been established. The facilities allow studies on performance of conventional and renewable technologies in the mini-grid.

Singapore offers a range of favourable tax incentives to all industry sectors, including the renewable energy industry. The Singapore Productivity & Innovation Credit offers tax deduction/allowance and cash payout to encourage research and development in green innovation. It provides 400% tax deduction on the first SGD 400,000 of qualifying R&D expenditure for each year of assessment, and 150% on expenditure in excess of SGD 400,000. From 2013, the businesses are allowed to convert up to SGD 100,00 of the qualifying expenditure into a non-taxable cash payout at the rate of 60%.

In May 2008, the Singapore Economic Development Board launched the SGD 20-million Solar Capability Scheme to help companies with installing solar systems in new private commercial and industrial buildings. The eligible buildings must be certified with minimum Green Mark Gold Plus rating by the Building Construction Authority (BCA) and the minimum solar system installed should be 150 kWp. The solar project developers can obtain financial up to 40% of the project cost, capped at SGD 1 million per project.

ENERGY EFFICIENCY AND CONSERVATION (EE&C) SECTOR

EE&C TARGET

The Sustainable Development Blueprint sets a target to reduce their energy intensity (per dollar GDP) by 20% from 2005 levels by 2020, and by 35% from 2005 levels by 2030. Singapore is also targeting to reduce GHG emissions by 16% below BAU level by 2020. Singapore's key strategy to reduce greenhouse gas emissions is to be more energy efficient. In support of overall intensity reduction, the Building and Construction Authority sets out ambitious plans to accelerate its green building agenda and meet the targets of greening 80 % of the buildings (by gross floor area) in Singapore by 2030.

In order to help Singapore to achieve the targets, National Environmental Agency (NEA) has established the Energy Efficiency Programme Office (E2PO) for promoting energy efficiency in the various sectors through the Energy Efficient Singapore (E2 Singapore) policies and measures.

EE&C POLICY

The Sustainable Singapore Blueprint (2009-2030) was launched by the Inter-Ministerial Committee on Sustainable Development in 2015, that serves as the umbrella framework for EE initiatives in Singapore and has set a target of 20% and 35% energy intensity reduction by 2020 and 2030 respectively. The Energy Conservation Act (ECA) was introduced in 2013 and amended in March 2017 to mandate energy management requirements for energy-intensive users (companies consuming 54 TJ or more of energy per year). The main requirements of Energy Conservation Act include the appointment of energy managers, reporting of

greenhouse gas emissions and energy use, and submission of energy efficiency improvement plans.

The Singapore Minister for Finance announced at Budget 2017 to introduce a carbon tax starting from 2019. The tax will be applied on facilities that annually emit 25,000 tCO₂e or more of greenhouse gas (GHG) emissions. The tax will start at \$5/tCO₂e in from 2019 to 2023 and intended to increase to \$10/tCO₂e and \$15/tCO₂e by 2030.

EE&C POTENTIAL

According to The Ministry of Trade and Industry and National Environment Agency, Singapore cited energy consumption per GDP information which provided by IEA. The IEA has stripped away marine bunkers from its calculation of Singapore's energy consumption. Singapore is well known as the largest marine bunkering center in the world.

According to The National Environment Agency, power generation sector is having the major contribution for emission reduction. **Figure 5** below is showing potential emission reduction by each sector on 2020 BAU levels:

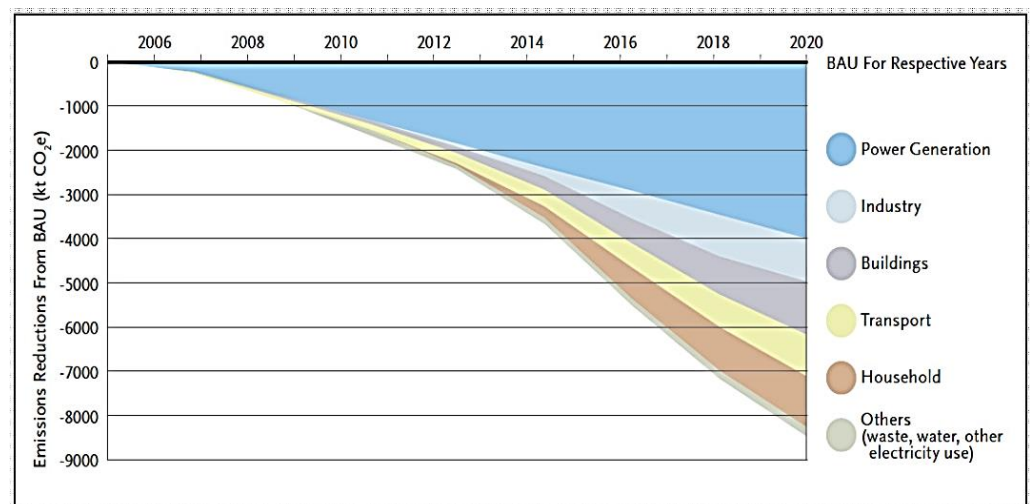


Figure 5: Sectoral contributions to emission reduction.

