

- 1 (2) Recognizing that light pollution must be considered as
2 an imminent threat to the environment, as well as that
3 climate change poses a threat to the outstanding
4 universal values of world heritage sites;
- 5 (3) Recognizing that the preservation of dark skies is an
6 important and necessary part in the process of the
7 protection and safeguarding of natural and cultural
8 properties worldwide; and
- 9 (4) Following the call of the UNESCO Director-General for
10 an integrated approach to issues of environmental
11 preservation and sustainable development.
- 12 (b) Specifically, the action plan proposed to:
- 13 (1) Elaborate the concept of starlight reserve;
- 14 (2) Identify the different categories of areas, reserves,
15 and properties accordingly to this concept;
- 16 (3) Establish general technical recommendations for
17 starlight protection related to the safeguarding of
18 natural and cultural properties, light pollution, and
19 intelligent lighting;
- 20 (4) Integrate these recommendations into the different
21 world heritage programs and initiatives; and



1 (5) Evaluate the possibility of nominating the starlight
2 reserve onto the world heritage list, the biosphere
3 reserve, or both.

4 A starlight reserve is a site where a commitment to defend the
5 quality of the night sky and access to starlight has been
6 established. Its main function is to preserve the quality of
7 the night sky and its associated cultural, scientific,
8 astronomical, natural, and landscape-related values. A starlight
9 reserve is to have a core or dark zone, which is an unpolluted
10 area where natural night sky light conditions are kept intact.
11 This core zone is to be protected by a buffer or protection zone
12 to avoid the adverse effects of air and light pollution reaching
13 the core zone. Finally, there is to be an external zone where
14 intelligent and responsible lighting criteria are to be
15 enforced, protecting night sky quality from harmful factors such
16 as air pollution.

17 (c) The requirements for each starlight reserve are to be
18 specific to the characteristics, singularities, and functions of
19 each site and that are targeted to preserve the quality of
20 astronomical observations and wildlife conservation, while
21 maintaining the integrity of nighttime landscapes and cultural
22 heritage scenarios. The declaration of a starlight reserve is



1 to be accompanied by a participative action plan and an ensemble
2 of recommendations aimed at preserving and recovering night sky
3 quality up to feasible limits and that also preserve related
4 cultural, educational, scientific, and environmental benefits.

5 (d) The legislature also finds that light pollution has
6 become a worldwide problem and is gradually diminishing the
7 human capacity to observe the stars. The International
8 Commission on Illumination defines light pollution as the sum of
9 all adverse effects of artificial light in as much as they have
10 an impact on the environment, including the direct impact of
11 outdoor lighting and the brightening of the night sky that
12 results from the reflection of radiation, also known as glare or
13 sky glow. Avoidable light pollution refers to light flow
14 emitted at night by artificial light sources that are
15 inappropriate in intensity, direction, or spectral range and
16 that are unnecessary to carry out their intended function or
17 when artificial lighting is used in particular sites, such as
18 observatories, natural areas, or sensitive landscapes.
19 Irresponsible lighting includes over-illumination, which makes an
20 excessive and unnecessary use of artificial light, as well as
21 poorly designed luminaires that cause glare or sky glow. (A
22 luminaire is an apparatus that controls the distribution of



1 light given by a lamp that includes all the components necessary
2 for fixing and protecting the lamp and for connecting it to a
3 power supply, colloquially known as a lighting fitting or
4 fixture.)

5 The legislature further finds that light pollution causes
6 the greatest amount of harm to the quality of the night sky even
7 though viable solutions are available to reduce light pollution.
8 The purpose of this Act is to reduce the amount of light
9 pollution so that the quality of the night sky is preserved in
10 the State.

