

- (2) A person may not serve more than two consecutive terms.
- (e) The Governor shall designate the chairperson of the Committee.
- (f) The Department of Natural Resources, in cooperation with the Department of Agriculture and the Office of Planning, shall provide staff support for the Committee.

§ 5-9A-09.

The Governor shall include in the annual capital budget an amount not less than \$5 million for this Program.

7 State House Station
Augusta, ME 04333-0007
Phone: (207) 287-1650
revisor.office@state.me.us

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LAND FOR MAINE'S FUTURE (HEADING: PL 1987, c. 506, §1 (new); 1989, c. 502, Pt. A, §157 (rpr); 1989, c. 571, Pt. B, §1 (rpr); 1993, c. 680, Pt. A, § 14 (rpr))

CHAPTER 353

LAND FOR MAINE'S FUTURE (HEADING: PL 1987, c. 506, §1 (new); 1989, c. 502, Pt. A, §157 (rpr); 1989, c. 571, Pt. B, §1 (rpr); 1993, c. 680, Pt. A, §14 (rpr); 1993, c. 728, §1 (rpr); 1995, c. 462, Pt. A, §8 (rpr))

5 § 6200. Findings

The Legislature finds that Maine is blessed with an abundance of natural resources unique to the northeastern United States; that these natural resources provide Maine residents and visitors to the State with an unparalleled diversity of outdoor recreation opportunities during all seasons of the year and a quality of life unmatched in this nation; that the continued availability of public access to these recreation opportunities and the protection of the scenic and natural environment are essential for preserving the State's high quality of life; that public acquisition programs have not kept pace with the State's expanding population and changing land use patterns so that Maine ranks low among the states in publicly owned land as a percentage of total state area; that rising land values are putting the State's real estate in shoreland and resort areas out of reach to most Maine citizens and that sensitive lands and resources of statewide significance are currently not well protected and are threatened by the rapid pace of development; and that public interest in the future quality and availability for all Maine people of lands for recreation and conservation is best served by significant additions of lands to the public domain. [1993, c. 728, §2 (amd).]

The Legislature further finds that Maine's private, nonprofit organizations, local conservation commissions, local governments and federal agencies have made significant contributions to the protection of the State's natural areas and that

these agencies should be encouraged to further expand and coordinate their efforts by working with state agencies as "cooperating entities" in order to help acquire, pay for and manage new state acquisitions of high priority natural lands. [1987, c. 506, § 1, 4 (new).]

The Legislature declares that the future social and economic well-being of the citizens of this State depends upon maintaining the quality and availability of natural areas for recreation, hunting and fishing, conservation, wildlife habitat, vital ecologic functions and scenic beauty and that the State, as the public's trustee, has a responsibility and a duty to pursue an aggressive and coordinated policy to assure that this Maine heritage is passed on to future generations. [1987, c. 506, § 1, 4 (new).]

Section History:
1987, c. 506, § 1,4 (NEW).
1993, c. 728, § 2 (AMD).

5 § 6201. Definitions

As used in this chapter, unless the context otherwise indicates, the following terms have the following meanings. [1987, c. 506, §§1, 4 (new).]

1. Appraised value. "Appraised value" means the fair market value of property without the consideration of the effect, if any, of dedication or other preservation-related restrictions.

[1987, c. 506, §§1, 4 (new).]

2. Cooperating entities. "Cooperating entities" means those private nonprofit organizations, municipal conservation commissions, local governments, federal agencies or other bodies designated by the Land for Maine's Future Board pursuant to section 6203, as able to assist the State in the acquisition or management of conservation lands.

[1987, c. 506, §§1, 4 (new).]

3. Matching funds. "Matching funds" means any combination of public and private funds used in conjunction with the Land for Maine's Future Fund or the Public Access to Maine Waters Fund for the purpose of this chapter, including, but not limited to: private contributions of cash or securities; money from municipal or other public agencies; money from a federal matching program, subject to the limitations of applicable federal and state laws, in an amount authorized by the federal program; contributions of real property, or interest in real property, that serves the acquisition needs of the State as determined by the Land for Maine's Future Board; in-kind contributions; or any combination of those funds. Contributions of land or interest in land must be valued, for purposes of this section, in the amount of their appraised value.

[1993, c. 728, §3 (amd).]