Source: National Environment Agency

In term of monetary saving, Industrial is the most potential sector in Singapore as referred by E2PO Singapore. The following industries as shown in **Figure 6** below have the highest potential for energy efficiency improvements mainly due to their large sizes and high energy intensity.

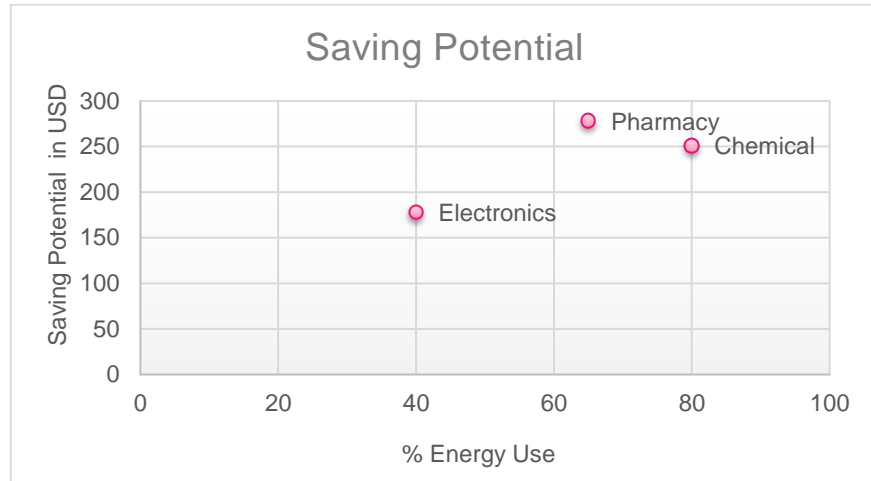


Figure 6: Saving Potential for industrial energy efficiency in Singapore (2015)

Source: E2PO Singapore

- **Chemical:** Energy usage in heating and cooling process in chemical industry is reaching 80%. The largest consumer of electricity amongst all industries.
- **Pharmaceutical and Biotech:** Areas of focus are in High Voltage Alternating Current which forms 65% of energy use on this industry sector
- **Electronics:** Process tools in this industry forms 30 to 40% of energy use.
- **Environment and Water:** A large proportion of the energy in this industry is consumed by pumps. As Singapore increases the use of seawater desalination as its water source, the energy intensity of this industry is due to increase. However, percentage of energy use on this sector has not been quantified yet.

EE&C ACTIVITIES AND INVESTMENT

Energy Efficiency Programme Office (E2PO) has identified the following implementations to develop a holistic energy efficiency plan for Singapore:

1. Promote the adoption of energy efficient technology and measures by addressing the market barriers to energy efficiency;
2. Build capacity to drive and sustain energy efficiency efforts, and develop the local knowledge base and expertise in energy management;
3. Raise awareness and reach out to the public and businesses to encourage energy efficient behavior and practices; and
4. Promote R&D to enhance Singapore's capability in energy efficient technologies.

As the industrial sector makes up about half electricity consumption share, the vast opportunities for energy efficiency improvements are plausible. The required investment for industrial energy efficiency in 2015 is estimated at USD 397 million to USD 739 million, depending on policies and demand push. Singapore has various financial schemes to finance EE projects such as the E2F) for the industrial sector and the GMIS for the building sector. The range of market potential is shown in **Figure 7** below:

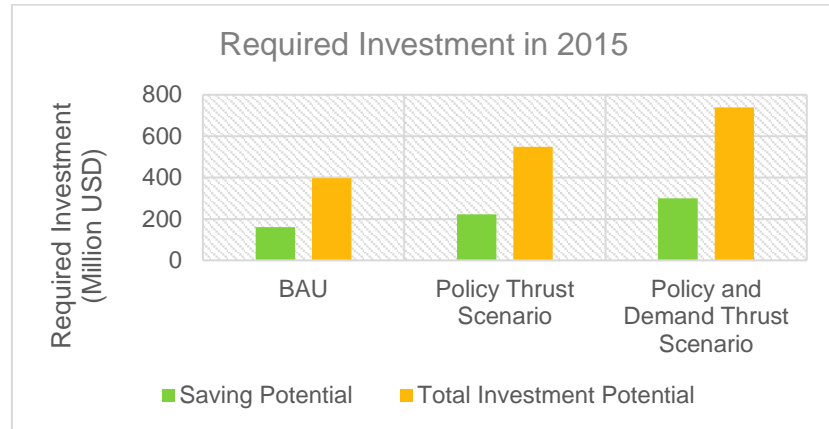


Figure 7: Required Investment in industrial energy efficiency based on scenario.