11 Part II

12 SECTION 2. **Statewide starlight reserve strategy; advisory**
13 **working committee; duty.** (a) The department of business,
14 economic development, and tourism shall develop a statewide
15 starlight reserve strategy. The department shall be assisted by
16 a temporary advisory committee, to be placed with the department
17 of business, economic development, and tourism for
18 administrative support purposes. The members of the temporary
19 advisory committee shall consist of representatives from the:

20 (1) Department of business, economic development, and
21 tourism;

22 (2) Office of aerospace development;



- 1 (3) Hawaii tourism authority;
- 2 (4) University of Hawaii;
- 3 (5) Department of health;
- 4 (6) Department of transportation;
- 5 (7) Department of land and natural resources;
- 6 (8) Mayors of the counties of Kauai, Maui, Hawaii, and the
- 7 city and county of Honolulu;
- 8 (9) Office of Hawaiian affairs; and
- 9 (10) Counties of Oahu, Maui, Kauai, and Hawaii, who shall
- 10 be residents of the respective counties.

11 (b) The director of business, economic development, and
12 tourism shall designate the chairperson of the advisory
13 committee. The advisory committee shall convene its initial
14 meeting no later than July 30, 2009.

15 (c) It shall be the duty of the department of business,
16 economic development, and tourism, assisted by the advisory
17 committee, to develop a statewide starlight reserve strategy to
18 preserve the quality of the night sky and its associated
19 cultural, scientific, astronomical, natural, and landscape-
20 related values. The department shall develop necessary proposed
21 legislation to implement the statewide starlight reserve
22 including a light pollution law to eliminate irresponsible



1 lighting, such as over-illumination that makes use of excessive
2 or unnecessary use of artificial light, and poorly designed
3 luminaires that cause glare of sky glow at night.

4 SECTION 3. **Statewide starlight reserve strategy;**

5 **principles and functions; components.** (a) The statewide
6 starlight reserve strategy shall be based on the following
7 principles expressing the functions of the starlight reserve
8 concept:

- 9 (1) To value, protect, and promote the tangible and
10 intangible worldwide cultural heritages associated
11 with the night sky;
- 12 (2) To defend the quality of the night sky for
13 astronomical observation, including establishing
14 measures and regulations to prevent its deterioration
15 through light and atmospheric pollution;
- 16 (3) To establish new bases, especially in natural areas,
17 to safeguard the equilibrium of the biosphere and to
18 protect the earth's biological diversity whose
19 nocturnal and diurnal habitats are threatened by light
20 and atmospheric pollution; and
- 21 (4) To preserve and recover the quality of nocturnal
22 starlit landscapes that have traditionally been



1 perceived by people as an integral part of their
2 natural and cultural heritage.

3 (b) The statewide starlight reserve strategy shall have
4 the following components:

5 (1) An intelligent lighting system that includes:

6 (A) Reduction and prevention of light pollution
7 created by:

8 (i) The unnecessary use at night of artificial
9 light sources that are inappropriate in
10 intensity, direction, or spectral range; and

11 (ii) The use of artificial lighting in certain
12 areas such as observatories, natural areas,
13 or sensitive landscapes;

14 (B) Reduction and prevention of glare or sky glow
15 caused by over-illumination and poorly designed
16 luminaires; and

17 (C) Minimizing the use of artificial lighting only
18 for essential purposes and thereby also
19 conserving energy;

20 (2) A tourism component that preserves the quality of the
21 night sky through the use of innovative promotional
22 and educational ecotourism products related to



1 astronomical observation, natural nightscapes, and
2 associated native Hawaiian cultural values and
3 heritage;

4 (3) An educational component to educate both Hawaii
5 residents and visitors to the State about the
6 importance of preserving the night sky; and

7 (4) A statewide monitoring component to measure and
8 monitor the quality of the night sky.

