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## No. S 246

### ENERGY CONSERVATION ACT 2012 (ACT 11 OF 2012)

#### ENERGY CONSERVATION (ENERGY MANAGEMENT PRACTICES) REGULATIONS 2013

##### ARRANGEMENT OF REGULATIONS

###### PART I

###### PRELIMINARY

###### Regulation

1. Citation and commencement
2. Definitions
3. Circumstances in which activity or activities (including ancillary activities) will form part of single undertaking or enterprise
4. Activities to be attributable to same industry sector as principal activity

###### PART II

###### REGISTRATION OF REGISTRABLE CORPORATION

5. Registration of registrable corporation
6. Circumstances in which registered corporation may apply to cancel registration
7. Application to cancel registration

###### PART IIA

###### ENERGY MANAGEMENT PRACTICES FOR NEW VENTURES

- 7A. Definitions of this Part
- 7B. Application of this Part
- 7C. Energy efficiency opportunities assessment for new ventures
- 7D. Energy efficiency opportunities assessment report for new ventures
- 7E. Records to be kept for new ventures

## PART IIB

MINIMUM ENERGY EFFICIENCY STANDARDS  
FOR ENERGY-CONSUMING SYSTEMS

## Regulation

- 7F. Definitions of this Part
- 7G. Relevant person
- 7H. Prescribed energy-consuming system
- 7I. Prescribed change to energy requirements
- 7J. Prescribed permanent measuring instruments
- 7K. Prescribed manner of assessment
- 7L. Minimum energy efficiency standard
- 7M. Requirements for assessment reports
- 7N. Requirements relating to keeping of records

## PART III

ENERGY MANAGEMENT PRACTICES OF  
REGISTERED CORPORATION

- 8. Periodic reporting of energy use
- 9. Records to be kept
- 10. Energy efficiency improvement plan
- 11. Appointment of energy manager

## PART IV

ENERGY EFFICIENCY OPPORTUNITIES  
ASSESSMENTS FOR REGISTERED CORPORATIONS

- 12. Definitions of this Part
- 13. Application of this Part
- 14. First energy efficiency opportunities assessment
- 15. Subsequent energy efficiency opportunities assessments
- 16. Requirements of energy efficiency opportunities assessments
- 17. Energy-consuming systems of relevant business activities
- 18. Objective of energy efficiency opportunities assessments
- 19. Reference period of energy efficiency opportunities assessments
- 20. Methods and processes to be used for energy efficiency opportunities assessments
- 21. Individuals conducting energy efficiency opportunities assessments
- 22. Requirements of assessment reports
- 23. Records to be kept for this Part

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Regulation

The Schedules

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In exercise of the powers conferred by sections 2, 3(3), 23(1) and (2), 24(3), 25(1), 27(1) and (2), 28(1) and (2), 29(1) and (2), 30(1), (2) and (4) and 78 of the Energy Conservation Act 2012, the Minister for the Environment and Water Resources hereby makes the following Regulations:

## PART I

### PRELIMINARY

#### **Citation and commencement**

1. These Regulations may be cited as the Energy Conservation (Energy Management Practices) Regulations 2013 and shall come into operation on 22nd April 2013.

#### **Definitions**

2. In these Regulations, unless the context otherwise requires —

“chief executive” means any person, by whatever name described, who is in the direct employment of, or acting for or by arrangement with, a corporation, and is principally responsible for the management and conduct of the business of the corporation;

“energy” has the same meaning as in the Energy Conservation (Registrable Corporations) Order 2013 (G.N. No. S 248/2013);

“energy commodity” has the same meaning as in the Energy Conservation (Registrable Corporations) Order 2013;

“energy consumption” has the same meaning as “consumption of energy” in the Energy Conservation (Registrable Corporations) Order 2013;

“energy-consuming system” means any piece of equipment or pieces of equipment working together to perform a task or

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support one or more processes which consume fuel or energy commodities, including but not limited to any of the following:

- (a) fuel combustion system;
- (b) heating, ventilation and air-conditioning system (including air handling system);
- (c) cooling system;
- (d) system used to produce or generate energy commodity or commodities;
- (e) system used for bonding, separation, conversion, treatment, testing or processing;
- (f) system used for pumping, movement, transportation, mixing or recovery;

“feedstock” refers to any fuel or energy commodity that is used as raw material to produce products containing carbon;

“greenhouse gas” refers to any of the gases as specified in the First Schedule;

“manufacturing and manufacturing-related services” has the meaning given by paragraph 2 of the Energy Conservation (Registrable Corporations) Order 2013 (G.N. No. S 248/2013);

*[S 972/2020 wef 01/12/2020]*

“registrable corporation” has the same meaning as in the Energy Conservation (Registrable Corporations) Order 2013;

“relevant business activity” means a business activity under the operational control of the registered corporation that —

- (a) resulted in the corporation’s registration; or
- (b) would have qualified the corporation as a registrable corporation if it was not already so registered;

“specific energy consumption” means a measure of the energy consumption of the business activity or energy-consuming system, as the case may be, that is expressed —

(a) by reference to a unit of production or service that is reasonably relevant to the business activity or energy-consuming system, its energy use, or both; and

(b) providing a metric (number) and a measure (production unit or unit relevant to the service);

*[S 972/2020 wef 01/12/2020]*

“supply of electricity, gas, steam, compressed air and chilled water for air-conditioning” has the meaning given by paragraph 2 of the Energy Conservation (Registrable Corporations) Order 2013;

*[S 972/2020 wef 01/12/2020]*

“water supply and sewage and waste management” has the meaning given by paragraph 2 of the Energy Conservation (Registrable Corporations) Order 2013.

*[S 972/2020 wef 01/12/2020]*

**Circumstances in which activity or activities (including ancillary activities) will form part of single undertaking or enterprise**

3.—(1) For the purposes of section 3(1)(b) of the Act, this regulation specifies the circumstances in which an activity, or a series of activities, will form part of a single undertaking or enterprise.

(2) Activities that together produce one or more products or services (referred to in this regulation as the primary production process) will form part of a single undertaking or enterprise if the activities take place at a single site.

(3) If there is another activity or series of activities (referred to in this regulation as the other production process) that —

(a) is under the overall control of the corporation that has overall control of the primary production process; and

(b) produces one or more other products or services for the primary production process (which are not used solely in the primary production process),

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then provided that other production process takes place at the same site as the primary production process, all of the activities in the primary production process and the other production process will form part of a single undertaking or enterprise.

**Activities to be attributable to same industry sector as principal activity**

4.—(1) For the purposes of section 3(2) of the Act, this regulation specifies what activities that form part of a single undertaking or enterprise must be attributed to a particular industry sector.

(2) If activities will form part of a single undertaking or enterprise under regulation 3, then unless paragraph (3) applies, all of the activities are attributable to the particular industry sector that the principal activity for the undertaking or enterprise is attributable to.

(3) In this regulation, “principal activity”, in relation to a single undertaking or enterprise, means the activity that —

- (a) results in the production of a product or service that is produced for sale on the market; and
- (b) produces the most value for the single undertaking or enterprise out of any of the activities forming part of the single undertaking or enterprise.

## PART II

### REGISTRATION OF REGISTRABLE CORPORATION

**Registration of registrable corporation**

5.—(1) An application to be registered as a registered corporation shall be made —

- (a) using the relevant form provided in the electronic service provided at <http://www.nea.gov.sg>; and
- (b) in the manner specified by the Director-General.

(2) Every application referred to in paragraph (1) shall be accompanied by the following information and documents:

- (a) registered name of the corporation;

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- (b) Singapore unique entity number of the corporation;
  - (c) principal place of business;
  - (d) name of the chief executive, and his designation, contact details and identification number;
  - (e) name of corporation representative, and his designation, contact details and identification number;
  - (f) name of energy manager(s) (if any), and his designation, contact details and identification number;
  - (g) address of site of each business activity that qualifies the corporation as a registrable corporation, and that site's electricity and gas account number (if any);
  - (h) energy bills and other records (if any) of energy consumption, showing that the energy use of the business activity has attained the energy use threshold in at least 2 out of the 3 preceding calendar years;
  - (i) the business profile of the corporation (if any);
  - (j) signed statement from the chief executive, that the information submitted is accurate and complete; and
  - (k) such other information or document as may be specified in the form provided or as may be required by the Director-General.

**Circumstances in which registered corporation may apply to cancel registration**

6.—(1) For the purposes of section 25(1)(c) of the Act, this regulation specifies the circumstances in which a registered corporation may apply to the Director-General to cancel its registration.

(2) A registered corporation may apply to cancel its registration if it has ceased its business activity and has no intention of resuming its business activity within the next 3 years.

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**Application to cancel registration**

7.—(1) For the purposes of section 25(1) of the Act and regulation 6, an application for cancellation of registration as a registered corporation shall be made —

- (a) using the relevant form provided in the electronic service provided at <http://www.nea.gov.sg>; and
- (b) in the manner specified by the Director-General.

(2) Every application referred to in paragraph (1) shall be accompanied by the following information and documents:

- (a) registered name of the corporation;
- (b) Singapore unique entity number of the corporation (if any);
- (c) address of site of each relevant business activity;
- (d) grounds for cancelling the registration;
- (e) details of contact person (name, designation and contact details);
- (f) energy bills and other records (if any) showing the relevant energy consumption data, if the ground for cancelling the registration is the ground referred to in section 25(1)(b) of the Act;
- (g) notice of cessation of business activity submitted by the chief executive, if the ground for cancelling the registration is the ground referred to in regulation 6(2);
- (h) signed statement from the chief executive, that the information submitted is accurate and complete; and
- (i) such other information or documents as the Director-General may require.

**PART IIA****ENERGY MANAGEMENT PRACTICES  
FOR NEW VENTURES**

*[S 605/2018 wef 01/10/2018]*

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## Definitions of this Part

**7A.** In this Part, unless the context otherwise requires —

“best available technology” means technology that results in the best energy efficiency, use and consumption;

“energy” has the same meaning as in paragraph 2 of the Energy Conservation (Registrable Corporations) Order 2013 (G.N. No. S 248/2013);

“energy and material flows” means a method of computing —

(a) the energy and materials provided for and released from the processes and energy-consuming systems in a business activity; and

(b) the energy conversions and energy use within the processes and energy-consuming systems in the business activity;

“energy commodity” has the same meaning as in paragraph 2 of the Energy Conservation (Registrable Corporations) Order 2013;

*[Deleted by S 972/2020 wef 01/12/2020]*

“post-assessment design” means a design of a new venture facility that includes any energy efficiency opportunity identified in an energy efficiency opportunities assessment conducted in respect of the new venture.