Source: E2PO Singapore

The E2PO is a multi-agency committee that jointly promotes and facilitates the activities of energy efficiency in Singapore. **Table 1** below is showing whole of related government entities to improve energy efficiency in Singapore:

Table 1: Related government entities to improve energy efficiency in Singapore

Source: E2PO Singapore

Sector	Entities
Power Generation	<ul style="list-style-type: none"> Energy Market Authority
Industry	<ul style="list-style-type: none"> National Environment Agencies EDB Singapore
Buildings	<ul style="list-style-type: none"> National Environment Agencies Housing & Development Board Building & Construction Authority
Transport	<ul style="list-style-type: none"> MPA Singapore CAAS Singapore Land Transport Authority
Households	<ul style="list-style-type: none"> National Environment Agencies Housing & Development Building & Construction Authority

Since 2017, National Environment Agency (NEA) established Energy Efficiency Fund (E2F). The objective of E2F is supporting industrial companies to design resource efficient facilities, conduct energy assessments to identify energy efficiency measures, and adopt energy efficient equipment or technologies. The Energy Efficiency Fund (E2F) supports the following implementations on business to improve energy efficiency of industrial facilities:

- a) Resource Efficient Design
 Companies setting up new industrial facilities in Singapore are encouraged to integrate energy and other resource (e.g. water, gas) efficiency improvements into the design of the facility. Design workshops are focused and collaborative

efforts to design facilities to be energy efficient. The E2F co-funds up to 50% of the cost of a design workshop or USD 600,000 whichever is lower.

b) Energy Assessment of Existing Facilities

Companies are encouraged to carry out energy audits on operating industrial facilities to identify and quantify areas where energy savings can be made and estimate the amount of savings achievable. The E2F co-funds up to 50% of the costs of such energy audits, subject to a cap of USD 200,000.

c) Energy Efficient Equipment

Companies operating new and existing manufacturing facilities are encouraged to invest in energy efficient equipment or technologies. The E2F co-funds up to 30% of the investment cost of energy efficient equipment or technologies

REFERENCE SOURCES

- 1 Energy Market Authority (EMA). 2018. *Singapore Energy Statistic 2018*. Singapore
- 2 Reegle, n.d. *Energy Profile Singapore* [online] Reegle. Available at <<http://www.reegle.info/countries/singapore-energy-profile/SG>> [Accessed November 2017]
- 3 World Bank. 2017. *Singapore data*. [online] Available at: <<http://data.worldbank.org/country/singapore?view=chart>> [Accessed December 2017]
- 4 Singapore Power. 2018. *Tariff rates*. [online] Available at: <<https://www.spgroup.com.sg/wcm/connect/spgrp/28af0f6d-38ff-4242-a283-e44ae7586706/%5B20180629%5D+Media+Release+-+Electricity+Tariff+Revision+For+The+Period+1+July+To+30+September+2018.pdf?MOD=AJPERES&CVID=>>> [Accessed September 2018]
- 5 Department of Statistics Singapore. 2017. *National accounts*. [online] Available at: <<http://www.singstat.gov.sg/statistics/browse-by-theme/national-accounts>> [Accessed December 2017]
- 6 Singapore Power. 2017. *Historical Electricity Tariff* [pdf]. Available at: <<https://www.spgroup.com.sg/>> [Accessed December 2017]
- 7 REN21 Renewables Interactive Map [online] REN21. Available at <www.ren21.net/REN21Activities/InteractiveMap.aspx> [Accessed December 2016]
- 8 Bhaskar Ram. 2015. *Energy Efficiency Potential and Initiative's*. In: National Environment Agency. *Regulators Forum*. 24 Nov 2016.
- 9 Melissa Low and Su Bin, 2017. *Singapore's Drive towards Energy Efficiency*. Energy Studies Institute, Singapore. 30 May 2017
- 10 Ministry of Trade and Industry Singapore. 2007. *National Energy Policy Report*. [pdf] Available at: <<https://www.mti.gov.sg/ResearchRoom/Documents/app.mti.gov.sg/data/pages/885/doc/NEPR%202007.pdf>> [Accessed December 2017]
- 11 ASEAN Centre for Energy. 2016. *ASEAN Renewable Energy Policies*. Jakarta
- 12 ASEAN Centre for Energy. 2018. *Financing Energy Efficiency in the ASEAN Region*. Jakarta
- 13 ASEAN Centre for Energy. 2018. *Green Building and Energy Efficiency & Conservation Codes in ASEAN*. Jakarta