9 SECTION 4. **Starlight reserve areas; categories.** The
10 statewide starlight reserve strategy shall consider the
11 inclusion of the following categories of starlight reserve
12 areas:

13 (1) Starlight heritage site: archaeological and cultural
14 sites or monuments created as an expression of
15 humanity's relationship with the firmament, which
16 reflect the development of astronomy and its
17 manifestation in the arts and traditions, and that may
18 include:

19 (A) Monuments or groups of buildings related to
20 astronomy;



- 1 (B) Relevant sites and manifestations of cultural
- 2 heritage related to sky observation, including
- 3 archaeoastronomical sites;
- 4 (C) Areas where expressions of tangible and
- 5 intangible cultural heritage associated with
- 6 astronomy and starlight, including music,
- 7 traditions, legends, folk tales, and folklore,
- 8 still survive; and
- 9 (D) World heritage properties and biosphere reserves;
- 10 (2) Starlight astronomy site: exceptional observation
- 11 sites for optical, infrared, and radio astronomy,
- 12 including potential future sites, and that may
- 13 include:
 - 14 (A) Relevant astronomical observatories and their
 - 15 environment;
 - 16 (B) Potential areas for advanced astronomical
 - 17 observation, recognized by the International
 - 18 Astronomical Union and the international
 - 19 scientific community; and
 - 20 (C) Exceptional astronomical observation sites whose
 - 21 characteristics render them especially suited for
 - 22 the development of educational and scientific



1 activities or for the promotion and spread of
2 astronomy;

3 (3) Starlight natural site: natural areas where the
4 integrity of the natural conditions, including the
5 quality of the natural night sky, is preserved, and
6 that may include:

7 (A) Habitats of particular relevance that host
8 nocturnal wildlife species particularly sensitive
9 to the loss of night sky quality or vulnerable to
10 the effects of light pollution;

11 (B) Terrestrial and marine areas used as corridors
12 and resting sites by migratory wildlife species
13 whose habits and displacement are harmed by glare
14 or loss of natural night light;

15 (C) Protected natural areas with a special relevance
16 for the development of night-time environment
17 research and management and the study of the
18 natural patterns of light and dark;

19 (D) World heritage properties, biosphere reserves,
20 Ramsar Convention wetland sites, and marine or
21 terrestrial protected areas of international
22 importance; and



1 (E) All protected nature areas in general, since all
2 species and ecosystems depend on natural cycles
3 of day and night;

4 (4) Starlight landscape: places where aesthetic and
5 cultural manifestations of the night sky can be
6 observed, and that may include:

7 (A) Areas where the starry sky, as well as
8 exceptional manifestations of light-related
9 phenomena, can be observed;

10 (B) Expressions of nature and geological monuments
11 that create night landscapes of acknowledged
12 value;

13 (C) Cultural landscapes or expressions of natural and
14 artificial works of nature and where the
15 astronomical dimension prevails; and

16 (D) Natural heritage properties and biosphere
17 reserves;

18 (5) Starlight oasis--human habitat: populated areas free
19 from negative effects that impede star viewing and
20 decrease night sky quality and that may include:



- 1 (A) Rural areas of outstanding singularity where the
- 2 starry sky view is part of their recognized
- 3 identity;
- 4 (B) Small villages that maintain the night sky
- 5 reasonably free from atmospheric and light
- 6 pollution; and
- 7 (C) Tourist destinations that consider the night sky
- 8 an important resource and that offer activities
- 9 based on or related to astronomy and the
- 10 enjoyment of the night sky; and
- 11 (6) Mixed starlight site: sites that combine two or more
- 12 of categories (1) through (5).

13 SECTION 5. **Statewide lighting law; considerations; lighting**
14 **in zones.** (a) The department of business, economic
15 development, and tourism, with the assistance of the advisory
16 group, shall develop necessary proposed legislation to implement
17 a statewide intelligent lighting and light pollution law taking
18 into consideration the following:

- 19 (1) Develop rules regulating the requirements of outdoor
- 20 lighting to guarantee the protection of night sky
- 21 quality;