4. Stewardship account. "Stewardship account" means an account held separate and apart from all other money, funds and accounts of a state agency for the purposes of management of land owned in fee or less-than-fee simple meeting the criteria established in section 6207.

[1987, c. 506, §§1, 4 (new).]

Section History:
1987, c. 506, § 1,4 (NEW).
1993, c. 728, § 3 (AMD).

5 § 6202. Land for Maine's Future Board

The Land for Maine's Future Board, as established in chapter 379, shall be an Executive Department Board and shall be referred to in this chapter as the "board." [1987, c. 506, § 1, 4 (new)]

Section History:
1987, c. 506, § 1,4 (NEW).

5 § 6203. Land for Maine's Future Fund

1. Fund established. There is established the Land for Maine's Future Fund that is administered by the board. The Land for Maine's Future Fund consists of the proceeds from the sale of any bonds authorized for the purposes set forth in subsection 3 and any funds received as contributions from private and public sources for those purposes. The Land for Maine's Future Fund must be held separate and apart from all other money, funds and accounts. Eligible investment earnings credited to the assets of the Land for Maine's Future Fund become part of the assets of that fund. Any balance remaining in the Land for Maine's Future Fund at the end of any fiscal year must be carried forward for the next fiscal year.

[1993, c. 728, §4 (amd).]

2. Fund available. The Land for Maine's Future Fund is available to state agencies and designated cooperating entities upon authorization of the board for the purposes identified in subsection 3.

[1993, c. 728, §4 (amd).]

3. Fund proceeds. The proceeds of the Land for Maine's Future Fund may be applied and expended to:

A. Acquire property or an interest in property that is determined by the board to be of state significance under the guidelines of this chapter; and [1993, c. 728, §4 (amd).]

B. Fund minor capital improvements on lands acquired by proceeds from the Land for Maine's Future Fund to improve accessibility, as long as these improvements do not exceed 5% of the appraised value of the acquired property. [1993, c. 728, §4 (amd).]

[1993, c. 728, §4 (amd).]

Section History:
1987, c. 506, § 1,4 (NEW).
1993, c. 728, § 4 (AMD).

5 § 6203-A. Public Access to Maine Waters Fund

1. Fund established. There is established the Public Access to Maine Waters Fund that is administered by the board. The Public Access to Maine Waters Fund consists of the proceeds from the sale of bonds authorized for the purposes set forth in subsection 3 and funds received as contributions from private and public sources for those purposes. The Public Access to Maine Waters Fund must be held separate and apart from all other money, funds and accounts. Eligible investment earnings credited to the assets of the Public Access to Maine Waters Fund become part of the assets of that fund. Any balance remaining in the Public Access to Maine Waters Fund at the end of a fiscal year must be carried forward for the next fiscal year.

[1993, c. 728, §5 (new).]

2. Fund available. The Public Access to Maine Waters Fund is available to state agencies and designated cooperating entities upon authorization of the board for the purposes identified in subsection 3.

[1993, c. 728, §5 (new).]

3. Fund proceeds. The proceeds of the Public Access to Maine Waters Fund may be applied and expended to:

A. Acquire property or interests in property abutting fresh or coastal waters when public access to those waters does not exist or when the board determines that existing points of public access are not sufficient; and [1993, c. 728, §5 (new).]

B. Provide minor capital improvements on lands acquired by proceeds from the Public Access to Maine Waters Fund to provide public access or improve accessibility, as long as these improvements do not exceed 5% of the appraised value of the acquired property. [1993, c. 728, §5 (new).]

[1993, c. 728, §5 (new).]

Section History:
1993, c. 728, § 5 (NEW).

5 § 6204. Board composition

1. Composition. The board consists of 11 members, 6 who are private citizens and 5 who are permanent members. The permanent members are the Commissioner of Conservation; the Commissioner of Inland Fisheries and Wildlife; the Commissioner of Marine Resources; the Commissioner of Agriculture, Food and Rural Resources; and the Director of the State Planning Office.

[1993, c. 728, §6 (amd).]

2. Appointments. The 6 private citizens are appointed by the Governor, subject to review by the joint standing committee of the Legislature having jurisdiction over natural resources matters and to confirmation by the Legislature.

[1993, c. 728, §6 (amd).]

