Guideline for Lighting Design concerning Facility Implementation

GL 5-2-2 November 2023

Table of Contents

1. Introduction……1
1-1 Purpose of this Guideline……1
1-2 About the Lighting of 2025……..1
1-3 Electric energy overview……..2
1-4 World standards and conventions concerning lighting practices……...6

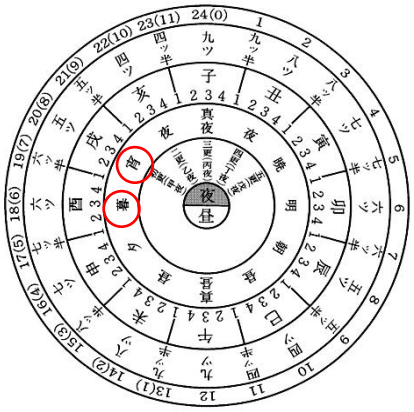
2. Arrangements of this Guideline……6
2-1 Guide and Control……6
2-2 Lighting design zoning on Expo site……..7
2-3 Ensuring responsible outdoor lighting……8
2-3-1 Light pollution [Preventing light leakage into the sky]……8
2-3-2 Light pollution [Preventing light from crossing into adjacent plots]……11
2-3-3 Colour temperature……12
2-3-4 Control over discomfort glare……12
2-4 Aiming to create nightscapes of higher degrees of perfection……...12
2-4-1 Recommendation on illuminating vertical surfaces……12
2-4-2 Approaches to illumination shows on facades……13
2-4-3 Recommendation on time-programmed lighting arrangements……..14
2-4-4 Recommendation on proactive use of the self-contained solar lighting system……14
2-4-5 Paying attention both to light and shadow……..14

3. References……15

Contact……...16

Definitions of abbreviations, acronyms, and units

Abbreviation/acronym	Full form
CIE	International Commission on Illumination (Commission Internationale de l'Eclairage)
Unit symbol	Unit name
K	Kelvin
lx	Lux
cd/m2	Candela per square metre
Ra	Ra
m	Metre
Term	Definition
Expo 2025	Expo 2025 Osaka, Kansai, Japan (Expo 2025 for short)
Illuminance	Par-unit-area proportion of luminous flux incident (from all directions) on a minute area that includes a given point defined on a surface. Unit: lux (lx)
Luminance	Proportion of the amount of luminous flux which passes through a minute area that includes a given point on a light-emitting surface, light-receiving surface, or a section plane of the light's projection path against the unit area on an orthogonal projection plane perpendicular to the direction of the projection or the unit solid angle. Unit: candela per square metre (cd/m2)
Luminous flux	A measure of psychologically registered physical quantity (perceived power) of light that expresses the brightness of entire light emitted from a light source in a given direction. Unit: lumen (lm) The amount of radiant flux obtained based on the CIE spectral luminous efficiency for photopic vision and maximum luminous efficiency function. Unit: lumen (lm)
Public area	The area other than Pavilion Plot.
Colour temperature	"The temperature of a black body which emits radiation whose chromaticity is equal to that of the applied stimulation.
Colour rendering	Colour rendering refers to the properties of light sources that determine how an object appears chromatically when illuminated by the light source.
Glare	Glare refers to the 'brightness' that interferes with clear vision, causing discomfort and difficulty of seeing. "A state in which discomfort results from an inappropriate luminance distribution or values within a field of view, or extreme contrast, or otherwise which causes to diminish the ability to see small details or the viewing target itself.
Building exterior wall line	A line that indicates the surface of an exterior wall or a column that replaces the exterior wall of a building.
Beam angle	The beam angle indicated in lighting equipment specifications refers to the dispersion of light emitted by directional lighting equipment, such as a spotlight, downlight, and floodlight. In general, there are several grades, such as 1/2 and 1/10, which refer to the angle between two points: one at which the luminosity is a half or one-tenth of the maximum luminosity and the other at the centre of the beam. Where it is only marked as beam angle, it usually refers to the half beam angle.
Cut-off line	The line along which the light emitted from lighting equipment is blocked physically.
Direct light	The light that directly illuminates. The light that is directed intentionally.
Exterior light	Lights installed to illuminate the plot area outside a building and the structures erected therein.
Short wavelength	The definition given in the JIS Z8120 standard is that the visible light in terms of the range of electromagnetic wavelength corresponding to

	visible light, which is between approximately 360 to 400 nm on the short wavelength side and 760 to 830 nm on the long wavelength side.	
Facade	Front side of a building that faces streets and squares. Side or rear surfaces may also be called facade if they are significant for the building's exterior appearance.	
Vertical surface	A surface that is perpendicular to a horizontal plane.	
Maximum average luminance	The maximum value of the average luminance on a given surface.	
Fade time	A duration of time during which light is gradually increased or decreased in intensity, or light appearances gradually change.	
Evening/twilight	 (under 'time' in the Kojien (third edition))	(2)b. A distinction between day and night. In modernity, a day is divided into two segments, gozen (or forenoon), from midnight (zero hour before noon) to midday (zero hour after noon), and gogo (or afternoon), from midday to midnight; these are further divided each into 12 (or the whole day into 24). In premodern time, a system based on zodiac hours was widely in use. In this system, midnight was assigned with the number 9, which descended by each hour down to 4, followed by midday, which was again the 9th hour, proceeding down to 4 toward midnight. Hours were also associated with geographical directions, divided into 12 and represented by 12 zodiac signs (the hour over midnight was the hour of rat; another approach was to assign the hour of rat to the period from midnight to 2 o'clock in the morning), further dividing one unit hour into the first and second halves, or into quarters. Later, three-part division came in use to divide one unit hour into the first, middle, and last stretches of the hour. Commoners, meanwhile, adopted a version which divided between day and night by the sun's rising and setting hours, which were set as the sixth hour, then each day and night was divided into six even segments, thus the hours differing in length relative to the seasons. Also 'jikoku' (time of clock) or 'kokugen' (time).

1. Introduction

1-1. Purpose of this Guideline

This Guideline has been prepared in view of the creation of ‘New Night’ in order to enable the Expo 2025 to represent a model vision for 2025 and beyond, through its nightscape in keeping with the overall harmony of the Expo venue intact during the evening and night hours in alignment with its theme ‘Designing Future Society for Our Lives’.
Lighting can influence people’s moods with calming, exciting, and other effects. The year 2025 should mark a time when lighting evolves from just being a means to provide luminosity and become a purpose of carefully creating a light environment that facilitates sustainability for people and other forms of life, as well as the global environment, with a sense of gratitude for having this invaluable energy. The ‘New Night’ as a concept to be realised entails the creation of light environments that express universal respect for not only human beings but also the entire biodiversity and represent the hope for future society, by making artificial lights change through time like natural light does, and by carefully coordinating illuminated environments according to the time of the day.
In order to attain this goal, detailed and easy-to-follow rules are provided as guidelines, addressing individual matters concerning lighting arrangements.

1-2. About the Lighting of 2025

The history of light tells us that, for the first several millennia of humankind, people spent night hours by the light of a bonfire. Light sources subsequently evolved, changing types of fuels from oil and wax to gases.
Electric light was invented in the 19th century, when the Edison’s lightbulbs illuminated the site of the 1881 Paris Exposition. The 1939 New York World’s Fair introduced the first fluorescent light, and the city’s subsequent World’s Fair in 1964 exhibited discharge lamps, xenon arc lamps, and other non-combustion light sources. These marked remarkable improvement of luminous intensity of lighting equipment. The most recent benchmarking point in the history of lighting technology is the invention and wide diffusion of light-emitting diode (LED) in the 21st century. As the light sources developed, people also expected the development of indirect lighting techniques and architectural lighting design as a means to make intentional light distributions in a given space. Lighting not only provides light for safety and security, but also plays a role in offering healing effects, enhancing the physical and psychological wellbeing by regulating the biorhythm of the human body.
At the Expo 2025 site, lighting designs are expected to express radiant and dynamic life, coherent with the architectural designs, in alignment with the Expo theme ‘Designing Future Society for Our Lives.’