*[S 972/2020 wef 01/12/2020]*

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*[S 605/2018 wef 01/10/2018]*

## Application of this Part

**7B.**—(1) This Part applies to a new venture of any person (whether or not a registered corporation) that is a business activity where —

(a) the estimated total energy to be consumed by the business activity equals or exceeds the threshold of 54 terajoules per calendar year, derived from one or more types of fuel or

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energy commodity specified in the First Schedule to the Energy Conservation (Registrable Corporations) Order 2013; and

- (b) the business activity is carried out at a single site and is attributable to one of the following industry sectors:
- (i) manufacturing and manufacturing-related services;
  - (ii) supply of electricity, gas, steam, compressed air and chilled water for air-conditioning;
  - (iii) water supply and sewage and waste management.
- (2) For the purposes of paragraph (1)(a), the estimated total energy to be consumed by the business activity —
- (a) must be calculated on the basis that the business activity is carried out at full capacity for 24 hours every day throughout the calendar year; and
  - (b) must be derived from all fuel and energy commodities estimated to be used to provide or produce the energy to be consumed by the business activity, but excludes energy estimated to be produced from any fuel or energy commodity that is already accounted for in the estimated total figure.
- (3) If an estimated quantity of fuel to be used is to be converted to an amount of energy in joules, the conversion is to be done using —
- (a) the default net calorific values set out in the Second Schedule to the Energy Conservation (Registrable Corporations) Order 2013; or
  - (b) the net calorific values specified by the person mentioned in paragraph (1) and approved by the Director-General under paragraph (7).
- (4) If an estimated quantity of an energy commodity to be used is to be converted to an amount of energy in joules, the conversion is to be done using —

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- (a) the default energy content values set out in the Third Schedule to the Energy Conservation (Registrable Corporations) Order 2013; or
  - (b) the energy content values specified by the person mentioned in paragraph (1) and approved by the Director-General under paragraph (7).

(5) A person mentioned in paragraph (1) seeking to specify the net calorific value of a fuel must submit to the Director-General a report by a laboratory containing the results of a test conducted in accordance with the relevant ASTM International, International Organization for Standardization (ISO) or other testing standards approved by the Director-General to ascertain the net calorific value of the fuel concerned.

(6) A person mentioned in paragraph (1) seeking to specify the energy content value of an energy commodity must submit to the Director-General the method by which the person derived the energy content value.

(7) The Director-General may approve or reject the net calorific value or the energy content value sought to be specified by a person under paragraph (5) or (6), as the case may be.

*[S 605/2018 wef 01/10/2018]*

### **Energy efficiency opportunities assessment for new ventures**

**7C.—**(1) A person required to conduct an energy efficiency opportunities assessment for a business activity of a new venture under this Part must determine the following:

- (a) the methods and processes of the business activity to be assessed;
- (b) the energy-consuming systems of the business activity to be assessed;
- (c) the objective of the assessment;
- (d) the time period for the assessment;
- (e) the methods and processes to be used to conduct the assessment;

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- (f) the individuals conducting the assessment, including each individual's role and experience.
- (2) For the purpose of paragraph (1)(c), the objective of the energy efficiency opportunities assessment must include —
- (a) identifying the energy efficiency opportunities that are available in respect of the business activity, including taking into account any dependencies in respect of the processes and energy-consuming systems of the business activity, after reviewing —
- (i) the optimum methods or processes of the business activity;
  - (ii) the proposed energy-consuming systems estimated to consume a total of at least 80% of the estimated annual energy consumption of the business activity, including the proposed location, arrangement and best operating practices of these energy-consuming systems; and
  - (iii) available alternative technology choices (including best available technology) for the business activity, and the proposed energy-consuming systems mentioned in sub-paragraph (ii);
- (b) assessing the technical and economic feasibility of implementing each such energy efficiency opportunity based on a comparison, between a case if the energy efficiency opportunity is implemented and a case if the efficiency opportunity is not implemented, of all the following:
- (i) the estimated investment and operation cost;
  - (ii) the estimated annual energy savings;
  - (iii) the estimated specific energy consumption;
  - (iv) the estimated annual greenhouse gas emissions;
  - (v) the estimated financial savings;
  - (vi) the estimated returns on investment;

(vii) other criteria, including non-energy related benefits such as greater productivity or improved reliability, as may be appropriate; and

(c) determining which such energy efficiency opportunities are to be included in the post-assessment design of the new venture facility.

(3) If any proposed energy-consuming system mentioned in paragraph (2)(a)(ii) is replaced with another proposed energy-consuming system during or after the energy efficiency opportunities assessment, a further energy efficiency opportunities assessment must be conducted in respect of the replacement energy-consuming system —

(a) if the replacement energy-consuming system forms part of the proposed energy-consuming systems estimated to consume a total of at least 80% of the estimated annual energy consumption of the business activity; and

(b) in accordance with this regulation.

(4) The energy efficiency opportunities assessment must be conducted —

(a) on the basis that the business activity is carried out at full capacity for 24 hours every day throughout the calendar year; and

(b) on the basis of sound and reliable information or documents, including information or documents from the supplier of the energy-consuming systems mentioned in paragraph (2)(a)(ii) and replacement energy-consuming system mentioned in paragraph (3), if any.

*[S 605/2018 wef 01/10/2018]*

### **Energy efficiency opportunities assessment report for new ventures**

**7D.**—(1) The report on the energy efficiency opportunities assessment conducted under regulation 7C must include the following:

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- (a) an executive summary that summarises the important findings of the energy efficiency opportunities assessment;
  - (b) general information of the business activity assessed, including —
    - (i) the type of business activity;
    - (ii) the intended outputs of the business activity; and
    - (iii) the estimated full capacity of the business activity and intended outputs of the business activity;
  - (c) the matters mentioned in regulation 7C(1) (read with regulation 7C(2)), (3) and (4);
  - (d) information about the post-assessment design of the new venture facility within which the business activity assessed is to be conducted, comprising —
    - (i) the proposed layout of the new venture facility;
    - (ii) the proposed process flow diagram and energy and material flows in respect of the business activity;
    - (iii) a description, and the proposed location and arrangement, of every proposed energy-consuming system estimated to consume a total of at least 80% of the estimated annual energy consumption of the business activity;
    - (iv) the estimated annual quantity and unit of measure, of each type of fuel or energy commodity to be used by the business activity, including each energy-consuming system mentioned in sub-paragraph (iii);
    - (v) the net calorific value of each type of fuel and energy content value of each type of energy commodity to be used by the business activity;
    - (vi) the estimated annual quantity and unit of measure of each intended output of the business activity, including from each energy-consuming system mentioned in sub-paragraph (iii);

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- (vii) the estimated specific energy consumption of the business activity, including by each energy-consuming system mentioned in sub-paragraph (iii); and
  - (viii) the estimated annual greenhouse gas emissions of the business activity, including from each energy-consuming system mentioned in sub-paragraph (iii);
- (e) the reasons for including or excluding the energy efficiency opportunities mentioned in regulation 7C(2)(a) in the post-assessment design of the new venture facility;
- (f) if any energy efficiency opportunity mentioned in regulation 7C(2)(a) is excluded in the post-assessment design of the new venture facility —
- (i) the processes and energy-consuming systems of the business activity in respect of the energy efficiency opportunity so excluded; and
  - (ii) a comparison of the information mentioned in paragraph (1)(d)(iv) to (viii) between the processes and energy-consuming systems mentioned in sub-paragraph (i) so excluded with the processes and energy-consuming systems included in the post-assessment design;
- (g) if any energy efficiency opportunity mentioned in regulation 7C(2)(a) is included in the post-assessment design of the new venture facility —
- (i) the processes and energy-consuming systems of the business activity in respect of the energy efficiency opportunity so included; and
  - (ii) a comparison of the information mentioned in paragraph (1)(d)(iv) to (viii) between the processes and energy-consuming systems mentioned in sub-paragraph (i) so included with any processes and energy-consuming systems reviewed but

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excluded in the post-assessment design of the new venture facility, if any;

- (h) such other information or document as the Director-General may require.
- (2) The report specified in paragraph (1) —
- (a) must be signed by the person principally responsible for conducting the energy efficiency opportunities assessment;
- (b) must be endorsed by the chief executive of the person mentioned in regulation 7B(1);
- (c) must be made —
- (i) using the relevant form provided in the electronic service provided at <http://www.nea.gov.sg>; and
- (ii) in the manner specified by the Director-General; and
- (d) may be submitted by an employee of, and authorised by, the person mentioned in regulation 7B(1).
- (3) Every application under section 31B(2) of the Act for a waiver of the application of section 26A(1) or (2) of the Act must —
- (a) be in writing;
- (b) state the reasons for the person's inability to comply with the requirements; and
- (c) be accompanied by supporting documents.

*[S 605/2018 wef 01/10/2018]*

### **Records to be kept for new ventures**

**7E.—(1)** A person mentioned in regulation 7B(1) must keep and maintain complete and accurate records of the information and documents in respect of the following for at least 5 years after the date of the certificate of statutory completion issued in respect of the new venture facility:

- (a) the matters mentioned in regulation 7C(1);
- (b) the energy efficiency opportunities identified in regulation 7C(2)(a);

- (c) the assessment of the technical and economic feasibility of implementing each energy efficiency opportunity mentioned in regulation 7C(2)(b);
- (d) the determination of the energy efficiency opportunities to be included in the post-assessment design of the new venture facility;
- (e) any other matters relied on by the person in preparing the report submitted under regulation 7D.

(2) In this regulation, “certificate of statutory completion” has the same meaning as in section 2(1) of the Building Control Act (Cap. 29).

*[S 605/2018 wef 01/10/2018]*

## PART IIB

### MINIMUM ENERGY EFFICIENCY STANDARDS FOR ENERGY-CONSUMING SYSTEMS

*[S 972/2020 wef 01/12/2020]*

#### **Definitions of this Part**

**7F.** In this Part, unless the context otherwise requires —

- “antifreeze” means any additive that prevents water from freezing by depressing the freezing point of water;
- “assessment report” means a report mentioned in section 26B(2)(b) or (3)(b) of the Act;
- “booster pump” means a pump that is installed on a chilled water pipeline to overcome a drop in pressure in the chilled water pipeline, to prevent over-pressurising chilled water in any parallel pipeline;
- “certificate of statutory completion” has the meaning given by section 2(1) of the Building Control Act (Cap. 29);
- “cooling tower” means any device in which atmospheric air is passed through sprayed water to lower the temperature of the sprayed water by evaporative cooling;

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“end-to-end uncertainty”, in relation to a parameter of a prescribed system, means the combined uncertainty of —

- (a) every prescribed permanent measuring instrument installed for the prescribed system for measuring that parameter; and
- (b) any accessory needed for the operation of those prescribed permanent measuring instruments, including a current or voltage transformer;

“energy management system”, in relation to a prescribed system, means a system that processes, analyses, displays and stores data collected from prescribed permanent measuring instruments installed for the prescribed system;

“energy performance”, in relation to a prescribed system, means —

- (a) the ratio of electrical power consumption (measured in kilowatts) to the refrigeration output (measured in kilowatts) of the prescribed system; or
- (b) the ratio of electrical energy consumption (measured in kilowatt-hours) to the refrigeration energy output (measured in kilowatt-hours) of the prescribed system;

“gross floor area” has the same meaning as “floor area” in rule 2(1) of the Planning (Development Charges) Rules (Cap. 232, R 5);

“kW<sub>c</sub>”, in relation to a prescribed system, means the refrigeration output of the prescribed system, expressed in kilowatts;

“prescribed permanent measuring instrument” means a measuring instrument mentioned in regulation 7J(1);

“prescribed system” means an energy-consuming system mentioned in regulation 7H;

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“qualified person” means —

- (a) an individual who is certified by the Institution of Engineers, Singapore as an energy efficiency opportunities assessor with systems-specific experience in chilled water systems; or
- (b) a professional engineer registered under the Professional Engineers Act (Cap. 253) in the branch of mechanical engineering, electrical engineering or chemical engineering, who has in force a practising certificate issued under that Act;

“specified AHRI Standard” means the AHRI Standard 551/591-SI-2018 published by the Air-Conditioning, Heating and Refrigeration Institute;

“SS 591/2013” means the Singapore Standard 591:2013 — Code of Practice for long term measurement of central chilled water system energy efficiency, published by the Enterprise Singapore Board;

“temporary occupation permit” has the meaning given by section 2(1) of the Building Control Act;

“water-cooled chilled water system” means a system comprising one or more of each of the following components:

- (a) a water-cooled chiller;
- (b) a chilled water pump for a water-cooled chiller;
- (c) a condenser water pump;
- (d) a cooling tower,

with interconnections and accessories (including thermal storage tanks, if any), operating together to produce chilled water, whether or not each component is situated in the same premises, and excludes any booster pump and other energy-consuming systems that use the chilled water produced, either directly or indirectly;

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“water-cooled chiller” means a factory-made and prefabricated assembly (whether or not it is shipped as one package) comprising one or more of each of the following:

- (a) a compressor;
- (b) a water-cooled condenser;
- (c) an evaporator,

with interconnections and accessories, designed to produce chilled water by using a vapour compression refrigeration cycle to remove heat from chilled water in the evaporator and reject the heat to water in the condenser;

“water-cooled condenser” means a refrigeration system component where refrigerant vapour is condensed and the heat rejected to water, resulting in a rise in water temperature.

