Title: Regulations Governing the Assessment of Energy Development and Utilization

Legislative: 1. Promulgated on November 24, 2015
2. Amended on April 18, 2023
3. Amended on June 27, 2024
4. Amended on November 3, 2025

Category: Ministry of Economic Affairs

**Article 1**

These regulations are promulgated pursuant to Article 15-1 of the Energy Administration Act (hereinafter referred to as the Act).

**Article 2**

The terms applied in these regulations are defined as follows:

1. Volume: in circumstances of electricity generation or cogeneration systems, refers to installed capacity of power generation equipment; in circumstances of petroleum refineries and massive energy-consumption users, refers to chartered capacity of electricity consumption and installed capacity of self-usage power generation equipment.
2. Category: refers to coal (metric ton), petroleum (kiloliters of oil equivalent), natural gas (kilo cubic meter) and electricity (megawatt).
3. Location: north district, refers to areas located north of Feng-Shan River and north of He-Ping River; central district, refers to areas located south of Feng-Shan River, north of Cho-Shui River, and Hualien County; south district, refers to areas located south of Cho-Shui River not belonging to north and central district as well as Taitung County; offshore islands, refer to islands where no transmission lines connecting to the grid of the main island of Taiwan.
4. Application Period: identified by the planned years of the business operation on the energy utilization manual.
5. Letter of Approval for Electricity Consumption Plan: refers to the letter for

the approval of applications of electricity consumption plans issued to the electricity enterprises.

**Article 3**

These regulations apply to the energy users of massive investment and production plan of electricity generation, cogeneration systems, petroleum refineries and massive energy-consumption users (hereinafter referred to as energy users), and the Scope of Applied Energy Users is promulgated in accordance with Article 16, Section 4 of the Act.

**Article 4**

Energy users shall submit the energy utilization manual for central competent authorities' approval through authorities which accept such application before the energy consumption facilities are established or expanded. The applicants shall state the reasons and apply directly to a central competent authority if no local authorities accept the application.

The preceding section applies mutatis mutandis when one of the following circumstances occur in content of the approved energy utilization manual:

1. Alteration of the energy use category.
2. Alteration of the location of energy consumption facilities.
3. Increase of the energy consumption volume.
4. Alteration of energy consumption efficiency.

**Article 5**

Power generating plant energy users' consumption volume, category, and location of application shall be calculated on the basis of nationwide staging and zoning installed capacity specified in the National Power Supply and Demand Report, and the applicable installed capacity of the category of energy in the applied period shall not be exceeded.

The location shall be identified by the parallel connection point between the power transmission lines of established or expanded energy consumption facilities applied by the power generating plant energy users and the grid.

**Article 6**

In order to ensure the stability and security of nationwide power supply, for power generating plant energy users located on offshore islands, their staging and zoning installed capacities and categories are not constrained by the preceding article.

**Article 7**

Electricity generation or cogeneration systems energy users' efficiency shall meet the following rules of best available techniques:

1. Utility systems and equipment (as table 1).
2. Processing techniques for electricity generation or cogeneration systems (as table 2).

The preceding section is not applicable in circumstances of being restricted by laws and regulations, patent right protection, international trade barriers, or other factors not attributable to the applicants, given evidence are submitted by the applicants.

**Article 8**

The applied volume category, and location of petroleum refineries or massive energy- consumption users shall meet the following rules:

1. Supplying capacity of electricity enterprise listed on the energy utilization manual shall be provided with letter of approval for Electricity Consumption Plan issued by an electricity enterprise and not exceed the approved supplying capacity.
2. Supplying capacity of self-usage power generation equipment listed on the energy utilization manual shall be provided with supporting evidence to explain there is no concern for blackout in the self-usage power generation equipment.

**Article 9**

Petroleum refineries or massive energy-consumption users' efficiency shall meet the following rules of Best available techniques:

1. Utility systems and equipment (as table 1).
2. Processing techniques:
   (1) Petroleum refineries or energy users' processing techniques (as table 3).
   (2) Semi-conductor or panel industrial processing techniques (as table 4).
   (3) Steel industrial processing techniques (as table 5).
   (4) Gas industrial processing techniques (as table 6).
   (5) Data processing, hosting and related activities industrial processing techniques (as table 7).

The preceding section is not applicable in circumstances of being restricted by laws and regulations, patent right protection, international trade barriers, or other factors not attributable to the applicants, given supporting evidence submitted by the applicants.

**Article 10**

For the energy utilization manuals which do not comply with the format and essential particulars listed in the Article 16, Section 4 of the Act, or is incomplete, wrongful or omitted in the application documents, shall be asked to take corrective actions within the time prescribed in central competent authorities' order. Applications shall be rejected if the corrective action is not made in time or fails to comply with the rules.

When the application documents have been found to comply with all requirements, the applicants shall pay the fee of review or revision within 15 days after receiving the notice. The preceding section applies mutatis mutandis if the applicants do not pay in accordance with the regulations.

**Article 11**

The central competent authorities shall make one of the following decisions according to Article 16, Section 2 of the Act after receiving the application according to Article 4 or the preceding article:

1. Approval.
2. Approval with incidental provisions.

3. Rejection.

**Article 12**

For the following circumstances where no corrective action is made or the correction is incomplete within the time prescribed in central competent authorities' order, the central competent authorities may reject the application:

1. The consumption volume, category, or location listed on the energy utilization manual does not comply with rules set in Article 5 or Article 8.
2. The efficiency listed on the energy utilization manual does not comply with Article 7 or Article 9.

**Article 13**

The central competent authorities shall revoke the approval decision if the years of planned business operation listed in the approved energy utilization manual end, and one of the following circumstances exists:

1. Electricity generation:
   (1) Not obtain the preparation approval for electricity enterprise establishment or expansion permit in accordance with electricity enterprise relevant laws and regulations.
   (2) The preparation approval for electricity enterprise establishment or expansion permit has been withdrawn, revoked, or voided for other circumstances.
   (3) The working permit of electricity enterprise has been withdrawn, revoked, or voided for other circumstances.
2. Cogeneration systems:
   (1) Not obtain the working permit for self-usage power generation equipment in accordance with electricity enterprise relevant laws and regulations.
   (2) The working permit for self-usage power generation equipment has been withdrawn, revoked, or voided for other circumstances.
3. Petroleum refineries:
   (1) Not obtain the permit to establish a petroleum refinery in accordance with

Petroleum Administration Act.

(2) The permit to establish a petroleum refinery has been withdrawn, revoked, or voided for other circumstances.

4. Massive energy-consumption users:

(1) Not obtain permit or approval in accordance with relevant enterprise administration laws or regulations.

(2) The permit or approval mentioned in the preceding sub-sub-section has been withdrawn, revoked, or voided for other circumstances.