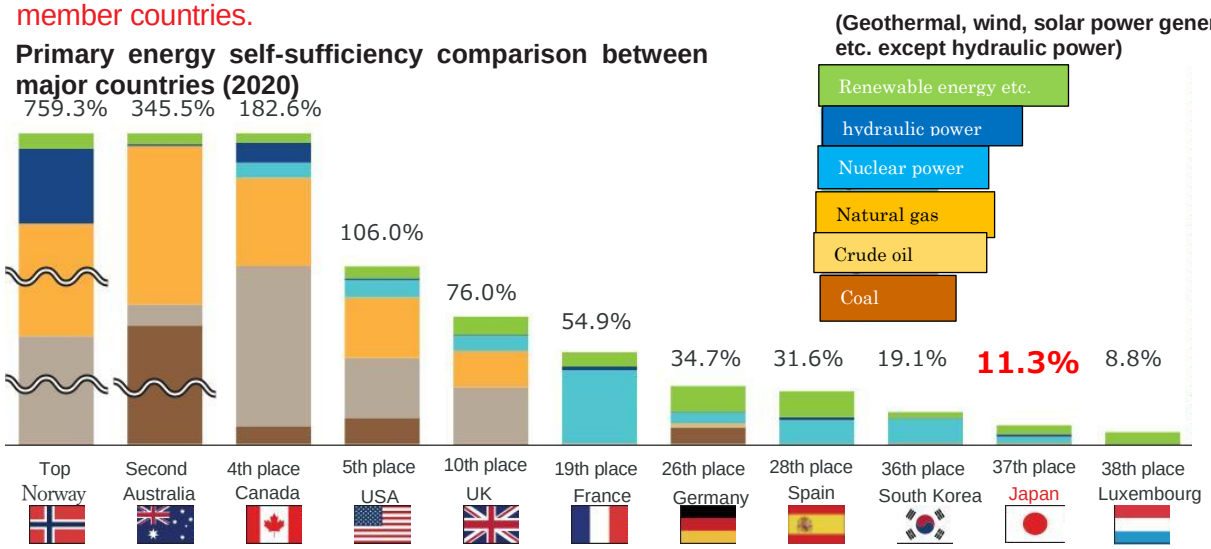
1-3. Electric energy overview

Japan's energy self-sufficiency rate is 11.3% (in 2020), ranking low in the world table at the 37th place. The country, however, heavily relies on fossil fuels, accounting for 83.2% of primary sources in FY2021, and most of it is procured through importation.

Q. How much of the energy used in Japan comes from domestic resources?

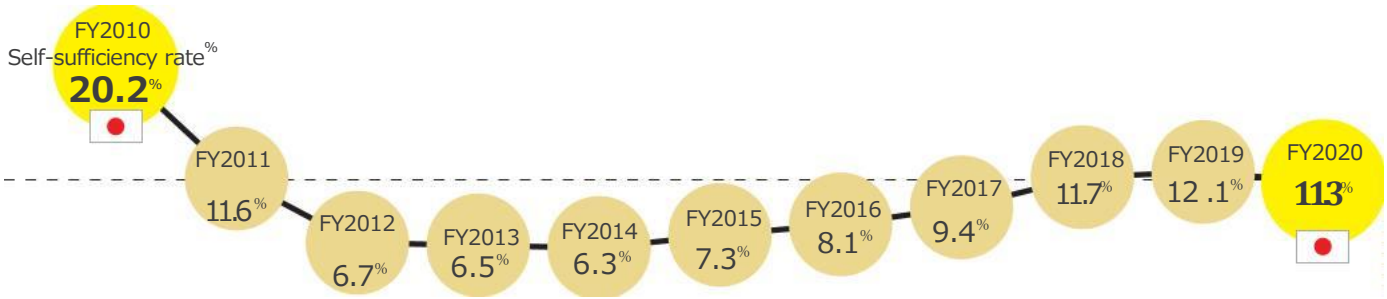
A. The energy self-sufficiency of Japan for fiscal 2020 was 11.3%, which is lower than most OECD member countries.

Primary energy self-sufficiency comparison between major countries (2020)



Sources: IEA estimates for 2020 from the *World Energy Balances 2021*; the figure for Japan: Agency for Natural Resources and Energy of Japan, reported figures from the *FY2020 Comprehensive Energy Statistics*. *The illustration above shows the ranking among the 38 OECD member countries.

Japan's energy self-sufficiency rates



Primary energy: the original forms from which energy is derived, such as petroleum, natural gas, coal, radioactive material, solar light, and wind

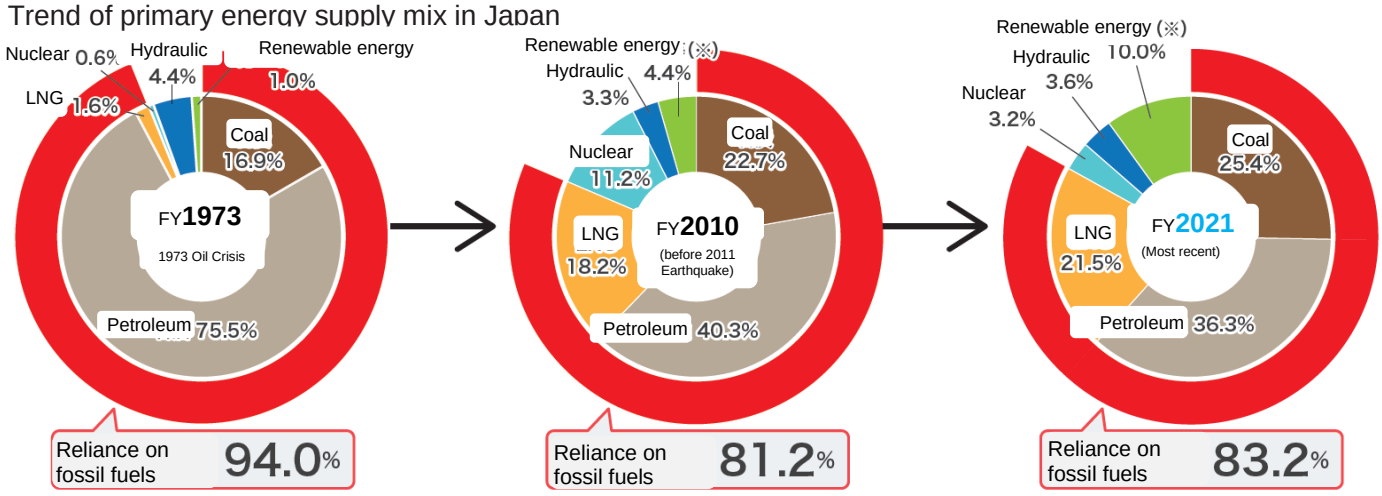
Energy self-sufficiency: the ratio of the energy generated or secured within a country against the total primary energy necessary for the population's daily and economic activities

Source: Japan's Energy: 10 questions for understanding the current energy situation, Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry

Q. What types of energy are used in Japan?

A. Japan heavily relies on imported fossil fuels, including petroleum, coal, and natural gas (LNG). The reliance on fossil fuels has intensified following the 2011 Great East Japan Earthquake, recording 83.2% in FY2021.

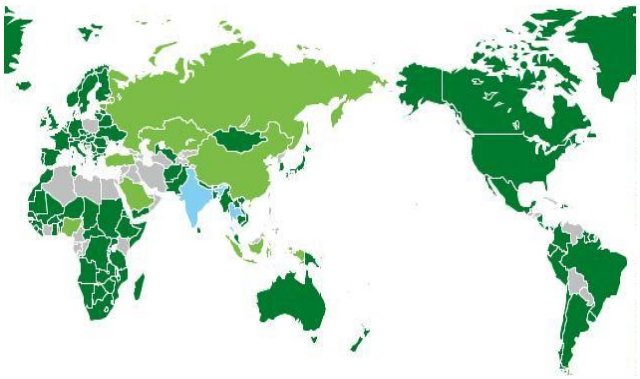
Trend of primary energy supply mix in Japan



Source: Agency for Natural Resources and Energy, provisional figures from the *FY2021 Comprehensive Energy Statistics*
*The total may not amount to 100% due to the rounding below decimal point.
*The renewable energy (geothermal, wind, solar power generation, etc. except hydraulic power) includes the potential energy.