*[S 972/2020 wef 01/12/2020]*

### **Relevant person**

**7G.** Section 26B(1) of the Act applies to a corporation that has operational control of —

- (a) any premises that are located within any land that is zoned as a Business 1 or Business 2 zone in the Master Plan under the Planning Act (Cap. 232); or
- (b) a business activity that is attributable to any of the following industry sectors:
  - (i) manufacturing and manufacturing-related services;
  - (ii) supply of electricity, gas, steam, compressed air and chilled water for air-conditioning;
  - (iii) water supply and sewage and waste management.

*[S 972/2020 wef 01/12/2020]*

### **Prescribed energy-consuming system**

**7H.** For the purposes of section 26B(2) of the Act, the prescribed energy-consuming system is a water-cooled chilled water system that —

- (a) is electrically driven;
- (b) comprises at least one chiller that produces, or the relevant person intends to be used to produce, chilled water without requiring the use of antifreeze;
- (c) has a total refrigeration capacity of 1055 kW<sub>c</sub> or more when rated at standard rating conditions in accordance with the specified AHRI Standard; and
- (d) generates, or the relevant person intends to be used to generate, chilled water at a temperature of 3°C or higher,

but excludes any chiller or part of a chiller comprised in the water-cooled chilled water system that produces, or that the relevant person intends to be used for the production of, chilled water requiring the use of antifreeze, and any chilled water pump for that chiller or part and interconnections to the pump.

*[S 972/2020 wef 01/12/2020]*

### **Prescribed change to energy requirements**

**7I.** For the purposes of paragraph (b) of the definition of “installation and retrofitting works” in section 26B(5) of the Act, any of the following changes to the energy requirements of a prescribed system are installation and retrofitting works:

- (a) the addition of a water-cooled chiller (other than a water-cooled chiller that produces, or that the relevant person intends to be used to produce, chilled water requiring the use of antifreeze) to the prescribed system that changes the energy performance of the system;
- (b) the substantial alteration or removal of a water-cooled chiller in the prescribed system that changes the energy performance of the system.

*[S 972/2020 wef 01/12/2020]*

### **Prescribed permanent measuring instruments**

**7J.—(1)** For the purposes of section 26B(2) of the Act, the following are the prescribed permanent measuring instruments for

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the purpose of assessing the as-built energy efficiency of a prescribed system:

- (a) subject to paragraph (2) —
  - (i) a temperature sensor to measure the chilled water supply temperature of each water-cooled chiller in the prescribed system; and
  - (ii) a temperature sensor to measure the chilled water return temperature of each water-cooled chiller in the prescribed system;
- (b) subject to paragraphs (2) and (4), a temperature sensor to measure the condenser water supply temperature of each water-cooled chiller in the prescribed system;
- (c) subject to paragraphs (2) and (4), a temperature sensor to measure the condenser water return temperature of each water-cooled chiller in the prescribed system;
- (d) subject to paragraph (2), one or more flowmeters by or from which the flowrate of the chilled water in each water-cooled chiller in the prescribed system may be measured or derived;
- (e) subject to paragraphs (2) and (4), one or more flowmeters by or from which the flowrate of the condenser water in each water-cooled chiller in the prescribed system may be measured or derived;
- (f) one or more power meters by which the total electrical energy and electrical power consumption of each of the following groups of equipment may be measured or derived:
  - (i) the water-cooled chillers;
  - (ii) the chilled water pumps;
  - (iii) the condenser water pumps;
  - (iv) the cooling towers.

(2) Where water-cooled chillers share a common chilled water header or a common condenser water header —

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- (a) a temperature sensor may be installed at the common header for the chilled water or the condenser water, as the case may be —
- (i) instead of for each water-cooled chiller; or
  - (ii) in addition to the temperature sensors for each water-cooled chiller; and
- (b) if temperature sensors are installed at the common headers to measure both the water supply and return temperatures for the chilled water or condenser water, a flowmeter may be installed at any common header for the chilled water or condenser water, as the case may be —
- (i) instead of for each water-cooled chiller; or
  - (ii) in addition to the flowmeters for each water-cooled chiller.
- (3) In relation to each temperature sensor mentioned in paragraph (1)(a), (b) or (c) —
- (a) a test plug or thermowell must also be installed on the chilled water and condenser water pipelines before and after each temperature sensor; and
  - (b) any thermowell installed must enable the temperature sensor inserted in the thermowell to come into direct contact with the fluid in the pipeline.
- (4) Paragraph (1)(b), (c) and (e) does not apply if the amount or rate of heat rejection of the prescribed system may be derived from other temperature and flowrate measurements taken in the prescribed system.
- (5) The end-to-end uncertainty for each measurement from a prescribed permanent measuring instrument must not exceed —
- (a) for a temperature sensor —  $\pm 0.05^{\circ}\text{C}$ ;
  - (b) for a flowmeter —  $\pm 1\%$ ; and
  - (c) for a power meter —  $\pm 2\%$ .

(6) Where a relevant person satisfies the Director-General that it is not reasonably practicable to install a flowmeter that complies with paragraph (5)(b), the relevant person may install a flowmeter with an uncertainty for each measurement that does not exceed  $\pm 2\%$ .

(7) The overall end-to-end uncertainty of all the prescribed permanent measuring instruments used in the prescribed system must not exceed  $\pm 5\%$ .

(8) For the purposes of paragraph (7), the overall end-to-end uncertainty of the prescribed permanent measuring instruments is the number ascertained by calculating the square root of the formula  $A^2 + B^2 + C^2$ , where —

- (a) A is the percentage end-to-end uncertainty of the difference between the chilled water supply and return temperatures, calculated in accordance with the formula  $[\sqrt{D^2 + E^2} \div F] \times 100$ , where —
- (i) D is the end-to-end uncertainty of the chilled water supply temperature measurement;
  - (ii) E is the end-to-end uncertainty of the chilled water return temperature measurement; and
  - (iii) F is the smallest value of all values calculated for the prescribed system of the measured chilled water return temperatures less the measured chilled water supply temperatures for the water-cooled chillers in the prescribed system;
- (b) B is the percentage end-to-end uncertainty of the chilled water flowrate measurement; and
- (c) C is the percentage end-to-end uncertainty of power consumption measurement.

(9) The percentage system heat balance for the prescribed system (calculated in accordance with paragraph B.2.2 of SS 591/2013) must be within  $\pm 5\%$  for at least 80% of data points.

*[S 972/2020 wef 01/12/2020]*

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**Prescribed manner of assessment**

**7K.**—(1) The assessment of the as-built energy efficiency of a prescribed system must be carried out in the following manner:

- (a) the assessment must be based on measurements made by the prescribed permanent measuring instruments —
  - (i) collected at intervals of one minute and recorded in 3 decimal places or more;
  - (ii) collected from the operation of the prescribed system over a continuous period of not less than 2 weeks (called in these Regulations the assessment period); and
  - (iii) stored in an energy management system that stores and calculates the information specified in paragraph (3);
- (b) a qualified person must certify that regulation 7J is complied with in relation to every prescribed permanent measuring instrument installed for the prescribed system and that the energy management system mentioned in sub-paragraph (a)(iii) accurately calculates the information specified in paragraph (3);
- (c) the qualified person mentioned in sub-paragraph (b) must separately verify the as-built energy efficiency of the prescribed system calculated by the energy management system, using the measurements mentioned in sub-paragraph (a).

(2) For the purpose of the assessment under paragraph (1), any measurements collected under sub-paragraph (a)(ii) of that paragraph for any period for which any part of a water-cooled chiller in the prescribed system is producing chilled water requiring the use of antifreeze, must be disregarded in the assessment of the as-built energy efficiency of a prescribed system under that paragraph.

(3) The information mentioned in paragraph (1)(a)(iii) and (b) comprises all of the following:

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- (a) where any cooling tower of the prescribed system cools water from a source external to the prescribed system and any prescribed permanent measuring instrument measures a parameter partially attributable to that external source — the heat gained by and heat lost from cooling water from that external source;
  - (b) the electrical energy and electrical power consumed by all chilled water pumps in the prescribed system in pumping chilled water through all the evaporators in the prescribed system, based on the ratio of its flowrate to the total flowrate through the pumps, if applicable;
  - (c) the electrical energy and electrical power consumed by all condenser water pumps in the prescribed system in pumping water through all the water-cooled condensers in the prescribed system, based on the ratio of its flowrate to the total flowrate through the pumps, if applicable;
  - (d) the electrical energy and electrical power consumed by all cooling towers in the prescribed system in rejecting heat from water that passes through all the water-cooled condensers in the prescribed system, based on the ratio of its heat rejected to the total heat rejected by the cooling towers, if applicable;
  - (e) the operating hours of the prescribed system;
  - (f) the refrigeration output and refrigeration energy output of the chilled water, the rate or amount of heat removal from the condenser water, and the electrical energy and electrical power consumption of the prescribed system;
  - (g) the energy performance of the following groups of equipment in the prescribed system:
    - (i) the water-cooled chillers;
    - (ii) the chilled water pumps;
    - (iii) the condenser water pumps;
    - (iv) the cooling towers;
  - (h) the energy performance of the prescribed system;

- (i) the heat balance of the prescribed system, calculated in accordance with paragraph B.2.2 of SS 591/2013.

(4) For the purposes of converting refrigeration output in refrigerant ton to kW<sub>c</sub>, the refrigeration output in unit of refrigerant ton must be multiplied by 3.517 kW<sub>c</sub>/RT.