5. Energy users fail to complete the business operation.

Energy users found to be under the condition described in Subparagraph 5 of the preceding paragraph may submit its reasons in writing six months before the end of the years of planned business operation listed in the approved energy utilization manual to the central competent authorities, in order to apply for an extension; provided that the extension period shall not exceed five years and is limited to one time only.

**Article 14**

These regulations shall come into force after the promulgation date.

**Article 7 and 9 Table 1**

**The Best Available Techniques Which Shall Be Applied in Utility Systems and Equipment**

Utility technology items shall comply with the following contents of the Best Available Techniques.

I. Combustion handling systems

| Item |
|---|
| 1. Lignite pre-drying |
| 2. Coal gasification |
| 3. Fuel drying |
| 4. Biomass gasification |
| 5. Bark pressing |
| 6. Expansion turbine to recover the energy content of pressurized gases |
| 7. Advanced computerised control of combustion conditions for emission reduction and boiler performance |
| 8. Using flue-gas heat to supply district heating system |
| 9. Reducing excess air and make it reach the optimum air-fuel ratio |
| 10. Properly reducing the exhaust temperature to reduce heat loss |
| 11. Reducing the concentration of carbon monoxide in the exhaust gas and improving boiler efficiency |
| 12. Heat accumulation |
| 13. Cooling tower discharge |
| 14. Different techniques for the cooling system |
| 15. Using waste heat to preheat gas fuels to improve thermal efficiency |
| 16. Preheating combustion air to improve fuel efficiency |
| 17. Installing recuperative or regenerative burners to recover burner waste heat |
| 18. Controlling and optimizing combustion conditions by monitoring fuel, air flow rates, and oxygen content in flue gas |
| 19. Fuel choice |
| 20. Using oxygen-enriched combustion technology to improve energy efficiency |
| 21. Reducing heat loss by insulation |
| 22. Reducing heat loss caused by frequent opening and closing or poor sealing of furnace doors |
| 23. Fluidised bed combustion |

II. Heat recovery systems

| Item |
|---|
| 1. Monitoring the efficiency periodically |
| 2. Preventing or removing the internal scaling and external dust accumulation of equipment |

III. Steam handling systems

| Item |
|---|
| 1. Energy efficient design and installation of steam distribution pipework |

| |
|---|
| 2. Throttling devices and the use of backpressure turbines: utilize backpressure turbines instead of PRVs |
| 3. Improve operating procedures and boiler controls |
| 4. Use sequential boiler controls (apply only to sites with more than one boiler) |
| 5. Install flue-gas isolation dampers (applicable only to sites with more than one boiler) |
| 6. For feed water preheating, the following methods are available:<br>(1)process waste heat recovery<br>(2)recovery of heat energy from combustion air by economizer<br>(3)heating condensate with deoxygenated feed water<br>(4)using heat exchangers to condense the steam used for degassing and feed water heating |
| 7. Prevention and removal of scale deposits on heat transfer surfaces. (Clean boiler heat transfer surfaces) |
| 8. Boiler blowdown is reduced by improving the water treatment system and installing automatic dissolved solids control equipment |
| 9. It is necessary to check and attach/repair the boiler refractory material during regular inspection |
| 10. Maintaining optimal discharge rate of degassers |
| 11. Minimise boiler short cycling losses |
| 12. Carrying out boiler maintenance |
| 13. Optimizing the steam distribution system |
| 14. Isolate steam from unused lines |
| 15. Regularly inspecting and confirming the heat insulation of steam pipes and condensate return pipes. (Confirming the proper heat insulation of the pipes, pipe fittings, valve bodies, and tanks) |
| 16. Implement a control and repair programme for steam traps |
| 17. Collect and return condensate to the boiler for re-use. (Optimise condensate recovery) |
| 18. Re-use of flash-steam. (Use high pressure condensate to make low pressure steam) |
| 19. Recover energy from boiler blowdown |
| 20. Expansion turbine to recover the energy content of pressurised gases |
| 21. Change turbine blades when repairing |
| 22. Using advanced materials to meet high steam parameter requirements to improve efficiency |
| 23. Supercritical steam parameters |
| 24. Double reheat |
| 25. Regenerative feed-water |
| 26. Use of heat content of the flue-gas for district heating |
| 27. Heat accumulation |
| 28. Advanced computerised control of the gas turbine and subsequent recovery boilers |

## IV. Electric power supply systems

| Item |
|---|
| 1. Installing capacitors in the AC circuits to decrease the magnitude of reactive power |
| 2. Minimising the operation of idling or lightly loaded motors |
| 3. Avoiding the operation of equipment above its rated voltage |
| 4. When a new or replacement motor is installed, a high efficiency motor (≥ IE3) should |

| |
|---|
| be used |
| 5. Ensure power cables have the correct dimensions for the power demand |
| 6. Keep online transformer(s) operating at a load above 40 ~50 % of the rated power |
| 7. Use high efficiency/low loss transformers |
| 8. Place equipment with a high current demand as close as possible to the power source (e.g. transformer) |

## V. Electric motor drive subsystems

| Item |
|---|
| 1. Using efficient motors (EEMs) (≥ IE3) |
| 2. Proper motor sizing |
| 3. Installing high efficiency transmission/reducers |
| 4. Use: direct coupling where possible, synchronous belts or cogged V-belts in place of V belts, helical gears in place of worm gears |
| 5. Rewinding: avoid rewinding and replace with an EEM, or use a certified rewinding contractor (EEMR) |
| 6. Power quality control |
| 7. Lubrication, adjustments, tuning |

## VI. Air compressor systems

| Item |
|---|
| 1. Overall system design, including multi-pressure systems |
| 2. Improve cooling, drying and filtering |
| 3. Reduce frictional pressure loss (for example by increasing pipe diameter) |
| 4. Improvement of drives (high efficiency motors) |
| 5. Improvement of drives (speed controller) |
| 6. Use of sophisticated control systems |
| 7. Recover waste heat for use in other functions |
| 8. Use external cool air as intake |
| 9. Storage of compressed air near highly-fluctuating uses |
| 10. Optimise certain end use devices |
| 11. Reduce compressed air leaks |
| 12. More frequent filter replacement |
| 13. Optimise working pressure |

## VII. Pump systems

| Item |
|---|
| 1. Avoid oversizing when selecting pumps and replace oversized pumps |
| 2. Match the correct choice of pump to the correct motor for the duty |
| 3. Design of pipework system |
| 4. Control and regulation system |
| 5. Shut down unnecessary pumps |
| 6. Use of variable speed drives (VSDs) |
| 7. Using multiple pumps (number of units under control) |
| 8. Regular maintenance. Where unplanned maintenance becomes excessive, check for: cavitation, wear, wrong type of pump |
| 9. Minimise the number of valves and bends commensurate with keeping ease of operation and maintenance |
| 10. Avoid using too many bends (especially tight bends) |

| |
|---|
| 11. Ensuring the pipework diameter is not too small (correct pipework diameter) |