3. Qualifications. The 6 private citizens must be selected for their knowledge of the State's natural resources and landscape and their demonstrated commitment to land conservation. Appointments must provide broad geographic representation.

[1993, c. 728, §6 (amd).]

4. Terms; compensation. The appointed private citizen members are appointed to staggered 4-year terms. The initial appointments are: Two members for 2-year terms; 2 members for 3-year terms; and 2 members for 4-year terms. Appointed private citizen members may not serve more than 2 consecutive 4-year terms. The appointed members receive the legislative per diem pursuant to chapter 379.

[1993, c. 728, §6 (amd).]

5. Chair. The Governor shall appoint the chair of the board.

[1993, c. 728, §6 (amd).]

6. Assistance. The Department of Conservation; the Department of Inland Fisheries and Wildlife; the Department of Transportation; the Department of Agriculture, Food and Rural Resources; the State Planning Office; and all other state agencies shall provide staff support and assistance considered necessary by the board to fulfill the objectives of this chapter. If agency assistance is not available, consultants may be hired from the proceeds of either the Land for Maine's Future Fund or the Public Access to Maine

Waters Fund to assist the board in carrying out its responsibilities.

[1993, c. 728, §6 (amd).]

Section History:
1987, c. 506, § 1.4 (NEW).

1987, c. 858, § 1.2 (AMD).

1989, c. 502, § B2 (AMD).

1993, c. 728, § 6 (AMD).

5 § 6205. Board meetings; rules and administrative proceedings

1. Meetings. The board shall meet at least 4 times each year. The chair shall call the meetings of the board.

[1993, c. 728, §7 (amd).]

2. Rules. The board, acting in accordance with section 8052, may adopt rules it considers necessary for the conduct of its business.

[1993, c. 728, §7 (amd).]

3. Compensation. Appointed members are entitled to receive compensation equal to legislative per diem and travel expenses as allowed under section 12004-G, subsection 29 while engaged in board activities.

[1993, c. 728, §7 (amd).]

4. Quorum. A quorum of the board for the transaction of business is 7 members.

[1993, c. 728, §7 (amd).]

5. Personal bias. If a charge of bias or personal financial interest, direct or indirect, is filed against a member requesting that member to withdraw from a proceeding of the board, that member shall determine whether or not to withdraw and shall make that determination part of the record of that proceeding.

[1993, c. 728, §7 (amd).]

Section History:
1987, c. 506, § 1.4 (NEW).

1987, c. 858, § 3 (AMD).

1989, c. 503, § B22 (AMD).

1993, c. 728, § 7 (AMD).

5 § 6206. Board responsibilities

1. Responsibilities. The board shall:

A. Complete an assessment of the State's public land acquisition needs and develop a strategy and guidelines, based on that assessment, for use in allocating the proceeds of the Land for Maine's Future Fund and the Public Access to Maine Waters Fund. Both the assessment and the development of a strategy and guidelines must be conducted with opportunities for participation by interested state agencies and the public; [1993, c. 728, §8 (amd).]

B. [1993, c. 728, §8 (rp).]

C. Receive and review funding requests from state agencies and cooperating entities for acquisition projects meeting state guidelines; [1987, c. 858, §4 (rpr).]

D. In accordance with the strategy and guidelines developed under paragraph A, authorize distribution of proceeds from the Land for Maine's Future Fund and the Public Access to Maine Waters Fund for acquisitions of property or interests in property; and [1993, c. 728, §8 (amd).]

E. On January 1, 1995 and on January 1st every 2 years thereafter, report to the joint standing committee of the Legislature having jurisdiction over natural resources matters on expenditures from the Land for Maine's Future Fund and the Public Access to Maine Waters Fund and revisions to the strategies and guidelines. [1993, c. 728, §8 (amd).]

[1993, c. 728, §8 (amd).]

Section History:

1987, c. 506, § 1,4 (NEW).

1987, c. 858, § 4 (RPR).

1993, c. 728, § 8 (AMD).