*[S 972/2020 wef 01/12/2020]*

### **Minimum energy efficiency standard**

**7L.**—(1) For the purposes of section 26B(3) of the Act, the prescribed minimum energy efficiency standard applicable to a prescribed system is the energy performance corresponding to —

- (a) for a prescribed system that is used to produce chilled water only at one setpoint temperature at all times — the number ascertained in accordance with the formula specified in paragraph (2); and
- (b) for a prescribed system that is used to produce chilled water at 2 or more setpoint temperatures — the refrigeration output or refrigeration energy output weighted-average of the number ascertained in accordance with the formula specified in paragraph (2) for each temperature at which chilled water is produced by the prescribed system.

(2) The formula mentioned in paragraph (1) is  $0.212 - G \times 0.003$ , where G is either of the following, measured in degrees Celsius:

- (a) where the average temperature of the chilled water supply produced by the prescribed system during the assessment period is within 0.5°C of the setpoint temperature of the chilled water — the setpoint temperature rounded to the nearest 1°C;
- (b) in any other case — the average temperature of chilled water supply rounded to the nearest 1°C.

*[S 972/2020 wef 01/12/2020]*

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**Requirements for assessment reports**

**7M.**—(1) The assessment of the prescribed system must be completed and the assessment report mentioned in section 26B(2)(b) of the Act must be submitted —

- (a) where the prescribed system is situated in any premises that are wholly and lawfully used or occupied by only one person — within 15 months after the date the temporary occupation permit or certificate of statutory completion is issued (whichever is earlier) for building works that include the installation and retrofitting works on the prescribed system at the premises on which a water-cooled chiller is to be or is situated; or
- (b) in any other case — within 3 months after the earlier of the following:
  - (i) the date on which the following requirements are satisfied:
    - (A) the temporary occupation permit or certificate of statutory completion is issued for the building works at the premises that include the installation and retrofitting works on the prescribed system;
    - (B) more than 80% of the gross floor area of the premises is occupied;
  - (ii) the expiry of 36 months after the temporary occupation permit or certificate of statutory completion is issued (whichever is earlier) for the building works at the premises that include the installation and retrofitting works on the prescribed system.

(2) Any assessment report (whether under section 26B(2)(b) or (3)(b) of the Act) on the prescribed system must include the following, where applicable:

- (a) details of the components of the prescribed system, including —

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- (i) the unique identification of each component;
  - (ii) the type of each component, including whether variable frequency drives are present;
  - (iii) the installation year of each component;
  - (iv) the refrigeration capacity of each chiller at standard rating conditions in accordance with the specified AHRI Standard;
  - (v) the input power to each chiller where the refrigeration output corresponds to refrigeration capacity of the chiller mentioned in sub-paragraph (iv);
  - (vi) the chilled water supply temperature setpoint of each chiller;
  - (vii) the designed difference in chilled water supply temperature and return temperature of each chiller;
  - (viii) the rated performance of each chiller at standard rating conditions in accordance with the specified AHRI Standard;
  - (ix) the rated motor output power for each chilled water pump, condenser water pump and cooling tower fan;
  - (x) the pump head of each chilled water pump and condenser water pump;
  - (xi) the flowrate of each chilled water pump, condenser water pump and cooling tower;
  - (xii) the rated pump efficiency for each chilled water pump and condenser water pump;
  - (xiii) the rated fan efficiency for each cooling tower fan;
  - (xiv) the rated motor efficiency for each chilled water pump, condenser water pump and cooling tower fan;
  - (xv) an indication if the power consumption of each chilled water pump, condenser water pump and

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- cooling tower fan is attributable only to the prescribed system; and
- (xvi) the schematic of the prescribed system, including all components of the system;
- (b) details of the prescribed permanent measuring instruments installed, including —
- (i) the unique identification of each instrument;
  - (ii) the type of each instrument;
  - (iii) the parameter measured by each instrument;
  - (iv) the location of each instrument;
  - (v) the instrument range of each instrument;
  - (vi) the frequency of measurement taken by each instrument;
  - (vii) the end-to-end uncertainty of each measurement;
  - (viii) the last calibration date of each instrument; and
  - (ix) the location of each instrument superimposed on the schematic of the prescribed system;
- (c) the assessment period;
- (d) the information, documents or analyses relied upon by the qualified person in certifying the matters mentioned in regulation 7K(1)(b) and in conducting the verification in regulation 7K(1)(c);
- (e) the reasons given to the Director-General under section 31B of the Act or regulation 7J(6) for any waiver or modification of a requirement under section 26B of the Act or in this Part, if any;
- (f) the reasons for failing to comply with any requirement under section 26B of the Act or in this Part, if any;
- (g) such other information or document as the Director-General may require.

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- (3) The report specified in paragraph (2) must be —
- (a) endorsed by the qualified person mentioned in regulation 7K(1)(b);
  - (b) endorsed by the chief executive of the relevant person;
  - (c) submitted in the manner specified by the Director-General; and
  - (d) submitted by an employee of the relevant person who is authorised by the relevant person for this purpose.

*[S 972/2020 wef 01/12/2020]*

### **Requirements relating to keeping of records**

**7N.—(1)** Records containing the following information must be kept for the purposes of section 29(1) of the Act:

- (a) all measurements mentioned in regulation 7K(1)(a) and information mentioned in regulation 7K(3);
- (b) all calculations mentioned in regulation 7K made by the qualified person in preparing the assessment report;
- (c) the as-built drawings of the prescribed system plant room layout indicating details of the location of every prescribed permanent measuring instrument and any test plug or thermowell;
- (d) all as-built schematic drawings of the prescribed system;
- (e) all calibration certificates from accredited laboratories or factory calibration certificates from manufacturers for every prescribed permanent measuring instrument;
- (f) all input parameters for every prescribed permanent measuring instrument;
- (g) the technical specifications of each component of the prescribed system;
- (h) any other information relied on in preparing the assessment report.

(2) For the purposes of section 29(2)(a) of the Act, the prescribed period to keep and maintain the records mentioned in paragraph (1) in

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relation to an assessment report is 5 years after the date the assessment report is submitted.

(3) Without affecting paragraph (2), the measurements mentioned in regulation 7K(1)(a) and information mentioned in regulation 7K(3) must be kept in the energy management system for a period of at least 3 years after the date the assessment report is submitted.

*[S 972/2020 wef 01/12/2020]*

### PART III

#### ENERGY MANAGEMENT PRACTICES OF REGISTERED CORPORATION

##### **Periodic reporting of energy use**

**8.—(1)** A registered corporation shall submit an energy use report by 30th June of each year, which shall cover each business activity under the operational control of the registered corporation.

(2) The report shall be prepared and reviewed by the energy manager and endorsed by the chief executive of the registered corporation, and shall be submitted by the energy manager using the electronic service provided at <http://www.nea.gov.sg>.

(3) The energy use report shall be made —

(a) using the relevant form provided in the electronic service provided at <http://www.nea.gov.sg>; and

(b) in the manner specified by the Director-General.

(4) The energy use report shall contain, in respect of each relevant business activity, the following information relating to its operation during the preceding calendar year, or part thereof (if applicable) in the case of the first report submitted after registration:

(a) quantity of each type of fuel or energy commodity in the inventory of the corporation as at 1st January and 31st December of that calendar year, and their net calorific value or energy content value, and unit of measure;

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- (b) quantity of each type of fuel or energy commodity purchased or sold, or used for the purposes of producing or providing energy, during that calendar year, and their net calorific value or energy content value, and unit of measure, but excluding any fuel or energy commodity purchased, used or stored for the purposes of any emergency standby generator;
  - (c) quantity of each type of fuel or energy commodity produced for the purposes of producing or providing energy, and their net calorific value or energy content value, and unit of measure;
  - (d) in respect of energy-consuming systems forming part of the business activity, the aggregate energy consumption of which shall not be less than 80% of the total energy consumption of the business activity, the following information for each energy-consuming system:
    - (i) type and description of energy-consuming system;
    - (ii) type of fuel or energy commodity used;
    - (iii) quantity and unit of measure of annual energy consumption;
    - (iv) quantity and unit of measure of each intended output of the energy-consuming system;
    - (v) specific energy consumption;
    - (vi) predicted specific energy consumption calculated on the basis that the energy-consuming system is new and clean, if available; and
    - (vii) the ratio of the specific energy consumption to the predicted specific energy consumption referred to in sub-paragraph (vi), if available;
  - (e) specific energy consumption;
  - (f) reasons for increase or decrease in specific energy consumption compared to that reported in the previous year to the extent necessary for a reasonable understanding

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of the significant factors that affected the energy efficiency of the business activity;

- (g) information relating to items listed in the second and third columns of the Second Schedule in respect of the processes or activities resulting in greenhouse gas emissions as listed in the first column thereof;
- (h) information on type, quantity and unit of measure of each fuel or energy commodity used as feedstock to produce products containing carbon;
- (i) basic process diagrams showing the energy-consuming systems and the general process and energy flow; and
- (j) such other information or document as may be required by the Director-General.

(4A) Despite paragraph (4), if the relevant business activity to which the energy use report relates is a new venture that is a business activity (called in this regulation new business activity), then in the report —

- (a) the quantity of each type of fuel or energy commodity used for the purposes of producing or providing energy in respect of the new business activity, during the calendar year covered by the report, and their net calorific value or energy content value, and unit of measure, but excluding any fuel or energy commodity used for the purposes of any emergency standby generator, must be expressed as a measured value; and
- (b) the information mentioned in paragraph (4)(d) must include the information of every energy-consuming system of the new business activity, the aggregate energy consumption of which is at least 80% of the total energy consumption of the new business activity.

*[S 605/2018 wef 01/10/2018]*

(5) The energy use report shall, in respect of every other business activity under the operational control of the corporation that is not a relevant business activity, state the following in relation to the operation of all such business activities during the preceding calendar

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year, or part thereof (if applicable) in the case of the first report submitted after registration:

- (a) the estimated aggregate energy consumption as a percentage of the corporation's total energy consumption during the same period;
- (b) the estimated aggregate energy production as a percentage of the corporation's total energy production during the same period; and
- (c) the estimated aggregate greenhouse gas emissions as a percentage of the corporation's total greenhouse gas emissions during the same period.

(6) Subject to paragraph (6A), any quantity or figure required in paragraph (4)(d)(iii) to (vi), (g) or (h) may be expressed either as a measured value or an estimated value.

*[S 605/2018 wef 01/10/2018]*

(6A) Despite paragraph (6), any quantity or figure required in paragraph (4)(d)(iii) to (vi) —

- (a) must, in respect of every energy-consuming system of a new business activity, the aggregate energy consumption of which is at least 80% of the total energy consumption of the new business activity, be expressed as a measured value; and
- (b) may, in respect of the energy-consuming systems of the new business activity not mentioned in sub-paragraph (a), be expressed either as a measured value or an estimated value.

*[S 605/2018 wef 01/10/2018]*

(7) The Director-General may extend the time prescribed in paragraph (1) for the submission of the report on such terms as he deems fit, if he is satisfied, on written application accompanied by supporting documents —

- (a) that the registered corporation required to submit the report is unable to comply with the requirement due to circumstances beyond the corporation's reasonable control; or

(b) that an extension of any such time would be otherwise appropriate having regard to the circumstances of the case.

(8) Every application under section 31B(4) of the Act for a waiver of the application of section 27 of the Act requiring any quantity or figure to be expressed as a measured value must —

- (a) be in writing;
- (b) state the reasons for the person's inability to comply with the requirements; and
- (c) be accompanied by supporting documents.