## VIII. Heating, ventilation, and air conditioning systems

| Item |
|---|
| 1. Overall system design. Identify and equip areas separately for<br>(1)general ventilation<br>(2)specific ventilation<br>(3)process ventilation |
| 2. Optimise the number, shape, and size of intakes |
| 3. Use fans：<br>(1)of high efficiency<br>(2)designed to operate at optimal rate |
| 4. Managing the airflow, including the consideration of dual ventilation systems (indoor and outdoor ventilation and heat exchange) |
| 5. Air system design：<br>(1)ducts are of a sufficient size<br>(2)circular ducts<br>(3)avoid long runs and obstacles such as bends, narrow sections |
| 6. Optimise electric motors, and consider installing a VSD |
| 7. Use automatic control systems. Integrate with centralised technical management systems |
| 8. Integration of air filters into air duct system and heat recovery from exhaust air (heat exchangers) |
| 9. Reduce heating/cooling needs by：<br>(1)building insulation<br>(2)energy-efficient glazing<br>(3)air infiltration reduction<br>(4)automatic closure of doors<br>(5)destratification<br>(6)lowering of temperature set point during non-production period (programmable regulation)<br>(7)reduction of the set point for heating and raising it for cooling |
| 10. Improve the efficiency of heating systems through：<br>(1)recovery or use of wasted heat<br>(2)heat pumps<br>(3)radiative and local heating systems coupled with reduced temperature set points in the non-occupied areas of the buildings |
| 11. Improve the efficiency of cooling systems through the use of free cooling |

## IX. Lighting systems

| Item |
|---|
| 1. Determining the lighting requirements based on the illuminance and spectral content (color temperature and color rendition) required by the predetermined task |
| 2. Plan space and activities in order to optimise the use of natural light |
| 3. Selection of fixtures and lamps according to specific requirements for the intended use |
| 4. Use of lighting management control systems, including occupancy sensors, timers, etc. |
| 5. Train building occupants to utilise lighting equipment in the most efficient manner |

## X. Drying, separation and concentration processing systems

| Item |
|---|
| 1. Selecting the best separation technology or a combination of the following separation technologies to satisfy specific process equipment |
| 2. Use of surplus heat from other processes |
| 3. Use a combination of techniques |
| 4. Mechanical processes, e.g. filtration, membrane filtration |
| 5. Heat drying method:<br>(1)directly heated dryers<br>(2)indirectly heated dryers<br>(3)using multiple effect |
| 6. Superheated steam |
| 7. Heat recovery (including MVR and heat pumps) |
| 8. Optimise insulation of the drying system |
| 9. Radiation processes |
| 10. Process automation in thermal drying processes |

## XI. Industrial cooling systems

| Item |
|---|
| 1. The overall system is designed based on the requirements of the manufacturing process and factory and is categorized as:<br>(1)closed type<br>(2)open type |
| 2. For the BAT of the design phase of the industrial cooling systems, the lowest energy consumption is achieved by the following combinations:<br>(1)reducing pressure loss in water flow and airflow<br>(2)adopting high efficiency and low energy consumption equipment<br>(3)reducing the number of energy-demanding equipment<br>(4)applying optimized cooling water treatment in water-cooled cooling systems to keep the heat transfer surfaces clean and avoid scaling, rusting, fouling, etc., so that in each individual case, the lowest energy consuming combination of the above factors must be achieved to operate the industrial cooling systems |
| 3. The methods to reduce direct energy consumption are provided as follows.<br>Fans or pumps:<br>(1)matching motors with high efficiency<br>(2)designing for optimum pressure loss and flow rate<br>(3)using speed variators |
| 4. Operating the industrial cooling systems according to process requirements:<br>(1)water supply pressure<br>(2)backwater pressure<br>(3)temperature of water supply<br>(4)temperature difference between the water supply and back water<br>(5)pump efficiency<br>(6)fan motor efficiency<br>(7)point-of-use pressure requirements |

**Article 7 Table 2**

**The Best Available Techniques Which Shall Be Applied in Processing Techniques for Electricity Generation or Cogeneration Systems**

1. Energy Users as Electricity Generation:

Shall meet the requirements and efficiency values of energy efficiency related processing techniques of "new plants" or "new installations" listed in the following applicable edition of the European Union's "Reference Document on Best Available Techniques for Large Combustion Plants".

| "Reference Document on Best Available Techniques for Energy Efficiency" by Industries | Applicable Edition |
|---|---|
| Large Combustion Plants | BREF BATC(12.2021)[note] |

Note：BREF refers to the Industrial Emissions Directive (IED, 2010/75/EU) Best Available Techniques Reference Documents; BATC (12.2021) refers to the December 2021 edition.

2. Energy Users as Cogeneration Systems:

(1) Shall meet the cogeneration system related requirements listed in the European Union's "Reference Document on Best Available Techniques for Energy Efficiency" for specific industries.

(2) If no preceding documents are applicable, it shall meet the requirements and efficiency values of energy efficiency related processing techniques of "new plants" or "new installations" listed in the following applicable edition of the European Union's "Reference Document on Best Available Techniques for Large Combustion Plants".

| "Reference Document on Best Available Techniques for Energy Efficiency" by Industries | Applicable Edition |
|---|---|
| Large Combustion Plants | BREF BATC(12.2021)[note] |

Note：BREF refers to the Industrial Emissions Directive (IED, 2010/75/EU) Best Available Techniques Reference Documents; BATC (12.2021) refers to the December 2021 edition.

(3) In the reference document mentioned by the preceding section, note (2) of Table 2 shall be revised as: “except for note (1), due to the factors such as Taiwan’s domestic conditions and the designing particularities of operation modes, the values of minimum energy efficiency may be further lowered; note (3) is not applicable. 。

**Article 9 Table 3**

**The Best Available Techniques Which Shall Be Applied in Processing Techniques for Petroleum Refineries and Massive Energy Consumption Users**

1. Energy Users as Petroleum Refineries

Shall meet the requirements and efficiency values of energy efficiency related processing techniques listed in the following applicable edition of the European Union's "Reference Document on Best Available Techniques for Refining of Mineral Oil and Gas".

| "Reference Document on Best Available Techniques for Energy Efficiency" by Industries | Applicable Edition |
|---|---|
| Refining of Mineral Oil and Gas | BREF（2015）note |

Note：BREF refers to the Industrial Emissions Directive (IED, 2010/75/EU) Best Available Techniques Reference Documents; BREF (2015) refers to the 2015 edition.