- 1 (2) Incorporate measures to conserve energy and promote
- 2 responsible outdoor night lighting;
- 3 (3) Develop standards for intelligent lighting design in
- 4 architecture, urban planning, engineering, and
- 5 infrastructure development;
- 6 (4) Strengthen statewide commitment to preserving the
- 7 night sky by adopting intelligent lighting in the
- 8 public sector;
- 9 (5) Promote labeling to recognize intelligent lighting
- 10 fixtures and products;
- 11 (6) Develop alliances with both public and private
- 12 entities primarily responsible for outdoor night
- 13 lighting;
- 14 (7) Develop measures to avoid obtrusive light and improve
- 15 the quality of life of local populations; and
- 16 (8) Educate local residents about existing solutions, as
- 17 well as the environmental, personal, and energy-saving
- 18 benefits that intelligent night-sky lighting entails.
- 19 (b) The intelligent lighting law shall apply to three
- 20 different zones: core zone, buffer zone, and external zone, as
- 21 follows:

- 1 (1) A core zone is an unpolluted area where natural night
2 sky light conditions are kept intact and is devoid of
3 any element that may cause light or air pollution.
4 The core zone includes areas whose ratio between the
5 artificial sky brightness and the natural sky
6 brightness is less than 0.1 and correspond to class 1
7 and class 2 sites in the Bortle dark-sky scale. Within
8 the core zone:
- 9 (A) Flying over the zone shall be restricted;
 - 10 (B) The installation and operation of radio
11 communications stations shall be regulated, with
12 a power flux density limit of W/m² in force over
13 observatories;
 - 14 (C) Where radio astronomy observations are conducted,
15 radio interference limits shall be established to
16 ensure that equipment and measurements are not
17 corrupted;
 - 18 (D) Use of isolated lights that dazzle animal species
19 and lighting systems emitting in a harmful range,
20 such as ultraviolet radiation, and the blue part
21 of the visible spectrum shall be restricted;



1 (E) If an illumination level is deemed necessary, the
2 full moon criterion (less than one lux) shall be
3 used and shall be restricted to the immediate
4 area to be illuminated; and

5 (F) Lighting of monuments and cultural sites
6 necessary for interpretive and security reasons
7 shall be designed to avoid impact on the quality
8 of the night sky;

9 (2) A buffer, or high sensitivity zone, can be seen
10 directly from the core zone, providing an adjacent
11 security belt within which all sources of air and
12 light pollution that are harmful to the core zone's
13 night sky quality are eliminated, and may include
14 small human settlements, corridors of migratory
15 species, and other areas of activity. Within the
16 buffer zone:

17 (A) All luminaires shall avoid pointing their light
18 emission towards the sky or horizon, achieving a
19 high coefficient of utilization--ideally an
20 upward light ratio of zero;

21 (B) Luminaires shall use appropriate optics or employ
22 screens or baffles;



- 1 (C) All lighting installations shall avoid
- 2 over-illumination, or excessive luminance, taking
- 3 into account the effects of reflected light;
- 4 (D) Starlight saving time: outdoor lighting shall be
- 5 used only during hours when strictly necessary,
- 6 especially in the case of road lighting, public
- 7 areas, illuminated advertisements, commercial
- 8 areas, parking, and sport facilities. Dark times
- 9 shall be established to avoid harmful activities
- 10 conducted in the core zone, such as astronomical
- 11 observation, tourism, educational tours,
- 12 research, and biodiversity conservation
- 13 management;
- 14 (E) Sky beamers and laser floodlights shall be
- 15 prohibited;
- 16 (F) Illuminated advertisements may be permitted with
- 17 discretion, and lights shall be aimed downwards
- 18 and turned off after businesses hours;
- 19 (G) Only the most energy efficient outdoor luminaires
- 20 shall be used. Luminaires shall produce no or a
- 21 minimum of ultraviolet or blue emissions;