*[S 605/2018 wef 01/10/2018]*

### **Records to be kept**

**9.—**(1) A registered corporation shall keep and maintain complete and accurate records of the information prescribed in paragraph (2) for not less than 5 years after the date of creation or receipt of the record.

(2) The information referred to in paragraph (1) is as follows:

- (a) records of purchase of every type of fuel or energy commodity;
- (b) records of consumption of every type of fuel or energy commodity and other similar records;
- (c) detailed process diagrams showing the energy-consuming systems and the general process and energy flow and other similar records;
- (d) measurement data on energy consumption of energy-consuming systems or equipment and other similar records, as well as specifications and calibration records of measurement equipment or systems and other similar records;
- (e) measurement data on energy consumption of various systems or equipment before and after implementation of any energy efficiency measure and other similar records, as well as specifications and calibration records of

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measurement equipment or systems and other similar records; and

(f) records relied upon by the corporation to provide the information referred to in regulation 8(4)(g) or (h).

(3) The records kept and maintained pursuant to this regulation may be kept and maintained in electronic form.

### **Energy efficiency improvement plan**

**10.**—(1) A registered corporation shall submit an energy efficiency improvement plan by 30th June of each year, covering each business activity under the operational control of the registered corporation.

(2) The plan shall be prepared and reviewed by the energy manager and endorsed by the chief executive of the registered corporation, and shall be submitted by the energy manager using the electronic service provided at <http://www.nea.gov.sg>.

(3) The energy efficiency improvement plan shall be made —

(a) using the relevant form provided in the electronic service provided at <http://www.nea.gov.sg>; and

(b) in the manner specified by the Director-General.

(4) The plan shall cover a period of not less than one year and not more than 5 years, which shall start from 1st January of the year of submission.

(5) The plan shall include the following information in respect of each relevant business activity:

(a) description of energy efficiency measures to be implemented or completed, and the following information in respect of each measure:

(i) estimated start and end dates;

(ii) projected reduction in energy consumption together with underlying assumptions;

(iii) projected improvement in specific energy consumption together with underlying assumptions;

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- (iv) projected improvement in the ratios referred to in regulation 8(4)(d)(vii), if available, that would be affected by the measures;
  - (v) estimated cost; and
  - (vi) name of person responsible for implementation;
- (b) update on the progress of energy efficiency measures described in the previous energy efficiency improvement plan submitted; and
- (c) for each measure implemented before the end of the preceding year, the following information:
- (i) estimated or measured difference in energy consumption attributable to each measure;
  - (ii) estimated or measured difference in specific energy consumption attributable to each measure;
  - (iii) difference in ratios referred to in regulation 8(4)(d)(vii), if available, attributable to each measure; and
  - (iv) description of how each difference referred to in sub-paragraph (i), (ii) or (iii) was measured and verified.
- (6) The plan shall include a description of energy efficiency measures to be implemented or completed in respect of each business activity that is not a relevant business activity.
- (7) Every application under section 31B(2) of the Act for a waiver of the application of section 28(1) of the Act shall —
- (a) be in writing;
  - (b) state the reasons for the registered corporation's inability to comply with the requirements; and
  - (c) be accompanied by supporting documents.

*[S 752/2017 wef 01/01/2018]*

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**Appointment of energy manager**

11.—(1) A registered corporation shall appoint from among its employees not less than one energy manager who shall possess the qualifications prescribed in paragraph (4).

(2) Subject to paragraph (3), a registered corporation shall notify the Director-General of every appointment of an energy manager within 30 days after the appointment using the electronic service provided at <http://www.nea.gov.sg>.

(3) A registered corporation shall notify the Director-General of the appointment of its first energy manager not later than 30 days after registration.

(4) With effect from 1st April 2014, no person may be employed as an energy manager unless he —

- (a) holds a Singapore Certified Energy Manager (Professional Level) certificate issued by the Institution of Engineers, Singapore; or
- (b) holds such other qualification and experience which the Director-General may approve as being, in his opinion, substantially equivalent to any qualification referred to in sub-paragraph (a).

(5) An application by a person under paragraph (4)(b) for approval of his qualification and experience to be appointed as an energy manager shall be made in writing and be accompanied by the following:

- (a) a copy of the applicant's certificate showing his qualification as an energy manager;
- (b) a copy of the applicant's university degree or equivalent qualification;
- (c) written evidence of the applicant's practical experience in the work of energy management, which shall include details of the duration and a description of the practical experience; and
- (d) such other evidence or particulars as the Director-General considers necessary to determine the application.

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(6) A person who is aggrieved by the Director-General's decision in refusing to grant an approval under paragraph (4)(b) may, within 30 days after the date he is notified of the Director-General's decision, appeal to the Minister in writing.

(7) The Minister may, after considering the appeal, dismiss or allow the appeal, unconditionally or subject to such conditions as he thinks fit, and the decision shall be confirmed, rescinded or varied in such manner as the Minister may decide.

(8) The Minister may, in considering an appeal under paragraph (6), give the appellant an opportunity to make representations in writing.

(9) The decision of the Minister in any appeal under paragraph (6) shall be final.

(10) A person shall not be employed or act as an energy manager for more than one corporation at any point in time.

(11) If an energy manager vacates his appointment —

(a) the registered corporation shall, within 30 days after the vacation of the appointment, notify the Director-General of that fact using the electronic service provided at <http://www.nea.gov.sg>; and

(b) if the energy manager who vacates his office is the only energy manager of a registered corporation, the registered corporation shall notify the Director-General of the appointment of the substitute energy manager within 90 days after the vacation of the appointment.

(12) If the only energy manager of a registered corporation vacates his appointment, the corporation may designate another employee to perform the energy manager's responsibilities pending the appointment of another energy manager.

(13) Every application under section 31B(4) of the Act for a waiver of the application of section 30(1) of the Act shall —

(a) be in writing;

(b) state the reasons for the registered corporation's inability to comply with the requirements; and

(c) be accompanied by supporting documents (if any).

*[S 752/2017 wef 01/01/2018]*

## PART IV

### ENERGY EFFICIENCY OPPORTUNITIES ASSESSMENTS FOR REGISTERED CORPORATIONS

*[S 898/2019 wef 01/01/2020]*

#### **Definitions of this Part**

**12.—(1)** In this Part —

“assessment period”, in relation to a relevant business activity, means —

- (a) the first assessment period relating to the first assessment for the relevant business activity; or
- (b) a subsequent assessment period relating to a subsequent assessment for the relevant business activity following the first assessment period mentioned in paragraph (a);

“assessment report” means a report in respect of a first assessment or subsequent assessment, as the case may be;

“energy” and “energy commodity” have the meanings given by paragraph 2 of the Energy Conservation (Registrable Corporations) Order 2013 (G.N. No. S 248/2013);

“energy efficiency opportunities assessor” means an individual mentioned in regulation 21(a);

“first assessment”, in relation to a relevant business activity, means an energy efficiency opportunities assessment conducted under regulation 14(1);

“first assessment period” has the meaning given by regulation 14(2) or (3)(c) or (d), as the case may be;

“reference period” has the meaning given by regulation 19(a);

“subsequent assessment”, in relation to a relevant business activity, means an energy efficiency opportunities assessment

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that is conducted after a first assessment was conducted for the relevant business activity;

“subsequent assessment period” means the period mentioned in regulation 15(2) or (3), as the case may be.

(2) In this Part, the total energy consumed by a relevant business activity —

- (a) must be derived from all fuel and energy commodities used to provide or produce the energy consumed; but
- (b) excludes energy produced from any fuel or energy commodity that is already accounted for in the total figure.

*[S 898/2019 wef 01/01/2020]*

### **Application of this Part**

**13.—**(1) This Part applies to every relevant business activity carried out by a registered corporation, except the generation, transmission or distribution of electricity involving the operation of at least one gas turbine, steam turbine or unit containing one or more gas turbines and steam turbines, that has a designed power output of more than 10 megawatts.

(2) This Part does not apply to a registered corporation if —

- (a) in relation to a first assessment for a relevant business activity — the registered corporation ceases, before the expiry of the first assessment period for that relevant business activity, to have operational control of the relevant business activity;
- (b) in relation to a subsequent assessment for a relevant business activity — the registered corporation ceases, before the expiry of the subsequent assessment period for that relevant business activity, to have operational control of the relevant business activity; or
- (c) the registration of the registered corporation is cancelled under section 25(2) of the Act.

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(3) Regulations 18 and 20 do not apply in relation to an energy-consuming system that is an aircraft engine test cell.

*[S 898/2019 wef 01/01/2020]*

### **First energy efficiency opportunities assessment**

**14.—**(1) A registered corporation must, before the expiry of the first assessment period for each relevant business activity under its operational control —

- (a) conduct a first assessment for the relevant business activity; and
- (b) submit to the Director-General an assessment report in respect of the first assessment.

(2) Subject to paragraph (3), the first assessment period for a relevant business activity is the period of 6 years starting on the day the registered corporation establishes operational control of the relevant business activity on or after 1 January 2020.

(3) A registered corporation that established operational control of a relevant business activity before 1 January 2020 is taken to have complied with paragraph (1) if the registered corporation —

- (a) conducts a first assessment for the relevant business activity that satisfies the requirements in regulation 16; and
- (b) submits an assessment report that satisfies the requirements in regulation 22,

in respect of the applicable first assessment period as follows:

- (c) where the registered corporation established operational control of the relevant business activity on or before 2 June 2017 — the period starting on 1 January 2016 or the day the registered corporation established operational control of the relevant business activity (whichever is later) and ending on 31 December 2021;
- (d) where the registered corporation established operational control of the relevant business activity after 2 June 2017 — the period of 6 years starting on the day the registered

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corporation established operational control of the relevant business activity.

(4) For the purposes of paragraph (3), where the day on which the registered corporation establishes operational control of the relevant business activity falls on 29 February, the anniversary of that date in a year that is not a leap year is to be taken as 1 March.

*[S 898/2019 wef 01/01/2020]*

### **Subsequent energy efficiency opportunities assessments**

**15.—**(1) A registered corporation must, where the total energy consumed by any relevant business activity under its operational control in at least 2 of the 3 calendar years in the applicable period for that relevant business activity —

- (a) is equal to or more than 500 terajoules of energy consumed per calendar year — comply with paragraph (2) in relation to that relevant business activity; or
- (b) is equal to or more than 54 terajoules, but is less than 500 terajoules, of energy consumed per calendar year — comply with paragraph (3) in relation to that relevant business activity.

(2) In relation to a relevant business activity mentioned in paragraph (1)(a), the registered corporation must, before the expiry of the period of 6 years starting immediately after the end of the immediately preceding assessment period for the relevant business activity —

- (a) conduct a subsequent assessment for the relevant business activity; and
- (b) submit to the Director-General an assessment report in respect of the subsequent assessment.

(3) In relation to a relevant business activity mentioned in paragraph (1)(b), the registered corporation must, if the Director-General by written notice requires —

- (a) conduct a subsequent assessment for the relevant business activity; and

- (b) submit to the Director-General an assessment report in respect of the subsequent assessment,

before the expiry of the period of 6 years starting on the date of the written notice.