2. Energy Users as Massive Energy- Consumption Users

Shall meet the requirements and efficiency values of energy efficiency related processing techniques listed in the following applicable edition of the European Union's "Reference Document on Best Available Techniques" for specific industries.

| "Reference Document on Best Available Techniques for Energy Efficiency" by Industries note 1 | | Applied Edition |
|---|---|---|
| （1） | Ceramic Manufacturing Industry | BREF（2007）note 2 |
| （2） | Ferrous Metals Processing Industry | BREF（2022） |
| （3） | Food, Drink and Milk Industries | BREF（2019） |
| （4） | Large Volume Inorganic Chemicals – Ammonia, Acids and Fertilisers | BREF（2007） |
| （5） | Large Volume Inorganic Chemicals – Solids and Others Industry | BREF（2007） |
| （6） | Large Volume Organic Chemicals | BREF（2017） |
| （7） | Manufacture of Glass | BREF（2013） |
| （8） | Manufacture of Organic Fine Chemicals | BREF（2006） |
| （9） | Non-ferrous Metals Industries | BREF（2017） |
| （10） | Production of Cement, Lime and Magnesium Oxide | BREF（2013） |

| | | |
|---|---|---|
| （11） | Production of Chlor-alkali | BREF（2014） |
| （12） | Production of Polymers | BREF（2007） |
| （13） | Production of Pulp, Paper and Board | BREF（2015） |
| （14） | Production of Speciality Inorganic Chemicals | BREF（2007） |
| （15） | Slaughterhouses and Animals By-products Industries | BREF（2005） |
| （16） | Smitheries and Foundries Industry | BREF（2005） |
| （17） | Surface Treatment of Metals and Plastics | BREF（2006） |
| （18） | Surface Treatment Using Organic Solvents including Wood and Wood Products Preservation with Chemicals | BREF（2020） |
| （19） | Tanning of Hides and Skins | BREF（2013） |
| （20） | Textiles Industry | BREF（2023） |

Note 1：Industries here refer to industries announced in the Industrial Emissions Directive (IED, 2010/75/EU) Best Available Techniques Reference Documents.

Note 2：BREF refers to the Industrial Emissions Directive (IED, 2010/75/EU) Best Available Techniques Reference Documents; BREF (2007) refers to the 2007 edition.

3. Co-generation system less than 50MW [note]

| Item |
|---|
| 1. System that generates effective thermal and electrical energy at the same time. |
| 2. Steam turbines and the power generation system: considering the use of a computer-controlled system. |
| 3. Steam turbines and the power generation system: considering the use of advanced materials. |
| 4. Steam turbines and the power generation system: upgrading steam turbines requires a consideration of increasing steam temperature and pressure. |
| 5. Steam turbines and the power generation system: optimizing working fluid operating conditions. |

Note：The items above refer to co-generation systems whose capacity are less than 50MW, and thus are not qualified to be categorized as the cogeneration systems in table2.

**Article 9 Table 4**

**Best Available Techniques for Semiconductor or Panel Industry Process Technology Items**

Energy users in the semiconductor or panel industries shall comply with the contents and efficiency values of the process technology items related to energy efficiency listed in the Best Available Techniques for the same industries below.

I. The best available techniques that the semi-conductor process technology items should meet

| Best Available Techniques for Semiconductor Industry Process Technology Items | |
|---|---|
| (1) | Energy-saving design of tools.<br>For the system side [such as vacuum pumps, local scrubbers, local chillers, heaters, exhausts, compressed dry air (CDA), ultrapure water, gas supply equipment], proposing energy-saving design solutions related to the tool system side (e.g. pressure loss, pipe diameter design, temperature difference, exhaust gas treatment using energy-saving intelligent control) or explaining the selection of a highly energy efficient tool. |
| (2) | Adoption of highly efficient tool components:<br>The tool components are energy-efficient products or conform to the latest international norms for energy-saving facilities; and see the following examples for the relevant energy-saving component items :<br>1. Using energy-efficient products (e.g. CNS 14400 IE3 class or higher) for motors with high power (single item or total) or long operating hours.<br>2. Adopting variable frequency control for electrical facilities. (such as pumps additionally installed with variable frequency devices or energy-saving regulators, etc.)<br>3. High efficiency RF Generators. (power supply specification capacity should match the load of the RF Generators to avoid excessive design)<br>4. UPS with an energy-saving mode control function.<br>5. High efficiency heat exchangers. (e.g. low pressure loss or large temperature difference)<br>6. Choosing energy-saving products if the process allows, or providing proof of energy saving efficacy. (meeting or exceeding the latest energy efficiency standards in the past three years) |

| | |
|---|---|
| (3) | Tool resource control design:<br>1. For the selection of primary tools and auxiliary equipment, considering hardware and control design with energy-saving efficacy, such as various energy-saving designs and the standby mode.<br>2. Energy-saving optimization for process utility system: the consumption regulation design and management mechanism for exhaust, cooling, compressed air, inert gas (such as nitrogen), etc. |
| (4) | Energy management system.<br>1. For large-scale electricity and heat-consuming utility equipment, such as water chiller units, air handing units and cooling towers (kW/CMM), pumps (kW/CMM), air compressors (kW/CMM), etc., an energy baseline for the energy efficiency of equipment should be established, and the energy efficiency of the equipment should be monitored on a continuous and real-time basis and its abnormalities should be managed to facilitate equipment maintenance or replacement, and keep the equipment in a state of high energy-efficient operation. Or the energy consumption value of related important energy-consuming equipment can be measured or estimated in reference to the SEMI S23 standard along with the establishment of the energy consumption baseline for the plant and explanation of relevant energy-saving planning. For related equipment items, the following table can be considered for reference: |

| | | |
|---|---|---|
| (1)Exhaust | (6)Water cooled by cooling-tower | |
| (2)Vacuum | (7)UPW or DIW ( Temp. < 25 ˚C) | |
| (3)CDA | (8)Hot UPW or DIW ( Temp. > 85 ˚C) | |
| (4)High pressure CDA (827~1034 kPa gauge) | (9)Heat load | Heat removal via air |
| | | Heat removal via water |
| (5)Water cooled by refrigeration ( $\Delta$T = 5 ˚C) | (10)$N_2$ | |

2. The energy management system can be used to manage the consumption percentages and energy-saving status of all kinds of energy.

(5) Process technology energy use intensity.