- 1 (H) Road lighting shall be rigorously restricted to
- 2 areas with justifiable needs, except at
- 3 intersections where the luminaire front glazing
- 4 should be kept at or near parallel to the surface
- 5 in order to obtain a light intensity at or above
- 6 the horizon below 0.5 cd/klm (candle per
- 7 kilolumen) and the upward light ration below one
- 8 per cent;
- 9 (I) Luminaires lighting monuments and public
- 10 buildings shall be oriented downwards,
- 11 restricting the luminous flux to the object to be
- 12 illuminated;
- 13 (J) Light trespass effects generated by outdoor
- 14 luminaires shall be strictly limited;
- 15 (K) The luminous flux emitted from a luminaire in the
- 16 upper hemisphere shall have an upward light ratio
- 17 of zero;
- 18 (L) Within inhabited areas farther away from the core
- 19 zone, the following limits shall be established:
- 20 (i) Luminaires for streets: upward light ratio
- 21 of less than 1.5 per cent; and

- 1 (ii) Luminaires for pedestrian use: --upward/
2 light ratio of less than two per cent;
- 3 (M) To avoid harmful light emissions towards the
4 horizon, the use of full cut-off luminaires shall
5 be recommended;
- 6 (N) Luminaires shall be installed without
7 inclination, especially if they have a curved,
8 lenticular, or convex transparent glazing;
- 9 (O) A schedule shall be established to retrofit
10 existing installations to comply with all outdoor
11 lighting criteria; and
- 12 (P) Within astronomical observation sites, the least
13 harmful option among the available technology
14 shall be used in outdoor lighting (low pressure
15 sodium lamps).
- 16 (3) An external zone is close to the reserve and is a
17 general use area where existing larger human
18 settlements may harm the night sky quality and where
19 activities require a more intensive use of artificial
20 lighting. Within the external zone:
 - 21 (A) The use of illumination shall be at the minimum
22 practical level;



- 1 (B) The area to be illuminated shall be as small as
2 practical;
- 3 (C) The duration of illumination shall be as short as
4 practical;
- 5 (D) The amount of ultraviolet emissions in
6 illumination shall be minimized;
- 7 (E) Only luminaires directing minimal amounts of
8 luminous flux directly to the sky shall be used
9 and emit less than two per cent of luminous flux
10 above the horizon;
- 11 (F) For road lighting, only luminaires with
12 reflectors and transparent--preferably flat or
13 shallow bowl--glass casing shall be used;
- 14 (G) Road and area luminaires shall not be inclined
15 more than ten degrees in case of flat glazing and
16 zero degrees in other cases;
- 17 (H) For roadway luminaires, the proportion of light
18 emitted along the street side of the road shall
19 be maximized and the proportion emitted on the
20 house side minimized;
- 21 (I) For sports lighting, "double-asymmetrical"
22 luminaires that can be mounted with their front



1 glass horizontal shall be recommended. Other
 2 types of luminaires shall not direct light at
 3 angles greater than seventy degrees (maximum
 4 intensity direction), to prevent direct glare and
 5 light trespass; and

6 (J) Ensure that all artificial lighting installations
 7 are designed to the lighting needs and minimize
 8 obtrusive light and energy use.

9 SECTION 6. Report; advisory committee terminated. (a)
 10 The department of business, economic development, and tourism
 11 shall submit a final report to the legislature no later than
 12 twenty days prior to the convening of the regular session of
 13 2010. The report shall include findings, recommendations, and
 14 necessary proposed legislation to implement this part.

15 (b) The advisory committee created in this part shall be
 16 terminated on June 30, 2011.

17 Part III

18 SECTION 7. This Act shall take effect upon its approval.

19 INTRODUCED BY:

[Handwritten signatures: Cindy Evans, Mel Cashell, Hank Takashima]



Report Title:

Starlight Reserve; Statewide Lighting Law

Description:

Requires department of business, economic development, and tourism, assisted by a temporary advisory committee, to develop a statewide starlight reserve strategy, including an intelligent statewide lighting law, to preserve the quality of the night sky and its associated cultural, scientific, astronomical, natural, and landscape-related values.