- (4) In this regulation —

“applicable period” means —

- (a) in relation to the first assessment period for a relevant business activity over which the registered corporation established operational control on or before 2 June 2017 — the calendar years 2018, 2019 and 2020; or
- (b) in any other case — the 3 calendar years immediately before the last calendar year of the immediately preceding assessment period for a relevant business activity;

“last calendar year” includes part of a calendar year.

*[S 898/2019 wef 01/01/2020]*

### **Requirements of energy efficiency opportunities assessments**

**16.** A registered corporation required to conduct a first assessment or subsequent assessment for a relevant business activity must determine the following:

- (a) the methods and processes of the relevant business activity;
- (b) the energy-consuming systems of the relevant business activity in accordance with regulation 17;
- (c) the objective of the assessment in accordance with regulation 18;
- (d) the reference period of the assessment in accordance with regulation 19;
- (e) the methods and processes to be used to conduct the assessment in accordance with regulation 20;

- (f) the individuals conducting the assessment, including each individual's role and experience, in accordance with regulation 21.

*[S 898/2019 wef 01/01/2020]*

### **Energy-consuming systems of relevant business activities**

17. For the purposes of regulation 16(b), the energy-consuming systems of a relevant business activity include —

- (a) all energy-consuming systems, the aggregate energy consumption of which is not less than 80% of the total energy consumption of the relevant business activity during the reference period; and
- (b) any energy-consuming system that uses, directly or indirectly, energy produced by any energy-consuming system mentioned in paragraph (a).

*[S 898/2019 wef 01/01/2020]*

### **Objective of energy efficiency opportunities assessments**

18.—(1) For the purposes of regulation 16(c), the objective of the first assessment or subsequent assessment (as the case may be) includes —

- (a) establishing the specific energy consumption of each energy-consuming system of the relevant business activity assessed;
- (b) identifying all energy efficiency opportunities that are available in respect of the relevant business activity, including taking into account any dependencies in respect of the processes and energy-consuming systems of the relevant business activity, after reviewing the matters in paragraph (2);
- (c) assessing the technical and economic feasibility of implementing each energy efficiency opportunity mentioned in sub-paragraph (b), based on a comparison of all the matters in paragraph (3) with the existing processes of, the equipment installed in and the

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- configuration and existing operations of, each energy-consuming system;
- (d) establishing the reason or reasons why the implementation of any energy efficiency opportunity mentioned in sub-paragraph (b) is assessed to be not feasible; and
  - (e) where no energy efficiency opportunities mentioned in sub-paragraph (b) are identified, establishing the reason or reasons why no energy efficiency opportunities have been identified.
- (2) The matters mentioned in paragraph (1)(b) are —
- (a) the existing processes of, equipment installed in and configuration of each energy-consuming system of the relevant business activity;
  - (b) the existing operations, including the variables (including temperature, rate of flow, pressure and power) and production requirements, of —
    - (i) the relevant business activity; and
    - (ii) each energy-consuming system of the relevant business activity; and
  - (c) the available alternative technology choices (including best available technology) for —
    - (i) the relevant business activity;
    - (ii) the optimum methods or processes of the relevant business activity; and
    - (iii) the energy-consuming systems of the relevant business activity mentioned in regulation 17.
- (3) The matters mentioned in paragraph (1)(c) are —
- (a) the estimated investment and operation cost;
  - (b) the estimated annual energy savings;
  - (c) the estimated specific energy consumption of each energy-consuming system;
  - (d) the estimated annual greenhouse gas emissions;

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- (e) the estimated financial savings;
  - (f) the estimated returns on investment, including the payback period; and
  - (g) any other criterion, including any non-energy related benefits such as greater productivity or improved reliability, that the registered corporation considers appropriate.
- (4) In this regulation —
- “best available technology” means technology that results in the best energy efficiency, use and consumption;
- “payback period”, in relation to an energy efficiency opportunity mentioned in paragraph (1)(b), means the total investment cost of implementing the energy efficiency opportunity divided by the annual financial savings attributable to that investment.

*[S 898/2019 wef 01/01/2020]*

### **Reference period of energy efficiency opportunities assessments**

**19.** For the purposes of regulation 16(d), the registered corporation —

- (a) may determine any reference period, being a period of 12 consecutive months that falls within an assessment period; but
- (b) must ensure that the operations of a relevant business activity during the determined reference period are representative of the typical day-to-day operations of the relevant business activity operating at its intended capacity.

*[S 898/2019 wef 01/01/2020]*

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**Methods and processes to be used for energy efficiency opportunities assessments**

**20.**—(1) For the purposes of regulation 16(e), the first assessment or subsequent assessment (as the case may be) must, in relation to each energy-consuming system mentioned in regulation 17 —

- (a) establish the current energy performance of the energy-consuming system, based on material and energy flows data that is continuously measured for a period of not less than 2 weeks;
- (b) identify the relevant variables (including temperature, rate of flow, pressure and power) that affect the energy performance of the energy-consuming system;
- (c) in relation to each energy efficiency opportunity identified for the energy-consuming system or any part of the system, measure continuously, for a period of not less than 2 weeks, the following:
  - (i) material and energy flows data for the energy-consuming system or part of the system, as the case may be;
  - (ii) the variables mentioned in sub-paragraph (b) relating to the energy-consuming system or part of the system, as the case may be;
- (d) adopt the instrument types, the accuracies of the instruments used and the practices used for on-site measurements that are specified in any applicable testing method for the energy-consuming system, subject to any applicable standard adopted under section 79(1) of the Act;
- (e) use only data that relate to the assessment period for the energy-consuming system or part of the system, as the case may be; and
- (f) verify, using energy and mass balances, the usability (including completeness, accuracy and method of acquisition) of all data collected and used for the purposes of the assessment.

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(2) In this regulation, “material and energy flows data”, in relation to an energy-consuming system or part of the system, means —

- (a) data relating to the actual material and energy flows (including flows of fuel or energy commodities) in and out of the energy-consuming system or part of the system, as the case may be; or
- (b) where the data mentioned in sub-paragraph (a) cannot be measured or obtained, data derived from any variables (including temperature, pressure, power and material flow rates) relating to material and energy flows in and out of the energy-consuming system or part of the system, as the case may be.

*[S 898/2019 wef 01/01/2020]*

### **Individuals conducting energy efficiency opportunities assessments**

**21.** For the purposes of regulation 16(f), the first assessment or subsequent assessment (as the case may be) must be conducted by —

- (a) at least one individual who is certified by the Institution of Engineers, Singapore as an energy efficiency opportunities assessor; and
- (b) at least one individual who is conversant with the energy-consuming systems of the relevant business activity mentioned in regulation 17.

*[S 898/2019 wef 01/01/2020]*

### **Requirements of assessment reports**

**22.—**(1) The assessment report in respect of a first assessment or subsequent assessment (as the case may be) must include, in respect of each relevant business activity, the following:

- (a) an executive summary that summarises the important findings of the assessment, including the following:
  - (i) the total energy consumption of the relevant business activity during the reference period;

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- (ii) the energy consumption, expressed as a percentage of the total energy consumption of the relevant business activity, of each energy-consuming system;
  - (iii) the energy-consuming systems identified for the purposes of regulation 17(a);
  - (iv) the energy efficiency opportunities identified;
  - (v) the proposed timeframe for implementing each energy efficiency opportunity identified and assessed to be feasible;
- (b) general information on —
- (i) the registered corporation;
  - (ii) the energy efficiency opportunities assessor who is principally responsible for conducting the assessment; and
  - (iii) any individual (including an individual mentioned in regulation 21(b)) who contributed to the assessment;
- (c) general information on the relevant business activity, including the following:
- (i) the type of business activity;
  - (ii) the outputs of the relevant business activity;
- (d) information about the manner in which the assessment is conducted and the methodology used for the assessment, including —
- (i) the method of data collection and the degree of accuracy of that method; and
  - (ii) the basis and degree of accuracy of any calculations or estimates, and the assumptions used for those calculations or estimates;
- (e) information about the energy efficiency opportunities identified, including —
- (i) considerations relating to the technology or practices chosen for each energy efficiency opportunity, as

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compared to the existing technology or practices used for or in the relevant business activity;

- (ii) the evaluation of all energy efficiency opportunities identified, including the ranking of those opportunities and the basis of, and criteria for, the ranking;
- (iii) the proposed timeframe for implementing the energy efficiency opportunities identified and assessed to be feasible; and
- (iv) any planned or intended changes to the scope or scale of the relevant business activity, and the estimated impact of those changes on the energy consumption of the relevant business activity;

(f) information about the requirements mentioned in regulation 16.

(2) Without limiting paragraph (1)(d), the information mentioned in paragraph (1)(d) includes the following:

- (a) the variables measured, or derived from variables measured, relating to the material and energy flows data mentioned in regulation 20;
- (b) the energy content of the fuel or energy commodity (called in this paragraph the energy input) consumed by each energy-consuming system mentioned in regulation 17(a);
- (c) the aggregate energy inputs of all energy-consuming systems mentioned in regulation 17(a);
- (d) block, process or energy flow diagrams that show the energy flows and interactions between any 2 or more energy-consuming systems;
- (e) a description of each energy-consuming system mentioned in regulation 17, including information relating to the energy input and output and specific energy consumption of the energy-consuming system;

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- (f) the energy and mass balance —
    - (i) within each energy-consuming system; and
    - (ii) between any 2 or more energy-consuming systems;
  - (g) process or energy flow diagrams that show the breakdown of the equipment comprising each energy-consuming system;
  - (h) the specific energy consumption of each fuel or energy commodity used in each energy-consuming system over the timeframe specified in the assessment report;
  - (i) the methodology for deriving the energy consumption of each energy-consuming system from the variables mentioned in sub-paragraph (a);
  - (j) the data collected and used for the assessment, and the types of instruments or meters used to collect that data, including —
    - (i) the accuracies of the instruments or meters; and
    - (ii) the duration and frequencies of the measurements taken.
- (3) The assessment report mentioned in paragraph (1) must be —
- (a) signed by the energy efficiency opportunities assessor who is principally responsible for conducting the assessment;
  - (b) endorsed by the chief executive of the registered corporation;
  - (c) made —
    - (i) using the relevant form set out in the electronic service provided at <http://www.nea.gov.sg>; and
    - (ii) in the manner specified by the Director-General; and
  - (d) submitted by a person authorised by the registered corporation using the electronic service provided at <http://www.nea.gov.sg>.
- (4) Every application under section 31B(2) of the Act for the waiver of the application of section 27B of the Act must —

- (a) be in writing;
- (b) state the reasons for the inability of the registered corporation to comply with section 27B of the Act; and
- (c) be accompanied by supporting documents.

*[S 898/2019 wef 01/01/2020]*

### **Records to be kept for this Part**

**23.—**(1) A registered corporation must keep and maintain complete and accurate records of any information or records relied upon by the registered corporation in preparing the assessment report submitted under regulation 22(3) for not less than 10 years after the date the assessment report to which the information relates is submitted to the Director-General.

(2) The records kept and maintained pursuant to this regulation may be kept and maintained in electronic form.

*[S 898/2019 wef 01/01/2020]*

## FIRST SCHEDULE

Regulation 2

### GREENHOUSE GASES

1. Carbon dioxide
2. Methane
3. Nitrous oxide
4. Sulphur hexafluoride
5. Nitrogen trifluoride
6. A hydrofluorocarbon of a kind prescribed in Table 1
7. A perfluorocarbon of a kind prescribed in Table 2.