The process technology for products under 6 inches and 8-inch products must meet the top 10% (Top 10) energy use intensity benchmark values, as indicated in the table below:

Unit: KWh/Silicon Wafer Area—Square Centimeter

| | Under 6 Inches[Note 1] | 8 Inches[Note 2] |
|---|---|---|
| Energy use intensity | 0.47 | 0.69 |

Note 1: Applicable to 6-inch products with 14 or less mask layers on average

Note 2: Applicable to 8-inch products with 15 or less mask layers on average

Note 3: If the average number of 6-inch mask layers exceeds 14, or the average number of 8-inch mask layers exceeds 15, or if the applicant is not compliant due to legal restrictions, patent protection, international trade barriers, or other factors not attributable to the applicant, the applicant is not subject to such restrictions after supporting materials are submitted.

Note 4: Equation for calculating Energy use intensity:

$$\text{Energy Use Intensity} = \frac{\text{Annual Energy Consumption (kWh) by the Same Single Dimension Process of the Fab}}{\text{Annual Silicon Wafer Output Area (Square Centimeter) under the Same Single Dimension Process}}$$

The above annual production area of silicon wafers under the same single dimension process is calculated by the formula: $\pi \times r^2 \times$ the number of wafer slices (slices), where $\pi$ is 3.1415926 and r is the radius of the silicon wafer (cm).

## II. Best Available Techniques Which Shall Be Applied in Processing Techniques for Panel Industries

| The Best Available Techniques for Panel Industries | |
|---|---|
| (1) | <u>Selection of Ancillary Devices for Equipment:</u><br>(1) Assess its energy efficiency as much as possible.<br>(2) Adopt a higher energy efficiency or variable frequency controller (such as the pump installed on equipment with a variable frequency drive or an energy saving device, etc.). |
| (2) | <u>Energy-Saving Design:</u><br>The devices for equipment shall conform to the following:<br>(1) Idle mode with the considered of energy saving; or alternative designs of energy saving mode with the same function.<br>(2) The corresponding software with automatic or manual control to perform the energy saving control of the energy consuming ancillary devices under the standby mode such as a vacuum pump and an oven etc. |
| (3) | <u>Energy Usage Intensity of Processing Techniques:</u><br>The processing techniques for the plants of the 5th generation and before, as well as |

the 5.5th generation to 8th generation plants must follow to the top 10's (Top 10%) benchmark of energy usage intensity which is shown as below:

Unit: kilowatt hour/input glass substrate area m²

| | 5th Generation and before Plant(1) | The 5.5th Generation Plant to the 8th Generation Plant(1) |
|---|---|---|
| Energy Usage Intensity | 148 | 110 |

Note 1：Applicable for the mask layer processing of amorphous LCD less than 5 PEP process, with the actual input capacity per month of both TFT-Array glass substrate and the color filter (CF) exceeded 120K (thousand pieces).

Note 2：Those due to the legitimation restrictions, patents protection, international trade barriers, or other causes not be attributable to the applicants, the given evidences should be submitted by the applicants.

Note 3：Equation for calculating energy usage intensity:

$$\text{Energy Use Intensity} = \frac{\text{Annual Energy Consumption (kWh) of the Entire Plant for the Same Generation}}{\text{Annual Input Area (m}^2\text{) of Glass Substrates for the Same Generation}}$$

The previous annual input quantity of various sized glass substrate and color filters, are calculated by: color filter (m²/pc) × pieces of each size of glass substrate (piece).

**Article 9 Table 5**

**The Best Available Techniques Which Shall Be Applied in Processing Techniques for Steel Industry**

Energy users in the steel industry shall comply with the contents of the Best Available Techniques below.

I. Sintering Process

| Item | Description |
|---|---|
| 1. Waste heat recovery from the sintering process | It mainly refers to the waste heat recovery from sinter cooler. |
| 2. Combustion efficiency optimization of ignition furnace in sintering machine | Combustion efficiency of the ignition furnace can be improved to reduce energy consumption. Available techniques include but are not limited to: use of hot air from the cooling machine as the combustion air of the ignition furnace; ignition furnace equipped with an automatic control system for adjusting furnace pressure, temperature and air-fuel ratio according to the surface of the mixture on the sintering pallet, the flame of the furnace nozzle, and the process changes. |

II. Coking Process

| Item | Description |
|---|---|
| 1. Recovery of coke oven gas | Recovered coke oven gas can be used as fuel for the production process, converted to electricity and heat, and optimized or high valued. |
| 2. Use of low humidity coals | Available techniques include but are not limited to: moisture control of coals within 12% through the use of indoor bins, feed control, preheating and drying, so as to increase coke production, reduce coking energy consumption in coke ovens, improve coke quality and stabilize coke oven operation. |
| 3. Dry coke quenching | With dry coke quenching, the hot coke is mainly placed in the quenching furnace, and the heat is transferred to the boiler area through cold circulating air. The heated boiler water is converted into steam for power generation or sold to users. |

## III. Blast Furnace Process

| Item | Description |
|---|---|
| 1. Recovery of blast furnace gas | Recovered blast furnace gas can be used as fuel for the production process or converted to electricity and heat. |
| 2. Power generation of blast furnace top gas pressure recovery turbine | (1) Blast furnace Top gas pressure Recovery Turbine (TRT) is a power generation system that can convert the physical energy of high-pressure blast furnace top gas into electricity by using an expansion turbine. Even if the pressure difference is small, a certain amount of gas makes energy recovery economically feasible.<br>(2) It is critical for the blast furnace top gas pressure recovery turbine to ensure that the expansion turbine can operate stably and efficiently with the blast furnace gas containing dust without damaging the operation of the blast furnace.<br>(3) Dry type TRT generate more electricity than wet type TRT. |
| 3. Direct injection of reducing agent | Available techniques include but are not limited to: injection of pulverized coal, fuel oil or natural gas to replace part of the coke used for chemical reduction of blast furnace, reducing the production of coke and saving energy. |
| 4. Waste heat recovery from hot blast stove | In the ironmaking process, the hot blast stove can be used to preheat the cold air blown into the blast furnace to raise the temperature of air blasting as required for the operation of the blast furnace. The hot blast stove uses a mixture of blast furnace gas and coke oven gas as fuel, and there is a risk of energy waste if its exhaust gas with a temperature of 250°C~350°C after combustion is discharged directly through the chimney. |
| 5. Blast furnace gas recovery from blast furnace top gas for charging and pressurizing | (1) The blast furnace gas, produced during the blast furnace production and purified by the gas purification system, can be used as fuel for combustion in its hot blast stove as well as pressurized gas before the charging bin.<br>(2) The blast furnace gas after charging is exhausted to the atmosphere through a pressure relief valve via a silencer in the conventional process. It is recommended to add cyclones on the charging and |

| | |
|---|---|
| | pressurizing relief pipelines as well as to add an ejector to the recovery pipeline in the blast furnace gas recovery system.<br>(3) The cyclone can be used to remove the powder and particles in the blast furnace gas by the change of the flow rate, achieving the quality of the recovered gas up to less than 5mg/Nm$^3$. In addition, the collected powder and particles are sent back to the charging bin for resource recovery during pressurizing charging bin.<br>(4) The ejector can be used to inject the high-pressure blast furnace gas through the nozzle to recover it to the common pipeline of blast furnace gas. |
| 6. Use of motor blower | The motor blower is driven by a motor (replacing the steam turbine blower) with associated auxiliary system characterized by simplicity, flexible operation, and less cooling water, which is built in an energy-saving and environment-friendly technique. |