Source: Japan's Energy: 10 questions for understanding the current energy situation, Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry

Countries and territories that have declared their carbon neutral goals



>Countries/territories aiming to attain carbon neutrality (CN) by 2050*1): 145
>Their CO_2 footprint accounts for 40.0% of the world's total CO_2 emissions (actual figure for FY2018*2)
>In addition, an increasing number of countries are setting their CN goals, such as China (32.0%), Russia (2.5%), Indonesia (2.2%), and Saudi Arabia (2.0%) among others, pledging to achieve CN by 2060, and India (2.7%) by 2070. (The ratio of the CO_2 footprint of these countries against the global emissions: 89.4%)

Countries declaring CN to be attained by 2050 (144 including Japan)
Countries declaring CN to be attained by 2060
Countries declaring CN to be attained by 2070

*1 Data prepared by the Ministry of Economy, Trade and Industry (as of the 9th of November 2021) by tallying the (1) Climate Ambition Alliance member countries and (2) countries that made their CN by 2050 pledges through the long-term strategies submitted to the United Nations or otherwise expressed their such intentions at the 2021 Leaders Summit on Climate held in April or COP26.
*2 The CO_2 footprint only covers the energy-related emissions calculated based on IEA's CO_2 Emissions from Fuel Combustion (2020).

Source: Japan's Energy: 10 questions for understanding the current energy situation, Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry

Meanwhile, as part of actions against global climate change and global warming, 145 countries and nations, including Japan, have pledged to attain carbon neutrality by 2050. Hopeful energy sources of the future are renewable energies (solar, wind, geothermal, and biomass power generation), and these

are entering the mainstream, helped by innovations in power storage technology. As of 2020, renewable power generation represents only 19.8% of the total power generated in Japan, but much improvement is expected in view of the figures from other countries, such as Germany, Spain, and Canada, where renewable energy accounts for 43.6%, 43.6%, and 67.9%, respectively.
In Japan, lighting consumes 15-20% of the total power generated, and we can no longer afford to unconditionally allow brightly lit evening events such as local festivals as we used to.

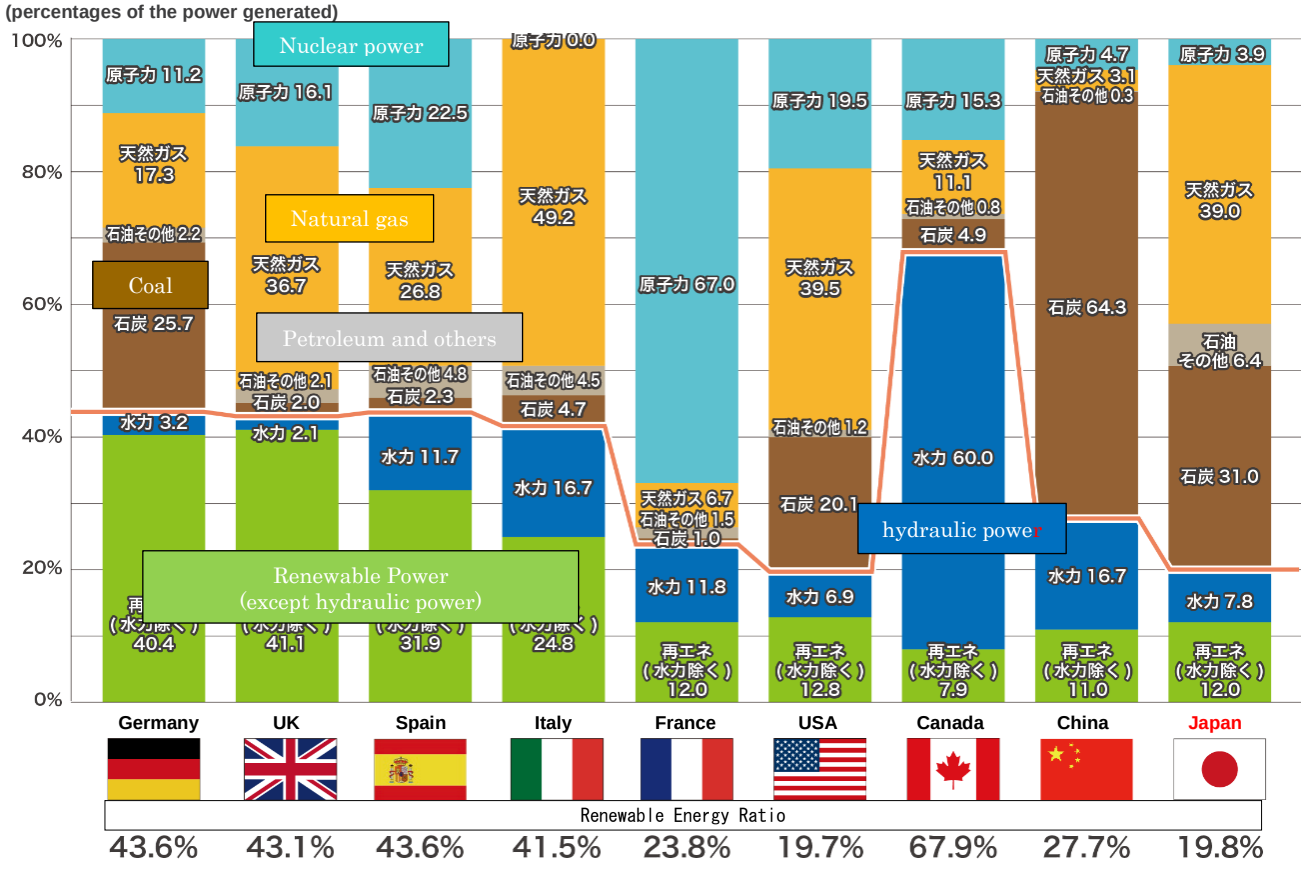
Q How advanced is the energy-saving system in Japan?

A Japan's renewable power ratio is 19.8% in FY2020.

Japan is the sixth largest country in terms of the renewable power generation capacity while coming in the third place by the solar power generation.

Renewable power ratio in national energy mix by countries

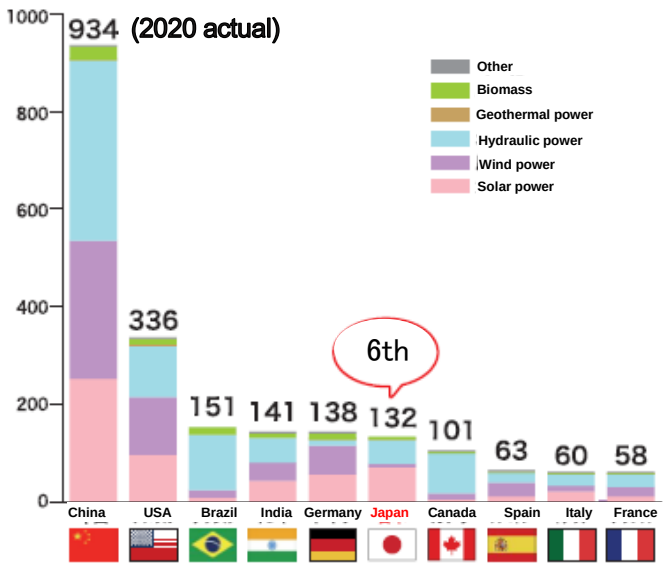
(percentages of the power generated)



Source: prepared by the Agency for Natural Resources and Energy from *Renewables 2021* by IEA

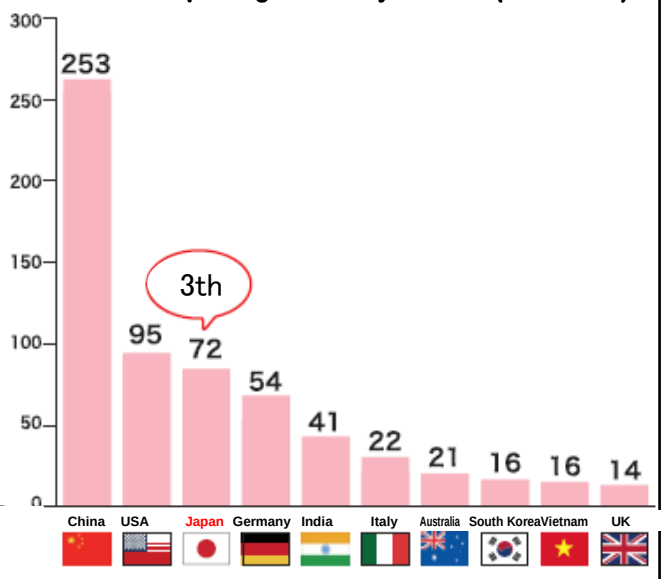
Renewable power generated by countries (2020 actual)