5 § 6206-A. Nominations

Prior to taking an action to designate land for negotiation for acquisition, the board shall send by certified mail or otherwise deliver a notice of this intention to the owner or owners of land within the area proposed by the board for acquisition, as the identity and address of such owner or owners is shown on the tax maps or other tax records of the municipality in which the land is located. If the land is located within the unorganized territory, notice must be sent to the owner or owners as shown on the tax maps or other tax records of the State Tax Assessor. After the completion of negotiations, the board shall publish a notice of its intent to designate land for acquisition in a newspaper or newspapers of general circulation that identifies the land proposed by the board for acquisition and that notifies the residents of the area that the board will accept public comments on the proposed acquisition. [1993, c. 728, §9 (amd).]

Any owner of land that has been nominated for acquisition and is subject to the notice requirements of this section may submit a properly sworn affidavit to the board indicating the owner's unwillingness to sell. The affidavit is notice to the board that continued evaluation of that land is inappropriate and, unless the board intends to acquire an interest in the land through the use of eminent domain pursuant to section 6207-A, the board may not consider that land for acquisition. [1993, c. 728, §9 (amd).]

Section History:

1989, c. 485, § 1 (NEW).

1989, c. 603, § 1 (RPR).

1989, c. 607 (AMD).

1993, c. 728, § 9 (AMD).

5 § 6207. Acquisition criteria

1. Distribution of funds. The board shall authorize the distribution of funds from the Land for Maine's Future Fund and the Public Access to Maine Waters Fund to state agencies and cooperating entities for the acquisition of natural lands that meet the criteria set forth in this chapter.

[1993, c. 728, §10 (amd).]

2. Determination of state significance. In determining whether a proposed acquisition must be funded, in full or in part, by the Land for Maine's Future Fund or the Public Access to Maine Waters Fund, the board shall consider whether the site is of state significance and:

A. Contains recreation lands, prime physical features of the Maine landscape, areas of special scenic beauty, farmland or open space, undeveloped shorelines, wetlands, fragile mountain areas or lands with other conservation, wilderness or recreation values; [1995, c. 462, Pt. D, §1 (amd).]

B. Is habitat for plant or animal species or natural communities considered rare, threatened or endangered in the State; or [1987, c. 506, §§1,4 (new).]

C. Provides nonmotorized or motorized public access to recreation opportunities or those natural resources identified in this section. [1995, c. 462, Pt. D, §1 (amd).]

[1995, c. 462, Pt. D, §1 (amd).]

3. Priorities. Whenever possible, the Land for Maine's Future Fund and the Public Access to Maine Waters Fund must be used for land acquisition projects when matching funds are available from cooperating entities, provided that the proposed acquisition meets all other criteria set forth in this chapter. For acquisitions funded by the Land for Maine's Future Fund, the board shall give priority to projects that conserve lands with multiple outstanding resource or recreation values or a single exceptional value, provide geographic representation and build upon or connect existing holdings.

[1993, c. 728, §10 (amd).]

4. Nonqualifying expenditures. The board may not fund:

A. Facilities for organized recreational activities, including, but not limited to, ballparks, tennis courts or playgrounds; [1987, c. 506, §§1,4 (new).]

B. Except as provided in section 6203, subsection 3, paragraph B and section 6203-A, subsection 3, paragraph B, capital improvements on any publicly owned facilities; and [1993, c. 728, §10 (amd).]

C. The acquisition of land of which the primary use value has been and will be as commercially harvested or harvestable forest land. [1993, c. 728, §10 (amd).]

[1993, c. 728, §10 (amd).]

Section History:
1987, c. 506, § 1,4 (NEW).
1989, c. 876, § B1 (AMD).
1993, c. 728, § 10 (AMD).
1995, c. 462, § D1 (AMD).

5 § 6207-A. Use of eminent domain

The board may expend funds to acquire an interest in land obtained by the use of eminent domain only if the acquisition has been approved by the Legislature or is with the consent of the owner or owners of the land, as the identity and address of the owner or owners is shown on the tax maps or other tax records of the municipality in which the land is located. If the land is located within the unorganized territory, for purposes of this section the identity of the owner or owners must be as shown on the tax maps or other tax records of the State Tax Assessor. [1995, c. 139, §1 (amd).]

Section History:
1989, c. 485, § 2 (NEW).
1989, c. 603, § 2 (RPR).
1993, c. 728, § 11 (AMD).
1995, c. 139, § 1 (AMD).

5 § 6208. Municipal approval

1. Approval. Approval by the elected municipal officials is required when more than 1% of a municipality's state valuation is considered for acquisition under a bond issue.