## IV. Converter Steelmaking and Continuous Casting Process

| Item | Description |
|---|---|
| 1. Recovery of converter gas | Recovered converter gas can be used as fuel for the production process, converted to electricity and heat, and further optimized or high valued; for example, carbon monoxide (CO) is purified to provide chemical raw materials required by the petrochemical industry (coproduction between steel and petrochemical plants). |
| 2. Automation control of converter and refining operation | (1) Today, the world's major steel mills are committed to introducing automation control of converter operation, which includes static control and dynamic control; wherein the dynamic control is carried out mainly by sublance analysis and furnace gas analysis.<br>(2) At present, production control of advanced steel mills in the world is mainly carried out by sublance analysis, furnace gas analysis or both.<br>(3) The molten steel in the converter is delivered to be treated in the refining system with automation control, such as vacuum degassing, ladle refining, alloy wire or powder addition and stirring stations. |

| | |
|---|---|
| | (4) Using automatic temperature measurement and sampling equipment is necessary to accurately obtain the temperature and composition required for downstream continuous casting. |
| 3. Optimization of stirring of converter blowing | Converter steelmaking is a top-bottom blown system that can remove impurities such as carbon, silicon, phosphorus, etc. in molten iron by top blown oxygen and the bottom stirred inert gas (nitrogen or argon) to convert molten iron into molten steel, and then adding steel scrap and alloys to balance heat and adjust the composition of molten steel. |

## V. Electric Arc Furnace and Continuous Casting Process

| Item | Description |
|---|---|
| 1. Optimization of electric arc furnace process | Available optimization of electric arc furnace process include but are not limited to the following technique items:<br>(1) (Ultra) high power operation<br>(2) Water-cooled side walls and roofs<br>(3) Oxy-fuel burners and oxygen lancing<br>(4) Bottom tapping system<br>(5) Foaming slag practice<br>(6) Ladle or secondary metallurgy<br>(7) Automated sampling and the addition of alloying elements<br>(8) Increased energy efficiency<br>(9) Computer-based process control and automation |
| 2. Optimization of molten steel stirring | Using top blowing or installing inert gas stirring at the bottom of the ladle; or installing supersonic oxygen blowing and carbon-increasing devices in the electric furnace so to uniform the molten steel temperature, thereby reducing power consumption. |
| 3. Thermal insulation | Available techniques include but are not limited to: use of insulation materials such as carbonized rice husk, refractory brick or insulation cover to reduce the heat loss of electric arc furnace and ladle. |

## VI. Hot Rolling Process

| Item | Description |
|---|---|
| 1. Hot charging of blooms and slabs | Increase the hot charging ratio and the temperature into the reheating furnace of blooms and slabs to reduce the fuel |

| | |
|---|---|
| | consumption of the reheating furnace. |
| 2. Direct rolling | For energy-saving, the slabs produced by continuous casting are delivered to subsequent rolling treatment without reheating or only slightly heating the edge. |
| 3. Waste heat recovery from cooling water of skid pipe in the reheating furnace | Available techniques include but are not limited to:<br>(1) Evaporating cooling (cooling water in, steam out) (Evaporating cooling), wherein the steam recovery is generated by vaporizing the water with the heat carried in the cooling water of skid pipe in the reheating furnace. Recovered steam can be sent into the steam pipe network for internal use or external sale. Compared to water cooling, the biggest advantages of evaporating cooling include the reduction of the amount of cooling water and power consumption of the cooling water pump. The water consumed by evaporating cooling is converted into steam.<br>(2) Waste heat recovery from cooling water of traditional water cooling (cooling water in, cooling water out). |
| 4. Heating furnace equipped with advanced combustion technique | Available techniques include but are not limited to:<br>(1) Regenerative combustion system, which is used to preheat the combustion air or gas up to 1,000°C by fully using the combustion exhaust gas with a heat accumulator under alternating operation modes of heat storage and heat release. Therefore, it can greatly reduce the flue gas discharge temperature and increase the effect of energy-saving, but the practical performance shall be analyzed on a case-by-case basis.<br>(2) Digital combustion heating furnace, which can be used to generate optimal energy output by using the temperature PID for controlling the switch of each burner based on the difference between the set temperature and the actual temperature in each control area. But the practical performance shall be analyzed on a case-by-case basis. |
| 5. Control system for dynamic furnace pressure and atmosphere closed loop of heating furnace | (1) Control of dynamic furnace pressure of the heating furnace can be achieved by predicting the level of air intake to |

| | |
|---|---|
| | compensate for the furnace pressure based on the state change of control loop of furnace pressure as the furnace door opens, which can effectively inhibit the amount of air intake as the furnace door opened.<br>(2) Control of oxygen-containing atmosphere closed loop of heating furnace can be achieved by automatically controlling the air fuel ratio in the multi-furnace area based on theoretical control (Soft sensor) and the measurement feedback of oxygen content in the combustion exhaust gas. Therefore, it can improve the uncontrollability of oxygen-over (deficient) atmosphere and the control accuracy of oxygen content, thereby achieving the effect of energy-saving, but the practical performance shall be analyzed on a case-by-case basis. |

## VII. Cold Rolling, Coating and Cutting

| Item | Description |
|---|---|
| 1. Control system for annealing furnace temperature | (1) The temperature control of the annealing furnace is a distributed control system (DCS) architecture, which is a common practice used in various steel mills.<br>(2) Due to the growing development of automatic control technology, there are some available techniques, including fuzzy control, numerical simulation model, and expert system, which can be combined with PID control of furnace temperature. |
| 2. Waste heat recovery | Heat recovery equipment can be designed in the following production lines include but are not limited to:<br>(1) Continuous annealing line<br>(2) Annealing furnace for Hot Dip galvanizing line<br>(3) Annealing and pickling line<br>(4) Electrical steel line |

## VIII. Integration of Energy Resources

| Item | Description |
|---|---|
| Integration of regional energy resources | For example, many energy by-products are produced along with processes in integrated steel mills. In addition to some self-consumption energy resources, the steam produced by cogeneration and waste heat recovery, various industrial gases (oxygen, nitrogen, argon) produced by the air separation plant, and excess energy exchangeable with adjacent factories in the same industrial park zone can be integrated into regional energy resources with the most efficient way. Interconnection of excess energy is integrated into regional energy resources to improve energy efficiency, reduce resource consumption and regional emissions of pollution and greenhouse gases, thereby effectively reducing environmental impact and improving environmental quality. |