(Unit: GW)



Solar power generated by countries (2020 actual)

(Unit: GW)



Source: prepared by the Agency for Natural Resources and Energy from *Renewables 2021* by IEA

Source: Japan's Energy: 10 questions for understanding the current energy situation, Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry

1-4. World standards and conventions concerning lighting practices

Lighting practices differ across the world as social infrastructure is different in each country. However, most developed countries follow guidelines and general rules provided by the International Commission on Illumination (CIE) and the Illuminating Engineering Society of North America (IES/NA). The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), meanwhile, provides ASHRAE Standards, which prescribe energy use intensity index applicable to air-conditioning and lighting. The green building certification program LEED uses the ASHRAE Standards as one of the evaluation references. Scores are given according to the extent to which the lighting energy use intensity falls below the standards, and the environmental performance is rated by the certification levels of platinum, gold, silver, and so on. One of the international organisations for environmental conservation, the International Dark-Sky Association, takes leadership in preventing the light leakage into the night sky and preserving the night with star-twinkling skies. They also pay attention to the colour temperatures of artificial lights at night time, promoting low colour temperatures for the wellbeing of all living things.

2. Arrangements of this Guideline

2-1. Guide and Control

For the realisation of the ‘New Night’ that offers beautiful night skies without superfluous consumption of the finite energy, the site of Expo 2025 shall have arrangements that allow visitors to stay comfortably while the illuminance on the floor is set low. To aid its realisation, specific guidelines are provided in the following to promote lighting designs with ingenious luminance distributions.
The public area is designed with human-centric lighting, keeping the illuminance and colour temperature low and eliminating discomfort glare while also paying attention to colour rendering. For the lighting designs in the Pavilion Plot areas, it is desirable that the points shown as Guides in this Guideline are adopted proactively. Where the adoption of Guides is not practically possible, the minimum requirement is to conform at least to the mandatory points. Regarding the Pavilion Plot areas, this Guideline is applicable to the setback zone (refer to ‘3-2. Planning Conditions’ in the Design Guidelines for Type A (Self-Built) Pavilions) and, where the building has an opening, the internal area within 3 metres from the building’s external wall line.
Note, however, that C-01 and the provisions under ‘2-3-1. Light pollution [Preventing light leakage into the sky]’ shall apply to the entire Pavilion Plot area.
Note also that the self-contained solar lighting equipment of less than 10 lm output capacity per unit is exempt from usage restrictions provided that due consideration is given for the neighbouring environments.

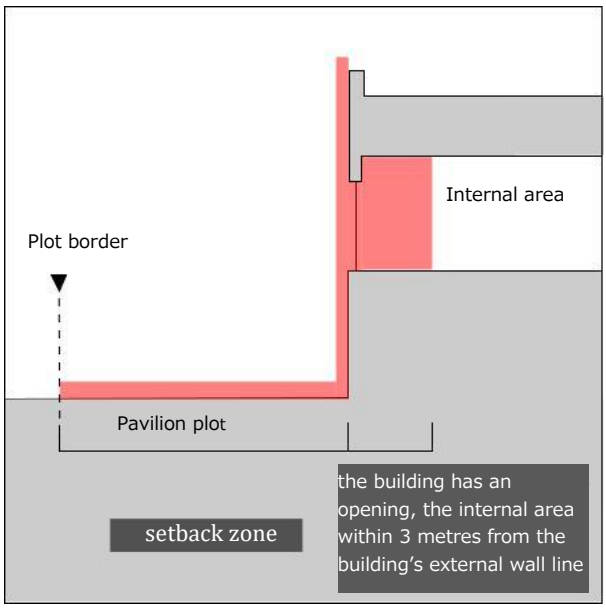
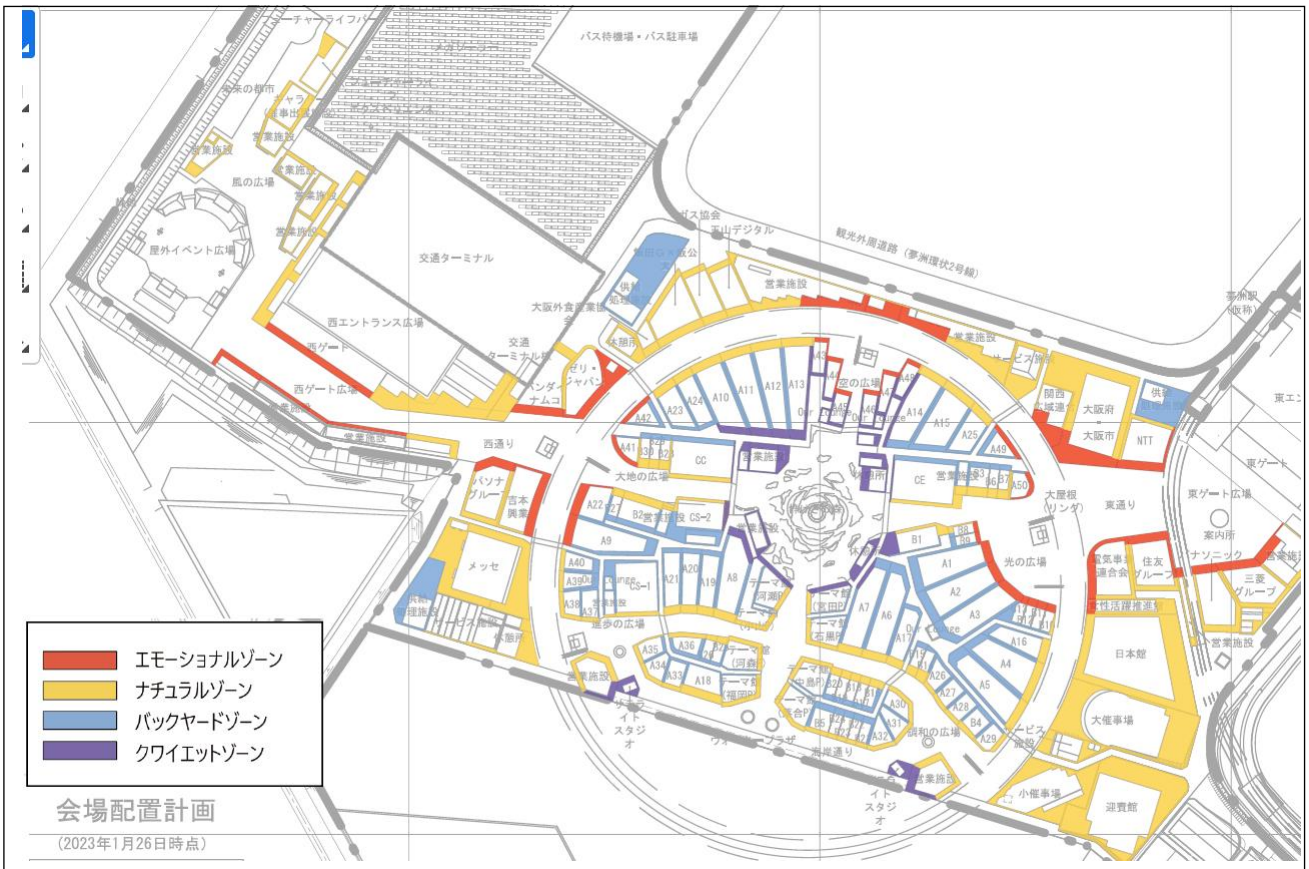


Figure 1. Area to which the Guideline for Lighting Design apply (marked in red)

Each Guide and Control is indicated with an alphanumeric code as follows:
G-00 (Guide) describes recommendations that are preferred to be adopted.
C-00 (Control) describes requirements that are mandatory.