**Table 1**

<b>Hydrofluorocarbons (HFCs)</b>	<b>Chemical Formula</b>
HFC-23	CHF <sub>3</sub>
HFC-32	CH <sub>2</sub> F <sub>2</sub>
HFC-41	CH <sub>3</sub> F

FIRST SCHEDULE — *continued*

HFC-125	$\text{CHF}_2\text{CF}_3$
HFC-134	$\text{CHF}_2\text{CHF}_2$
HFC-134a	$\text{CH}_2\text{FCF}_3$
HFC-143	$\text{CH}_2\text{FCHF}_2$
HFC-143a	$\text{CH}_3\text{CF}_3$
HFC-152	$\text{CH}_2\text{FCH}_2\text{F}$
HFC-152a	$\text{CH}_3\text{CHF}_2$
HFC-161	$\text{CH}_3\text{CH}_2\text{F}$
HFC-227ea	$\text{CF}_3\text{CHFCF}_3$
HFC-236cb	$\text{CH}_2\text{FCF}_2\text{CF}_3$
HFC-236ea	$\text{CHF}_2\text{CHFCF}_3$
HFC-236fa	$\text{CF}_3\text{CH}_2\text{CF}_3$
HFC-245ca	$\text{CH}_2\text{FCF}_2\text{CHF}_2$
HFC-245fa	$\text{CHF}_2\text{CH}_2\text{CF}_3$
HFC-365mfc	$\text{CH}_3\text{CF}_2\text{CH}_2\text{CF}_3$
HFC-43-10mee	$\text{CF}_3\text{CHFCHF}_2\text{CF}_3$

**Table 2**

<b>Perfluorocarbons (PFCs)</b>	<b>Chemical Formula</b>
PFC-14	$\text{CF}_4$
PFC-116	$\text{C}_2\text{F}_6$
PFC-218	$\text{C}_3\text{F}_8$
PFC-318	c- $\text{C}_4\text{F}_8$
PFC-3-1-10	$\text{C}_4\text{F}_{10}$
PFC-4-1-12	$\text{C}_5\text{F}_{12}$
PFC-5-1-14	$\text{C}_6\text{F}_{14}$

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**SECOND SCHEDULE**

Regulation 8(4)(g)

**DATA ON PROCESSES AND ACTIVITIES RESULTING IN  
GREENHOUSE GAS EMISSIONS**

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
<b>Chemical Industry</b>		
1. Acrylonitrile production	(1) Type of process (For example, SOHIO process)	
	(2) Amount of acrylonitrile produced	Tonne acrylonitrile produced
	(3) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne acrylonitrile produced
	(4) CH <sub>4</sub> emission factor	Kilogramme CH <sub>4</sub> /tonne acrylonitrile produced
2. Adipic acid production	(1) Amount of adipic acid produced	Tonne
	(2) N <sub>2</sub> O emission factor	Kilogramme N <sub>2</sub> O/tonne adipic acid produced
3. Ammonia production	(1) Amount of ammonia produced	Tonne
	(2) Fuel requirement for ammonia production, by type of fuel	Gigajoule of fuel/tonne ammonia produced
	(3) Carbon content of fuel	Kilogramme carbon/Gigajoule
	(4) Carbon oxidation factor of fuel	Fraction
	(5) Amount of urea produced	Kilogramme
4. Carbide production	(1) Type of carbide produced (For example, silicon carbide [SiC],	

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	calcium carbide [CaC <sub>2</sub> ]	
	(2) If based on raw material used —	
	(a) Raw material consumption (For example, petroleum coke)	Tonne
	(b) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne raw material used
	(c) CH <sub>4</sub> emission factor	Kilogramme CH <sub>4</sub> /tonne raw material used
	(3) If based on carbide produced —	
	(a) Amount of carbide produced	Tonne
	(b) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne carbide produced
	(c) CH <sub>4</sub> emission factor	Kilogramme CH <sub>4</sub> /tonne carbide produced
	(4) Calcium carbide used in acetylene production	Tonne
	(5) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne carbide used in acetylene production
5. Carbon black production	(1) Type of process (For example, furnace black process, thermal black process, acetylene black process)	

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	(2) Amount of carbon black produced	Tonne carbon black produced
	(3) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne carbon black produced
	(4) CH <sub>4</sub> emission factor	Kilogramme CH <sub>4</sub> /tonne carbon black produced
6. Caprolactam, glyoxal and glyoxylic acid production	(1) Type of chemical produced	
	(2) Amount of chemical produced	Tonne
	(3) N <sub>2</sub> O emission factor	Kilogramme N <sub>2</sub> O/tonne chemical produced
7. Ethylene dichloride (EDC)/ Vinyl chloride monomer (VCM) production	(1) Type of process (For example, direct chlorination process, oxychlorination process, balanced process)	
	(2) Amount of ethylene dichloride or vinyl chloride monomer produced	Tonne EDC produced or tonne VCM produced
	(3) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne EDC produced or tonne CO <sub>2</sub> /tonne VCM produced
	(4) CH <sub>4</sub> emission factor	Kilogramme CH <sub>4</sub> /tonne EDC produced or kilogramme CH <sub>4</sub> /tonne VCM produced

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
8. Ethylene oxide production	(1) Type of process	
	(2) Amount of ethylene oxide produced	Tonne ethylene oxide produced
	(3) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne ethylene oxide produced
	(4) CH <sub>4</sub> emission factor	Kilogramme CH <sub>4</sub> /tonne ethylene oxide produced
9. Ethylene production	(1) Type of feedstock	
	(2) Amount of ethylene produced	Tonne
	(3) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne ethylene produced
	(4) CH <sub>4</sub> emission factor	Kilogramme CH <sub>4</sub> /tonne ethylene produced
10. Fugitive emissions from oil and natural gas systems from venting, flaring, oil and natural gas production and upgrading, natural gas processing, natural gas transmission and storage, transport of oil, oil refining, oil and natural gas distribution	(1) Type of fuel (oil, natural gas)	

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	(2) Type of activity	
	(3) Type of greenhouse gas emitted	
	(4) Amount of process or activity	Tonne or volume in cubic metres of process or activity
	(5) Emission factor	Tonne greenhouse gas/tonne or volume in cubic metres of process or activity
11. HCFC-22 production	(1) Amount of HCFC-22 produced	Kilogramme
	(2) HFC-23 emission factor	Kilogramme HFC-23/kilogramme HCFC-22 produced
12. By-product emissions of greenhouse gases from production of fluorinated compounds other than HCFC-22	(1) Type of greenhouse gas emitted as by-product from production of principal fluorinated compound	
	(2) Type of principal fluorinated compound produced	
	(3) Amount of principal fluorinated compound produced	Kilogramme
	(4) By-product emission factor	Kilogramme by-product gas emitted/kilogramme fluorinated compound produced

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
13. Fugitive emissions from production of fluorinated compounds other than HCFC-22	(1) Type of fluorinated compound produced	
	(2) Amount of fluorinated compound produced	Kilogramme
	(3) Fugitive emission factor	Kilogramme fugitive gas emitted/kilogramme fluorinated compound produced
14. Methanol production	(1) Type of process (For example, conventional steam reforming process, combined steam reforming process)	
	(2) Type of feedstock	
	(3) Amount of methanol produced	Tonne
	(4) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne methanol produced
	(5) CH <sub>4</sub> emission factor	Kilogramme CH <sub>4</sub> /tonne methanol produced
15. Nitric acid production	(1) Amount of nitric acid produced	Tonne
	(2) N <sub>2</sub> O emission factor	Kilogramme N <sub>2</sub> O/tonne nitric acid produced
16. Soda ash production	(1) If based on raw material used —	

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	(a) Amount of trona utilised	Tonne
	(b) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne trona utilised
	(2) If based on carbide produced —	
	(a) Amount of natural soda ash produced	Tonne
	(b) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne natural soda ash produced
17. Titanium dioxide production, including titanium slag, synthetic rutile and rutile titanium dioxide	(1) Type of production	
	(2) Amount of production	Tonne
	(3) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne produced
<b>Electronics Industry</b>		
18. Integrated circuit or Semiconductor production	(1) Type of fluorinated compound used	
	(2) Type of process (For example, plasma etching thin film, cleaning chemical vapour deposition (CVD) tool chambers, furnace (diffusion),	

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	nitride removal (etching), cleaning of low k CVD reactors)	
	(3) If consumption of fluorinated compound is non-metered —	
	(a) Quantity of fluorinated compound purchased for use in the process	Kilogramme of fluorinated compound purchased for use in the process
	(b) Fraction of gas remaining in gas cylinder (heel) after use	Fraction
	(4) If consumption of fluorinated compound is metered —	Kilogramme of fluorinated compound fed into the process
	quantity of fluorinated compound fed into the process	
	(5) Fraction of fluorinated compound destroyed	Fraction
	(6) Fraction of fluorinated compound volume used in processes with emission control technologies	Fraction
	(7) Fraction of fluorinated compound	Fraction

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	destroyed by the emission control technology	
	(8) Emission factor for by-product emissions of CF <sub>4</sub>	Kilogramme by-product emissions of CF <sub>4</sub> /kilogramme of fluorinated compound used in process
	(9) Emission factor for by-product emissions of C <sub>2</sub> F <sub>6</sub>	Kilogramme by-product emissions of C <sub>2</sub> F <sub>6</sub> /kilogramme of fluorinated compound used in process
	(10) Emission factor for by-product emissions of C <sub>3</sub> F <sub>8</sub>	Kilogramme by-product emissions of C <sub>3</sub> F <sub>8</sub> /kilogramme of fluorinated compound used in process
	(11) Type of abatement technology (For example, plasma abatement, cryogenic absorption, membrane separation, chemical-thermal abatement, thermal oxidation)	
19. Photovoltaic material production	(1) Type of fluorinated compound used (For example, CF <sub>4</sub> , C <sub>2</sub> F <sub>6</sub> )	
	(2) Fraction of annual plant production capacity utilisation	Fraction

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	(3) Annual manufacturing design capacity	Million square metres of substrate processed
	(4) Fraction of photovoltaic material manufacture that uses fluorinated compounds	Fraction
	(5) Fluorinated compound emission factor	Grams of fluorinated compound/square metres of substrate processed
20. Thin-film-transistor (TFT) flat panel display production, liquid crystal display production	(1) Type of fluorinated compound used (For example, CF <sub>4</sub> , NF <sub>3</sub> , SF <sub>6</sub> )	
	(2) Fraction of annual plant production capacity utilisation	Fraction
	(3) Annual manufacturing design capacity	Giga square metres of glass processed
	(4) Fluorinated compound emission factor	Grams of fluorinated compound/square metres of glass processed
21. Use of C <sub>6</sub> F <sub>14</sub> as heat transfer fluid	(1) Fraction of annual plant production capacity utilisation	Fraction
	(2) Annual manufacturing design capacity	Giga square metres of silicon consumed