**Article 9 Table 6**

**The Best Available Techniques Which Shall Be Applied in Processing Techniques for Gas Industry**

Energy users in the gas industry shall comply with the contents of the Best Available Techniques below.

| Item | Description |
|---|---|
| 1. High-efficiency motors can be used in the process | The main process air compressor can be equipped with a synchronous motor or a high-efficiency motor of IE3/IE4 equivalent. |
| 2. Advanced energy-saving equipment can be applied | There is some available equipment can be used to reduce energy consumption as follows:<br>(1) High-performance process air compressors.<br>(2) High performance distillation column internals, heat exchangers with high heat transfer and low pressure loss. |
| 3. Pump energy-saving techniques can be applied | There are some available measures as follows:<br>(1) A pump with appropriate performance shall be used based on operation requirements.<br>(2) In the case of multiple pumps running in parallel, the number of operating pumps shall be adjusted flexibly based on production demand, and idling or backflow shall be avoided too.<br>(3) In the case of pumps equipped with a variable frequency (VFD) driving motor, the variable frequency control shall be optimized based on production demand.<br>(4) In the case of using an advanced program control system or a pump management integrated system, the number of units to be started and the sequence of start-up/ shutdown shall be determined based on operating conditions. |
| 4. The excess cold energy in the process can be recovered | There are some available measures as follows:<br>A heat exchanger can be set to recover gas products and the cold energy of exhaust gas for reuse in the process. |
| 5. The pressure energy in the process can be recovered | By installing an expander in front of the process exhaust to replace the decompression equipment, it is considered |

| | |
|---|---|
| | to drive the generator by the expansion energy generated by exhaust gas to generate electricity or drive the compressor, thereby saving energy consumption. |
| 6. Multiple processing systems can be designed | Loading of equipment operation can be adjusted to meet the production requirements, thereby improving energy efficiency. |
| 7. With program facilities as close to the user as possible, gaseous products can directly supplied with pressure and temperature required by the user | (1) With program facilities as close to the user as possible, gaseous products can be delivered through pipelines to reduce the energy consumption of production or storage of liquid products.<br>(2) Under the consideration of pressure loss caused by friction and cost of pipeline setting, the pipeline with the most suitable diameter shall be used to deliver gaseous products. |
| 8. Insulation of storage tanks for liquid products can be optimized | There are some available measures as follows:<br>(1) Appropriate cold insulators and insulation facilities can be used to reduce evaporation loss during product storage.<br>(2) The evaporation rate of BOG (Boil-Off Gas) per day shall be kept under design value<br>(3) Those gas products evaporated from the storage tank can be recovered. |
| 9. Liquid products can be filled and shipped | Filling tankers by gravity or pressure can be used to save energy. |
| 10. Advanced energy-saving techniques can be applied | There are some available techniques can reduce overall production energy consumption and relatively increase productivity as follows:<br>(1) Advanced air separation techniques can be applied to improve air extraction rate (such as: selection of segmental pressure of distillation column and heat integration, etc.) or related energy-saving and standby modes are planned.<br>(2) High-efficiency distillation and separation columns, heat exchangers with low temperature difference and workable for multi-product flows, designs for recovery of pressure energy, etc. can be considered to use.<br>(3) Additional energy consumption or loss caused by unwanted pressurization/ decompression or heating/cooling shall be reduced. |

**Article 9 Table 7**

**The Best Available Techniques Which Shall Be Applied in Processing Techniques for Industry of Data Processing, Hosting and Related Activities**

Energy users in the industry of data processing, hosting and related activities shall comply with the contents of the Best Available Techniques below.

I. Selection of Information Equipment

| Item | Description |
|---|---|
| 1. Information equipment cooling air inlet condition control | (1) Information equipment cooling air inlet condition shall comply with the temperature and humidity range of Class A2 specified in the Thermal Guidelines for Data Processing Environments published by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).<br>(2) If equipment satisfying the working temperature and humidity range of ASHRAE Class 2 cannot be used, equipment capable of withstanding the working temperature and humidity range of ASHRAE Class A1 shall be selected. |
| 2. Select an appropriate information equipment according to the power density design of the data center. | (1) Select and install information equipment according to the designed power density (per cabinet or square meter) of the data center, in order to prevent the operation of a cooling system outside the design parameters.<br>(2) If the information equipment power design is higher than the design value, it may cause cooling and airflow management issue, such that the capacity and efficiency may be reduced. |
| 3. Information equipment power matching with cooling system | During the selection of information equipment, suppliers shall be requested to provide the total system power, in order to |

| | |
|---|---|
| | ensure that the cooling system design is under the state of most optimal efficiency and capable of satisfying the cooling requirements and air inlet condition of the information equipment under its full-load condition. |
| 4. Information equipment matching with cabinet airflow design | During the installation of the information equipment in a cabinet, it is necessary to ensure that the airflow direction matches with the airflow design of the local area. |
| 5. Information equipment equipped with enablable power management function | During the installation of the information equipment, it shall be equipped with an enablable power management function, such as basic input/output system (BIOS), operating system and driver program settings. |
| 6. Information equipment power matching with power supply system planning | Power and cooling systems shall be planned according to the actual installation condition and the expected consumption power of the information equipment, rather than planning according to the power supply (PSU) specification or nameplate rated value, in order to prevent excessive power infrastructure design specification that may cause the occurrence of (partial) low load and low operating efficiency. |
| 7. Select information equipment with equivalent performance according to specification | Selection of information equipment may refer to the equivalent performance according to the following specification:<br>(1) EU Ecodesign Directive and EU Lot 9 Amendment of Regulations for Servers and Online Storage System.<br>(2) US Energy Star Standards. |
| 8. Select information equipment with power and air inlet temperature report output function | Select equipment with the power and air inlet temperature report output function, and consider the use of the industrial standard report output method, such as IPMI, DMTF Redfish or SMASH. |

| | |
|---|---|
| 9. Information equipment equipped with external control function | Select equipment allowing external control on the energy consumption of the information equipment, such as capable of restricting the maximum energy consumption of the server or triggering components from the external, or capable of shutting down the entire system or subsystem from the external. |
| 10. Select information equipment with high efficiency AC-DC power converter (≧90%) | Select information equipment equipped with high efficiency AC-DC power converter, and within the expected load range of the installed equipment, it shall comply with the "80 PLUS" Energy Efficiency Standards for Power Supplies. If the load range is between 10% and 100%, then the power supply efficiency shall not be lower than 90%. |