2-2. Lighting design zoning on Expo site

On the Expo 2025 site, Pavilion Plot areas are assigned with 4 types of lighting design zones according to the characteristics of the space use. Recommended parameters are shown below for each lighting design zone to guide toward the realisation of the ‘New Night,’ that ensures the consideration for the global environment and well-balanced lighting for relaxing and energising people.



- **Emotional zone**: the entrance areas and other limited zones that require lively arrangements
- **Natural zone**: applies to most part of the site, where photogenic views are to be created through effective use of a small amount of energy
- **Backyard zone**: a minimal amount of energy is used to efficiently provide necessary light in this zone
- **Quiet zone**: the ‘Forest of Tranquility,’ ‘Water World,’ and other areas where an illuminated environment with serenity is required

Figure 2. Lighting design zones of Expo site
※*Please note that the zoning has been altered and not identical with that illustrated in the Guideline for Lighting Design concerning Facility Implementation Abridged version .

G-01 It is desirable that lighting designs for each zone in terms of colour temperature, average floor illuminance, maximum average vertical luminance, and colour rendering are planned according to the following:

Zone	Colour temperature	Average floor illuminance	Maximum average vertical luminance	Colour rendering
Emotional zone	3,000 K or lower	150 lx or lower	400 cd/m^2 or below	Ra 80 or above (except self-contained solar lighting)(*1)
Natural zone	3,000 K or lower	30 lx or lower	400 cd/m^2 or below	
Backyard zone	3,000 K or lower	20 lx or lower	50 cd/m^2 or below	
Quiet zone	2,800 K or lower	5 lx or lower	50 cd/m^2 or below	

Figure 3. Recommended lighting parameters for each designated zone for the realisation of the 'New Night'

(*1) Self-contained solar lighting: lighting equipment with a solar generator and power storage device, requiring no external power source.

2-3. Ensuring responsible outdoor lighting

C-01 Lighting equipment relevant to the exterior vertical luminance (illuminance), as well as digital signage, projection mapping, and other arrangements, must not emit the light that may 'adversely affect the flight' of an aircraft, as stipulated in the Civil Aeronautics Act (Act No. 231 of 1952). Similarly, light should not be emitted in such ways as it disturbs the considerations for visitors' physical needs and, also, uninterrupted visits at, and exhibition designs of, adjacent Pavilions. Recommended values of luminance.

Lighting equipment shall be designed to keep in harmony with the adjacent environment by installing luminance (illuminance) adjusters or adopting dismountable lights so that brightness can be controlled in response to the Organiser's request in such cases as an excessive amount of light crosses the border with the adjacent plots or illuminates the sky, or the luminance (illuminance) level is deemed excessively high.

G-02 It is desirable to design the lighting in keeping with the adjacent environments.

2-3-1. Light pollution [Preventing light leakage into the sky]

G-03 It is desirable to control the direct light from lighting equipment so that it is not leaked into the night sky, as it amounts to unnecessary consumption of lighting energy and also because lighting up the sky purposelessly can adversely affect the ecosystem. Due attention shall be paid to the selection of lighting equipment as illustrated in Figures 4 to 6. It is also desirable that the lighting equipment adopts light-emitting styles taking into account the cut-off lines (Figure 7) of the emitted light (Figure 8).

However, self-contained solar lighting equipment of less than 300 lm output capacity per unit used for spotlighting is allowed to be directed upwards for purposes such as illuminating flowers.

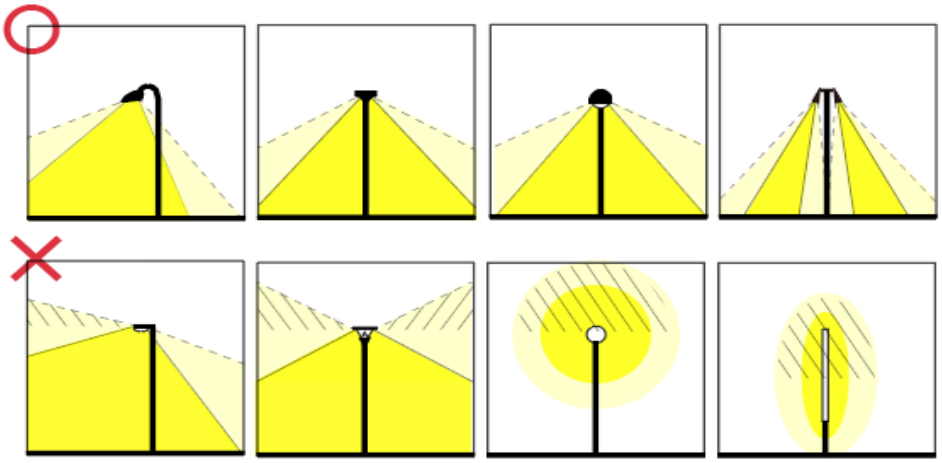


Figure 4. Recommended and non-recommendable lighting equipment by light distribution patterns [pole lights]

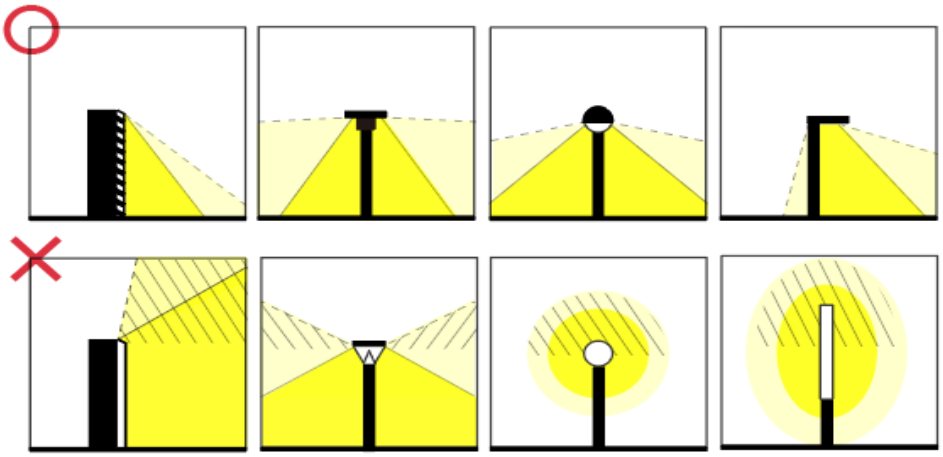


Figure 5. Recommended and non-recommendable lighting equipment by light distribution patterns [bollard lights]

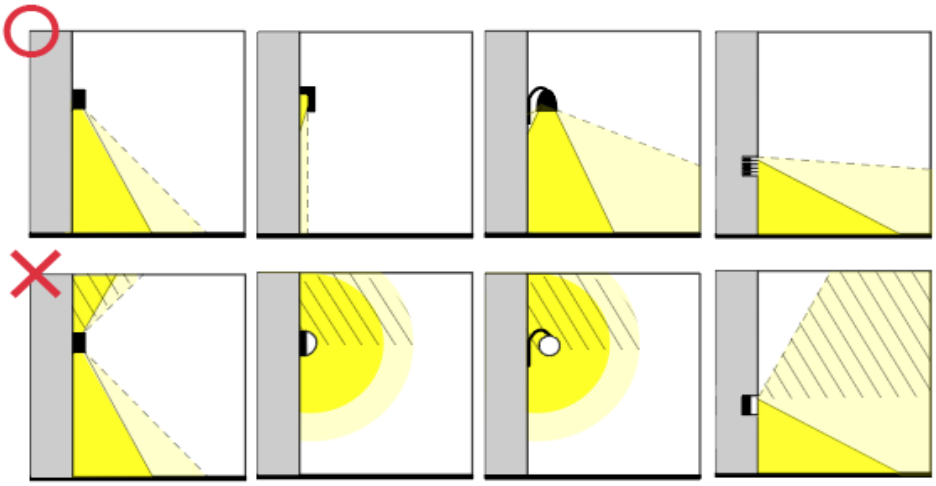


Figure 6. Recommended and non-recommendable lighting equipment by light distribution patterns [bracket lights/foot lights]