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	(3) C <sub>6</sub> F <sub>14</sub> emission factor	Kilogramme C <sub>6</sub> F <sub>14</sub> /square metres of silicon consumed
<b>Metal Industry</b>		
22. Aluminium production	(1) Type of technology (For example, Centre-Worked Prebake [CWPB], Side-Worked Prebake [SWPB], Vertical Stud Soderberg [VSS], Horizontal Stud Soderberg [HSS])	
	(2) Amount of aluminium produced	Tonne aluminium produced
	(3) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne aluminium produced
	(4) CF <sub>4</sub> emission factor	Kilogramme CF <sub>4</sub> /tonne aluminium produced
	(5) C <sub>2</sub> F <sub>6</sub> emission factor	Kilogramme C <sub>2</sub> F <sub>6</sub> /tonne aluminium produced
23. Ferroalloys production	(1) Type of ferroalloy	
	(2) Amount of ferroalloy produced	Tonne ferroalloy produced
	(3) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne ferroalloy produced
	(4) CH <sub>4</sub> emission factor	Kilogramme CH <sub>4</sub> /tonne ferroalloy produced
24. Iron and steel production	(1) Type of steelmaking method (For example,	

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	basic oxygen furnace, electric arc furnace, open hearth furnace, pig iron furnace [not converted into steel], direct reduced iron [DRI] production, sinter production, pellet production)	
	(2) Amount of steel or iron production	Tonne crude steel, pig iron, DRI, sinter or pellet produced
	(3) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne production
	(4) CH <sub>4</sub> emission factor	Kilogramme CH <sub>4</sub> /tonne production
25. Lead production	(1) Source and furnace type (For example, imperial smelt furnace production, direct smelting production, treatment of secondary raw materials)	
	(2) Amount of lead produced	Tonne lead produced
	(3) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne lead produced
26. Magnesium production	(1) Type of raw material (magnesite, dolomite)	
	(2) Amount of primary magnesium produced	Tonne primary magnesium produced

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	(3) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne primary magnesium produced
	(4) Amount of magnesium casting	Tonne magnesium casting
	(5) SF <sub>6</sub> emission factor	Kilogramme SF <sub>6</sub> /tonne magnesium casting
27. Zinc production	(1) Type of process (For example, waelz kiln, pyrometallurgical, electro-thermic)	
	(2) Amount of zinc produced	Tonne zinc produced
	(3) CO <sub>2</sub> emission factor	Tonne CO <sub>2</sub> /tonne zinc produced
<b>Mineral Industry</b>		
28. Cement production (if clinker used is produced in Singapore)	(1) Each type of cement produced	
	(2) Mass of each type of cement produced	Tonne
	(3) Clinker fraction in cement	Fraction
	(4) Imports for consumption of clinker	Tonne
	(5) Exports of clinker	Tonne
	(6) CO <sub>2</sub> emission factor for the clinker in cement	Tonne CO <sub>2</sub> /tonne clinker

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
29. Glass production	(1) Total glass production	Tonne
	(2) CO <sub>2</sub> emission factor for glass production	Tonne CO <sub>2</sub> /tonne glass
	(3) Average annual cullet ratio	Fraction
30. Lime production	(1) Type of lime produced	
	(2) Mass of lime produced	Tonne
	(3) CO <sub>2</sub> emission factor for lime production	Tonne CO <sub>2</sub> /tonne lime
31. Other uses of carbonates in production, including ceramics production, non-metallurgical magnesia production and use of soda ash in production	(1) Type of process where carbonates are used	
	(2) Mass of carbonate consumed	Tonne
	(3) Emission factor for carbonate consumption	Tonne CO <sub>2</sub> /tonne carbonate
<b>Adiabatic uses of SF<sub>6</sub> and PFCs</b>		
32. Adiabatic uses of SF <sub>6</sub> and PFCs	(1) Type of applications (For example, production of car tyres, production of	

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	shoe soles, production of tennis balls)	
	(2) Type of greenhouse gas used	
	(3) Quantity of the SF <sub>6</sub> or PFCs used in producing this application type 3 years preceding current reporting year	Tonne
<b>Manufacture and use of SF<sub>6</sub> in sound-proof glazing</b>		
33. Use of SF <sub>6</sub> in manufacture of sound-proof glazing	(1) SF <sub>6</sub> purchased to fill windows assembled in current reporting year	Tonne SF <sub>6</sub>
	(2) SF <sub>6</sub> emission factor during assembly	Fraction
34. Use of SF <sub>6</sub> in installed sound-proof glazing	(1) Amount of SF <sub>6</sub> in installed windows in current reporting year	Tonne SF <sub>6</sub>
	(2) Leakage emission factor	Fraction
35. Disposal of SF <sub>6</sub> in sound-proof glazing	(1) Amount left in windows at end of lifetime (disposed of in current reporting year)	Tonne SF <sub>6</sub>
	(2) Fraction of SF <sub>6</sub> recovered	Fraction

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
<b>N<sub>2</sub>O Emissions from Medical Applications and in Aerosol Products</b>		
36. N <sub>2</sub> O emissions from medical applications [For example, anaesthetic use, analgesic use, veterinary use] and in aerosol products	(1) Type of applications (Medical applications, propellant in aerosol products)	
	(2) Quantity of N <sub>2</sub> O supplied in this application type in current reporting year	Tonne
	(3) Quantity of N <sub>2</sub> O supplied in this application type in year preceding current reporting year	Tonne
	(4) N <sub>2</sub> O emission factor	Fraction
<b>SF<sub>6</sub> and PFC Emissions from Use of Tracers and Production of Optical Cables</b>		
37. SF <sub>6</sub> and PFC emissions from use of tracers or production of optical cables	(1) Type of applications	
	(2) Type of greenhouse gas used	

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	(3) Quantity of SF <sub>6</sub> or PFCs used in this application type in current reporting year	Tonne
	(4) Quantity of SF <sub>6</sub> or PFCs used in this application type in year preceding current reporting year	Tonne
<b>Use of HFCs and PFCs as Substitutes for Ozone Depleting Substances</b>		
38. Use of HFCs or PFCs as foam blowing agents to produce closed cell foam	(1) Type of HFCs or PFCs used	
	(2) Amount of HFC or PFC blown into closed cell foam	Tonne
	(3) Lifetime of closed cell foam	Years
	(4) First year losses of the HFC or PFC — Foam manufacture and installation	Tonne
	(5) Second and subsequent years — Annual emission factor for the HFC or PFC (in-situ losses from foam use, as a percentage of the amount of HFC or	Percentage

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	PFC blown into closed cell foam)	
39. Use of HFCs or PFCs as foam blowing agents to produce open cell foam	(1) Type of HFCs or PFCs used	
	(2) Amount of HFC or PFC used to produce the foam	Tonne
40. Use of HFCs and PFCs in aerosols	(1) Type of HFCs or PFCs contained in aerosol products used	
	(2) Quantity of HFCs or PFCs contained in aerosol products used	Tonne
41. Use of HFCs and PFCs in fire protection equipment	(1) Type of HFCs or PFCs used in the equipment	
	(2) Amount of the HFC or PFC in the equipment used	Tonne
	(3) Amount of the HFC or PFC in equipment disposed	Tonne
42. Use of HFCs or PFCs in refrigeration and air-conditioning equipment	(1) Type of HFCs or PFCs used in the equipment	
	(2) Amount of the HFC or PFC topped up in the equipment	Kilogramme

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	(3) Amount of the HFC or PFC in equipment disposed	Tonne
43. Use of HFCs and PFCs in solvents	(1) Type of HFCs or PFCs used	
	(2) Quantity of the HFC or PFC used	Tonne
44. Other applications of HFCs and PFCs (For example, sterilisation equipment, tobacco expansion applications, solvents in the manufacture of adhesive coatings and inks)	(1) Type of HFCs or PFCs used	
	(2) Quantity of the HFC or PFC used	Tonne
	(3) Emission factor (loss occurred)	Fraction
<b>Use of Lubricants and Paraffin Waxes</b>		
45. Use of lubricant	(1) Amount of lubricant consumed	Terajoule
	(2) Carbon content of lubricant	Tonne of Carbon/Terajoule
	(3) Fraction oxidised during use	Fraction

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
46. Use of paraffin wax	(1) Amount of paraffin wax consumed	Terajoule
	(2) Carbon content of paraffin wax	Tonne of Carbon/Terajoule
	(3) Fraction oxidised during use	Fraction
<b>Use of SF<sub>6</sub> in Airborne Warning and Control Systems</b>		
47. Use of SF <sub>6</sub> in Airborne Warning and Control Systems (AWACS)	(1) Number of AWACS	
	(2) SF <sub>6</sub> emission factor	Kilogramme SF <sub>6</sub> /AWACS
<b>Use of SF<sub>6</sub> in Electrical Equipment</b>		
48. Use of SF <sub>6</sub> in electrical equipment	(1) Type of equipment (For example, sealed-pressure, closed-pressure, gas-insulated transformers)	
	<i>SF<sub>6</sub> emissions from manufacturing</i>	
	(2) Amount of SF <sub>6</sub> used by equipment manufacturers	Tonne SF <sub>6</sub>
	(3) SF <sub>6</sub> emission factor during manufacture	Fraction
<i>SF<sub>6</sub> emissions during equipment installation</i>		

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	(4) Capacity of new equipment filled onsite	Tonne SF <sub>6</sub>
	(5) SF <sub>6</sub> emission factor during installation	Fraction
	<i>SF<sub>6</sub> emissions from equipment use</i>	
	(6) Capacity of installed equipment	Tonne SF <sub>6</sub>
	(7) SF <sub>6</sub> emission factor during use	Fraction
	<i>SF<sub>6</sub> emissions from equipment disposal</i>	
	(8) Capacity of disposed equipment	Tonne SF <sub>6</sub>
	(9) Fraction of SF <sub>6</sub> remaining at disposal	Fraction
<b>Use of SF<sub>6</sub> in Particle Accelerators</b>		
49. Use of SF <sub>6</sub> in industrial and medical particle accelerators	(1) Type of applications (For example, industrial accelerator [high voltage: 0.3-23 megavolts], industrial accelerator [low voltage: <0.3 megavolts], medical [radiotherapy])	
	(2) Number of particle accelerators that use SF <sub>6</sub>	Number
	(3) SF <sub>6</sub> charge factor	Kilogramme SF <sub>6</sub> /particle accelerator

SECOND SCHEDULE — *continued*

<i>First column</i>	<i>Second column</i>	<i>Third column</i>
<i>Process or Activity</i>	<i>Data on processes and activities to be provided</i>	<i>Unit of measure</i>
	(4) SF <sub>6</sub> emission factor	Fraction
50. Use of SF <sub>6</sub> in university and research particle accelerators	(1) Number of university and research particle accelerators	Number
	(2) SF <sub>6</sub> use factor	Fraction
	(3) SF <sub>6</sub> charge factor	Kilogramme SF <sub>6</sub> /particle accelerator
	(4) SF <sub>6</sub> emission factor	Fraction
<b>Any Other Process or Activity Resulting in Greenhouse Gas Emissions</b>		
51. Any other process or activity resulting in greenhouse gas emissions	(1) Type of process or activity	
	(2) Amount of process or activity	Tonne raw material or product from the process or activity
	(3) Type of greenhouse gas emitted	
	(4) Greenhouse gas emission factor(s)	Tonne greenhouse gas/tonne raw material or product from the process or activity.

Made this 17th day of April 2013.

CHOI SHING KWOK  
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