## II. Configuration of Information Software Services

| Item | Description |
|---|---|
| 1. Deploy Virtualisation technologies | For any new services (such as server, storage and network, etc.) requiring specialized hardware and not operating on a resource sharing platform, it is necessary to establish procedures requiring the approval of senior business department. |
| 2. Reduce information hardware resilience level | Determine the business impact of service event on each configured service, and configure hardware resilience level that is completely reasonable, in order to ensure that application program owner agrees with the information hardware resilience level. |
| 3. Reduce hot / cold standby equipment | It is necessary to determine the business impact of service event on each information service, and configure continuous or disaster-recovery backup information equipment and resilience level of reasonable impact. |

## III. Data Management

| Item | Description |
|---|---|
| 1. Establish data management policy | (1) Establish data management policy, in order to define the data preservation scope, time and protection level.<br>(2) Data manage policy shall be executed and conveyed to users.<br>(3) It is necessary to pay attention to the impact of any data preservation request on the energy consumption. |
| 2. Plan diverse media type to establish layered storage environment | Create a tiered storage environment utilizing multiple media types delivering the required combinations of performance, capacity and resilience. |
| 3. Select storage equipment of high efficiency and low power | Evaluate the energy efficiency according to the service-per-watt, and select storage equipment of lower power. |
| 4. Plan effective data identification procedure | Adopt effective data identification, management policy and procedure to reduce the total data storage volume. |
| 5. Plan data management strategy | Adopt data management strategy to reduce the volume of duplicates of logical and physical (mirror) data. |

## IV. Cooling System

| Item | Description |
|---|---|
| 1. Design cold and hot aisles | Arrange the airflow direction of the information equipment to allow the cold air to be supplied to the cold aisles, in order to ensure that all equipment are able to draw air from the cold aisles. The hot aisles does not supply cold air, and all equipment exhausts hot air into the hot aisles. |
| 2. Plan closed hot and cold air separated spaces | Design closed hot air or cold air space, in order to separate cold and hot airflows. |
| 3. Blind flange design planning | Install blind flange at a location where the information equipment is not placed, in |

| | |
|---|---|
| | order to reduce the recirculation of hot air passing through the cabinet gaps. |
| 4. Select perforated cabinet doors for ventilation | Replace solid cabinet doors to perforated doors at locations requiring cooling and ventilation, in order to ensure sufficient cooling airflow. |
| 5. Block unnecessary holes on elevated floor | (1) Check the opening location of the ventilation floor and relevant influencing factors, in order to reduce airflow bypass.<br>(2) Align the cabinets adjacent to each other in one row, in order to prevent the issue of recirculation of air passing through the gaps. |
| 6. Maintain clear underfloor ventilation channel | If underfloor ventilation is used, keep the ventilation channel clear as much as possible, or use elevated cable bridges to reduce hindrance. |
| 7. Equipment grouping and separation | Set up equipment group with significantly different environmental requirements or equipment airflow direction in an independent area. |
| 8. Adopt modular cooling equipment planning | Cooling equipment shall adopt the modular planning, and it is necessary to allow operators to turn off unnecessary equipment. |
| 9. Increase chilled water temperature setting under acceptable condition, and consider the use of free cooling | Check and increase the chilled water temperature setting point under possible condition, in order to use free cooling at the maximum extend and to reduce the energy consumption of the compressor. |
| 10. Adopt air-side free cooling measures | Design to draw cool and dry outdoor air to satisfy the cooling demands of a portion of or all facilities, in order to reduce or completely eliminate the reliance on machine cooling (e.g. compressor) and to reduce energy consumption. |

| | |
|---|---|
| 11. Adopt water-side free cooling measures | Design free-cooling coil such that when the environmental temperature is lower, the free-cooling coil can be used to perform heat exchange with the outdoor cold air, in order to generate chilled water or reduce the energy consumption of the compressor for generating chilled water. |
| 12. Prevent the use of humidity control as much as possible | (1) Increase the water temperature of the chilled water system or the evaporation temperature of the direct expansion evaporator, in order to prevent dehumidification effect.<br>(2) During the selection of new air conditioners, it is necessary to select air conditioners without humidity control function (including any reheating function), in order to reduce investment cost and maintenance cost. |
| 13. Use liquid-cooling technology | (1) Use liquid-cooling technology directly to perform cooling of a portion or all of the information equipment, in order to replace the air-cooling method.<br>(2) Liquid-cooling technology provides a more effective thermal loop and allows higher liquid-cooling system temperature, in order to further increase the efficiency, thereby increasing the waste heat recovery rate or complete use of free cooling. |

## V. Power System

| Item | Description |
|---|---|
| 1. Use modular uninterruptible power supply (UPS) | Use modular (expandable) UPS with widespread power transmission capability. |
| 2. Use high efficiency UPS equipped with energy-saving mode | Use high efficiency UPS equipped with energy-saving mode, such as compliance with the Energy Start Standard of the U.S. |

| | |
|---|---|
| | Environmental Protection Agency (EPA ENERGY STAR). |
| 3. Use UPS with the most effective setting of operation mode | Use UPS with energy optimization function to cope with the partial loading condition. |

## VI. Energy Monitoring and Management

| Item | Description |
|---|---|
| Plan for monitoring and managing energy efficiency system | Including but not limited to the use of the following energy monitoring and management indicator methods specified in ISO/IEC 30134 standard, in order to achieve the most optimal resource efficiency for data center:<br>(1) Power usage effectiveness (PUE).<br>(2) Renewable energy factor (REF).<br>(3) IT equipment energy efficiency for servers (ITEEsv).<br>(4) IT equipment utilization for servers (ITEUsv). |

## VII. Data Center Overall Efficiency

| Technique Item | Description |
|---|---|
| The whole-year average overall power usage effectiveness (PUE) of a data center shall comply with the following requirements:<br>1. Hyperscale Data Center: PUE ≦ 1.3<br>2. Colocation Data Center: PUE ≦ 1.4 | (1) Hyperscale Data Center refers to a server room constructed to satisfy the internal needs of self-operations of a company.<br>(2) Colocation Data Center refers to a server room provided to manage other enterprises requiring network information services.<br>(3) Power usage effectiveness (PUE) calculation method:<br>$\text{PUE} = \frac{\text{Data Center Total Equipment Power Usage}}{\text{Information Equipment Power Usage}}$<br>The aforementioned data center total equipment power usage refers to the information equipment power usage, air |

| | |
|---|---|
| | conditioner power usage, UPS power loss, line power loss and other power usage supporting the data center operations (such as lighting system, surveillance system, elevators)<br>(4) PUE measurement plan is established based on the measurement approach of $PUE_1$ defined in ISO/IEC 30134, meaning that the measuring point of "Information Equipment Power Usage" is the UPS output location. |