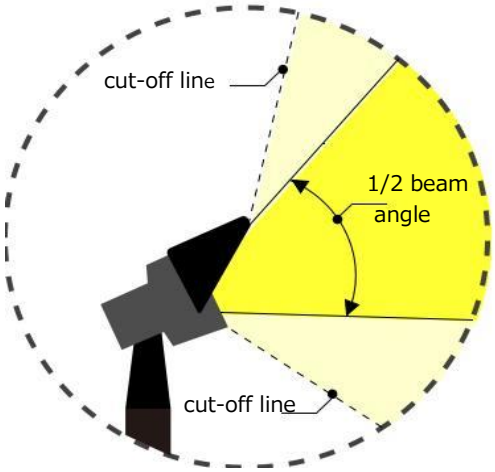
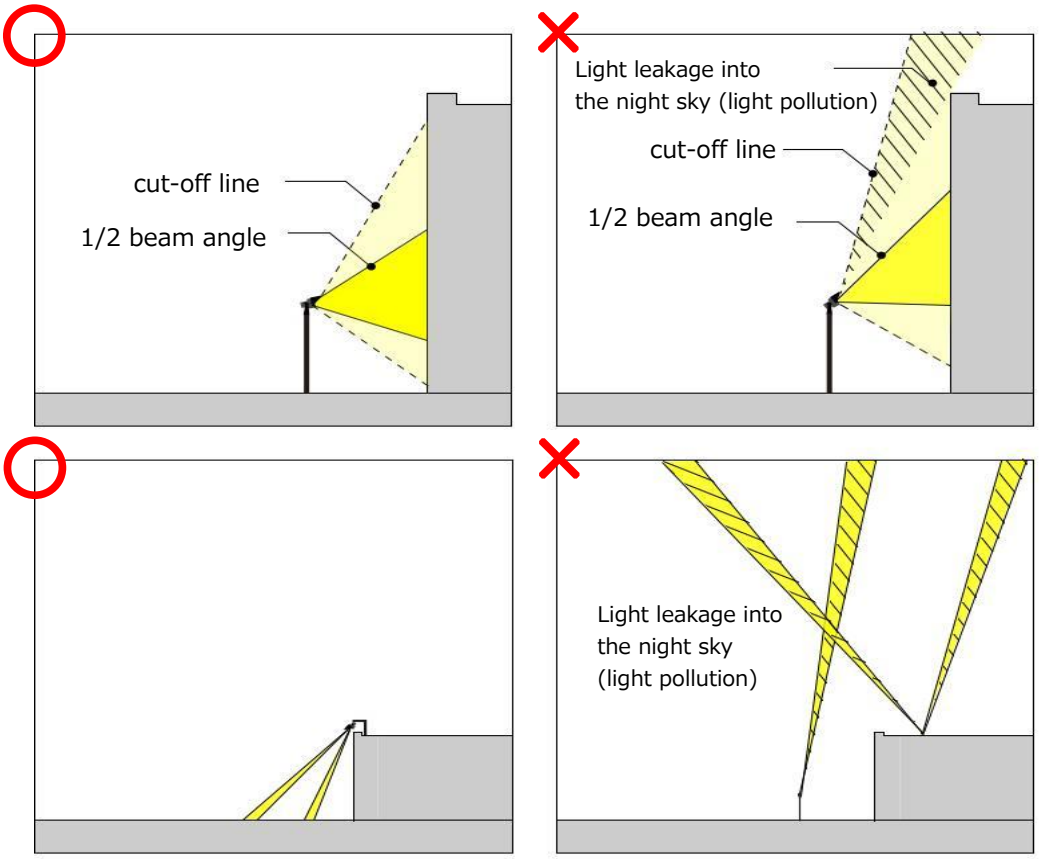


Figure 7. Illustration of cut-off lines of the light emitted by lighting equipment



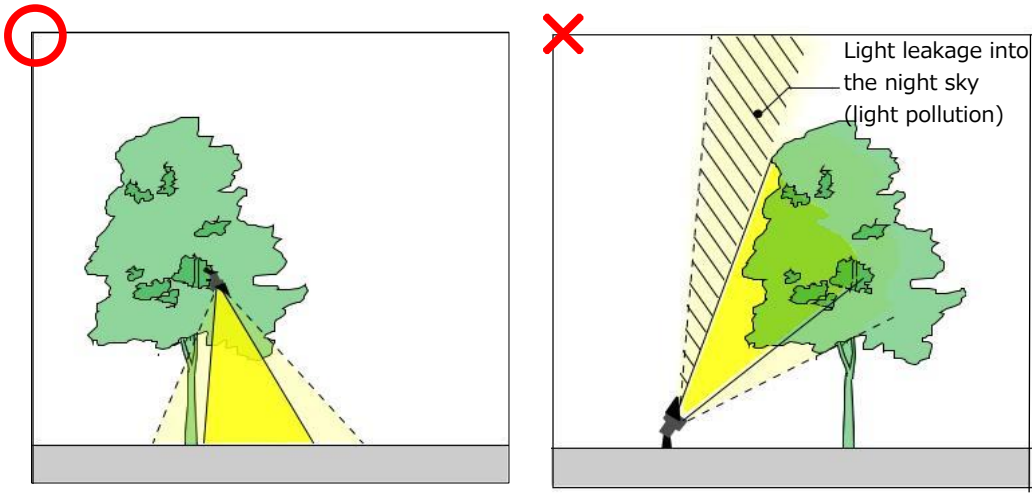


Figure 8. Directions of light emission without light leakage into the sky (left) and with light leakage (right)

2-3-2. Light pollution [Preventing light from crossing into adjacent plots]

G-04 It is desirable that the direct light from lighting equipment is controlled not to cross the plot borders (Figures 9,10 and 11).

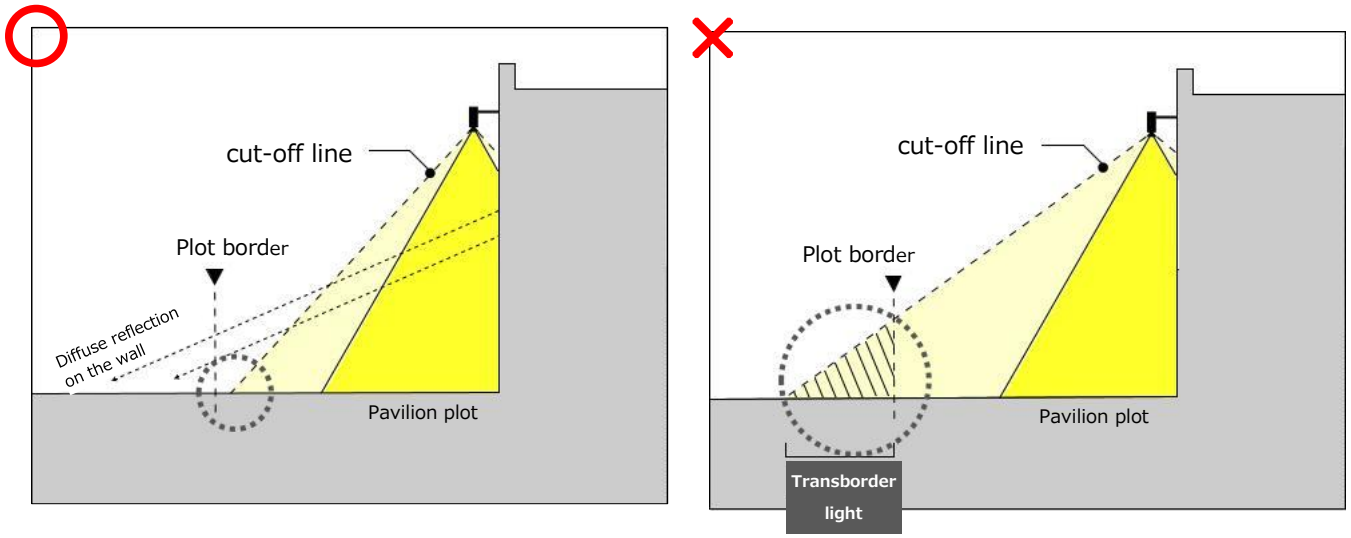


Figure 9. Controlling direct light from crossing plot borders [lights on facades]

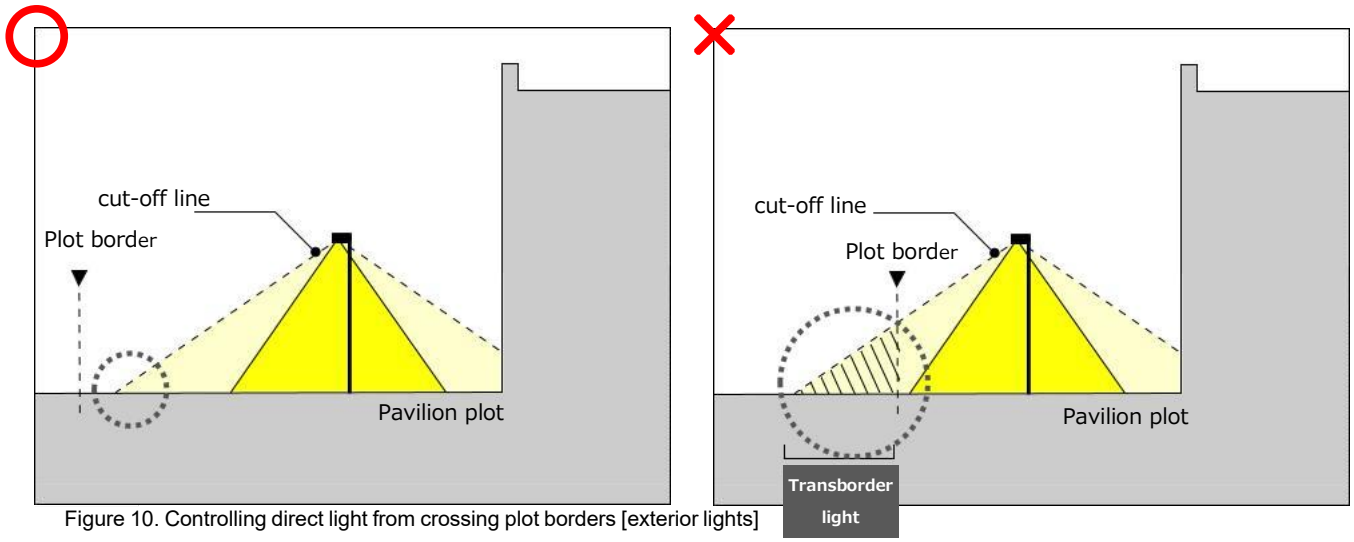


Figure 10. Controlling direct light from crossing plot borders [exterior lights]

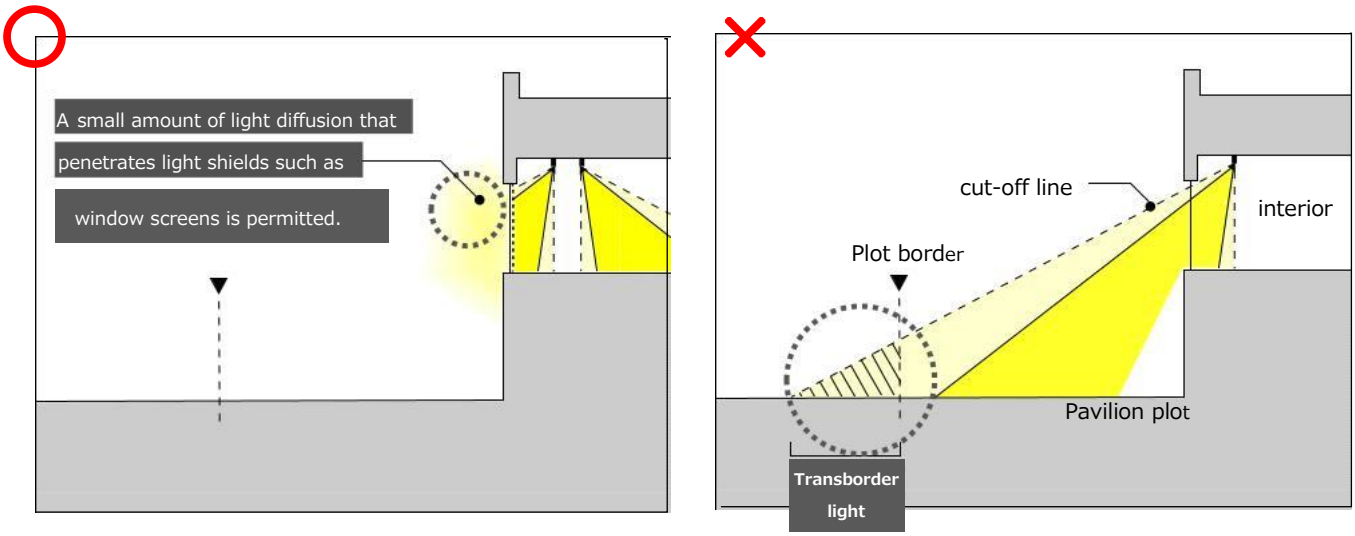


Figure 11. Controlling direct light from crossing plot borders [interior lights]

2-3-3. Colour temperature

G-05 In consideration of the impact on the night-time circadian rhythm and the effects of short-wavelength lights diffused in night skies, the selection of lights shall be based on low colour temperatures.

2-3-4. Control over discomfort glare

G-06 Discomfort glare should be controlled. The human eye is an organ highly adaptive to the environment, thus it can see quite well under conditions of low illuminance, provided that there are no glaring disturbances. When exposed to extreme brightness or dazzling light, the pupil contracts, which means that the eye needs more light to see. This will hinder the creation of illuminated environments that express universal respect for not only human beings but also the entire biodiversity, as set forth by the concept ‘New Night.’

2-4. Aiming to create nightscapes of higher degrees of perfection

2-4-1. Recommendation on illuminating vertical surfaces

G-07 It is desirable that the facades in the Pavilion Plot area that are visible from the public area are proactively illuminated by ‘lit-up windows’ and ‘lighting on vertical surfaces’ to create a dramatic welcoming ambience for visitors. It is also desirable to use lighting arrangements proactively, and within the maximum average vertical luminance levels assigned to each lighting design zone, to serve as components for creating an overall impression of brightness across the entire site.

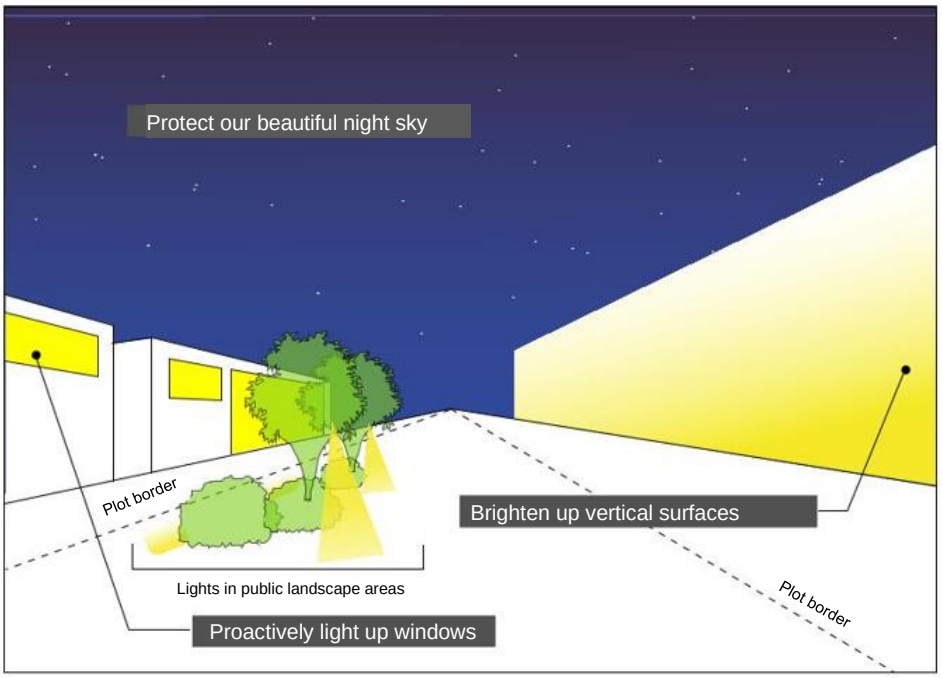


Figure 12. Proactive illumination of vertical surfaces while protecting beautiful night skies is recommended

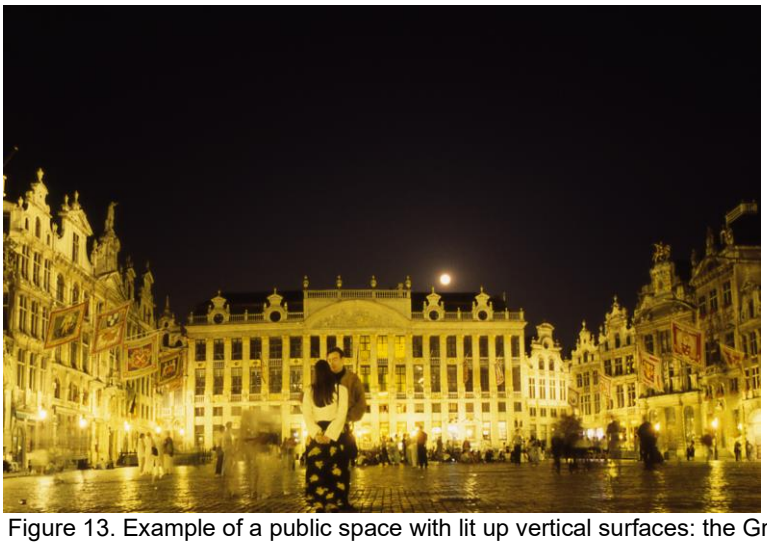


Figure 13. Example of a public space with lit up vertical surfaces: the Grand Place (Brussels, Belgium)

2-4-2. Approaches to illumination shows on facades

G-08 It is desirable that illumination shows projected on facades (*2) are organised with due consideration given for avoiding disruptions to the illuminated environments in the surrounding areas. It is desirable that these are planned in compliance with the points

described in '2-3. Ensuring responsible outdoor lighting.'
(*2) **Illumination shows projected on facades**: choreographed display of light with a fade time of less than 10 seconds.

2-4-3. Recommendation on time-programmed lighting arrangements

G-09 By programming lighting arrangements to change over periods of time, it is possible not only to create attractive night views according to the time of the day, but also to appropriately control the energy consumption. The following 4 programmes are applied to the arrangements in the public area. It is desirable that lighting programmes for the Pavilion Plot area are also based on these.

■ Evening: lighting arrangements for the period after the sunset until 8 p.m., for staging the beginning of the New Night
■ Twilight: lighting arrangements between 8 p.m. and 10 p.m., reducing the energy consumption from the Evening programme
■ Special: lighting arrangements for special occasions, such as programmed events, approved by the Organiser of the World Expo 2025
■ Emergency: precautionary lighting arrangements for assisting emergency evacuation in case of natural disasters and other emergency situations

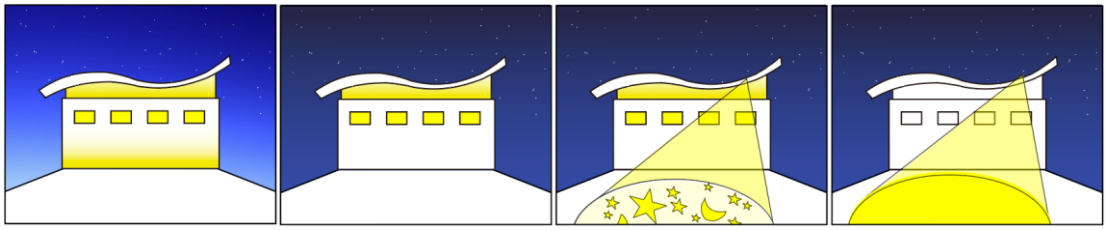


Figure 14. Illustration of lighting programmes: from left to right; Evening, Twilight, Special, and Emergency

2-4-4. Recommendation on proactive use of the self-contained solar lighting system

G-10 It is desirable to proactively adopt self-contained solar lighting systems with built-in solar generation units as a sustainable lighting solution without the need for external power sources. These offer advantages not only in terms of energy, but also in ensuring continued lighting at the time of power outage due to natural disasters. For the purpose of encouraging proactive introduction of self-contained solar lighting system on the site of Expo 2025, exceptional measures are applicable to the adoption of this system as follows:
[Exceptional measures applicable to the adoption of self-contained solar lighting system]

1. Exemption from the application of recommended colour rendering values.
2. No restrictions on spotlights of less than 300 lm output capacity per unit in terms of the upward lighting for purposes such as illuminating flowers.
3. No restrictions on the use of lighting equipment of less than 10 lm output capacity per unit as long as due consideration is given for the neighbouring environments.

2-4-5. Paying attention both to light and shadow

G-11 Japan enjoys a lighting culture that traditionally appreciates the light of finite energy by adding aesthetic arrangements created by shadows. For the purpose of creating the 'New Night,' it is desirable to aim for highly refined nightscapes by paying attention both to light and shadow.

Figure 15. ‘Kakitate’ (an object used as a weight to stabilise a wick of an oil lamp), Tokaido Akari no Museum

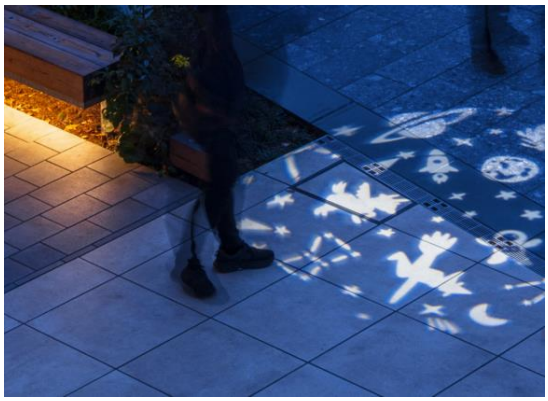


Figure 16. Light projection using silhouette, GREEN SPRINGS

3. References

The documents and materials quoted or referenced for the preparation of this Guideline are as follows:

- Ministry of the Environment: Guidelines for Countermeasures against Light Pollution (Revised Version, March 2021)
- Tokyo Metropolitan Government: Guidebook for architectural planning to create good night views (August 2019)
- Osaka City Government: Discussion on Policies Concerning Nighttime Cityscape (2018)
- City of Yokohama: Guidelines for the Creation of Nighttime Landscape in Urban Bay Area (March 2022)
- Water and air Dept., Environmental Div., Nagano Prefecture: Policies on Specific Initiatives to Prevent Light Pollution (March 2022)
- Civil Aeronautics Act (amended on the 21st of December, 2016)
- Ministry of the Environment: Guidelines for Environmental Considerations in relation to Solar Generation (March 2020)
- Osaka Prefectural Government: Osaka Prefectural Ordinance for Enforcement of the Outdoor Advertisement Act (enforced on the 1st of April, 2020)
- U.S. Green Building Council: LEED v4.1
- International Dark-Sky Association: Five Principles for Responsible Outdoor Lighting
- International Commission on Illumination (CIE): http://cie.co.at/ (accessed on the 31st of August, 2022)
- Expo 2025 Design Guidelines for Type A (Self-Built) Pavilions (June 2022)
- Expo 2025 Revised Universal Design Guidelines for Facility Implementation (for Official Participants’ use) (June 2022)
- Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry: Japan’s Energy: 10 questions for understanding the current energy situation (published in February 2021) (Trends of energy self-efficiency, countermeasures against global warming-carbon neutrality, introduction of renewable energy)
- Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry: Japan’s Nuclear Policies: situations with the domestic nuclear power stations (viewed on the 23rd of August, 2022)
- Japan International Association of Lighting Designers: https://ialdjapan.jp/ (accessed on the 31st of August, 2022)
- International Dark-Sky Association: https://www.darksky.org/ (accessed on the 31st of August, 2022)
- Ministry of Economy, Trade and Industry: Energy-efficient and energy-saving programmes of summer for households (June 2022)
- Japan Center for Climate Change Actions: Breakdown of household power consumption (fiscal 2021)
- Izuru Shinmura (ed.): Kojien (third edition), Iwanami Shoten (December 1983)

Contact

The Official Participants can send inquiries concerning the content of this Guide or uncertainties concerning procedures to the Organiser using the Queries function in the online portal for the Official Participants.

If you have any trouble using the online portal for the Official Participants, please contact us by email to ; participant@expo2025.or.jp

Japan Association for the 2025 World Exposition