[1993, c. 728, §12 (amd).]

2. Transactions. Any acquisition by eminent domain funded by the board, when the land exceeds either 50 acres or \$100,000 in assessed value, is subject to the approval of the municipality in which the land is located. That approval may be obtained either from the elected municipal officials or, if those officials do not approve, by vote of the town meeting or by referendum of the electorate. If the land involved is located within the unorganized territory, this requirement does not apply.

[1993, c. 728, §12 (amd).]

Section History:
1987, c. 506, § 1,4 (NEW).
1989, c. 603, § 3 (AMD).
1993, c. 728, § 12 (AMD).

5 § 6209. Ownership; title; management

1. Uses of funds. The board may use the Land for Maine's Future Fund and the Public Access to Maine Waters Fund to acquire real property in both fee and less-than-fee simple interest, including, but not limited to, conservation easements, access easements, scenic easements,

other permanent interests in land and long-term leases of at least 99 years, provided that those acquisitions are primarily natural lands meeting the criteria set forth in this chapter.

[1993, c. 728, §13 (amd).]

2. Title. Title to all lands acquired pursuant to this chapter must be vested solely in the State. Management responsibilities for the acquired lands may be contracted by the land-owning state agency to cooperating entities, subject to appropriate lease arrangements, upon the recommendation of the agency's commissioner and approval of the board.

[1993, c. 728, §13 (amd).]

3. Matching funds. When matching funds for a project include cash not derived from a bond request, an allocation of up to 20% of the appraised value of the acquired land or the amount of cash, whichever is less, may be put into the stewardship account of the state agency holding title to the land.

[1993, c. 728, §13 (amd).]

4. Payments. Payments from the fund may be made to cooperating entities for qualifying lands acquired on behalf of the State, provided that a state agency has issued to the cooperating entity a letter of intent requesting assistance in the acquisition. Upon submission to the state agency of a cooperating entity's direct expenses for acquisition and related costs of an authorized acquisition, the board shall authorize payment of those expenses, provided that the total of all expenses does not exceed the appraised value of the acquired property. Expenses must be paid at intervals during the acquisition process, as determined by the board.

[1993, c. 728, §13 (amd).]

5. Land evaluated. All lands acquired with money from the Land for Maine's Future Fund or the Public Access to Maine Waters Fund must be evaluated for rare, threatened or endangered species of plants and animals, exemplary natural communities, features of historic significance and other high priority natural features and ecologic functions as determined by the board, with reference to the best inventory data available to the State. Subsequent management by state agencies holding properties found to have such important features and functions must reflect the objective of maintaining and protecting those features and functions.

[1993, c. 728, §13 (amd).]

6. Legislative approval. Land acquired under this chapter may not be sold or used for purposes other than those stated in this chapter, unless approved by a 2/3 majority of the Legislature.

[1993, c. 728, §13 (amd).]

Section History:
1987, c. 506, § 1,4 (NEW).
1993, c. 728, § 13 (AMD).

5 § 6210. Data sharing

If the board transfers in writing to any local or federal agency any written information acquired by the board under this chapter concerning any land, the board shall, upon transfer, notify the landowner of the transfer by certified mail. [1989, c. 485, §3 (new).]

Section History:
1989, c. 485, § 3 (NEW).

5 § 6211. Land for Maine's Future Board-sponsored credit card

1. Land for Maine's Future Board-sponsored credit card. The Land for Maine's Future Board may enter into an agreement with a financial institution, as defined in Title 9-B, section 131, subsection 17, a credit union, as defined in Title 9-B, section 131, subsection 12, or other credit card issuer to issue a credit card for the benefit of the Land for Maine's Future Board.

[1995, c. 516, §1 (amd).]

2. Agreement. If the Land for Maine's Future Board enters into an agreement with a financial institution, credit union or other credit card issuer in accordance with subsection 1, the Land for Maine's Future Board shall negotiate the most favorable agreement for the Land for Maine's Future Board, considering such factors as:

- A. The rate for the Land for Maine's Future Board's fee by a credit card issuer; [1995, c. 358, §1 (new).]
- B. The ability of the financial institution or other credit card issuer to market the card successfully; and [1995, c. 516, §1 (amd).]
- C. Customer service offered by the financial institution or other credit card issuer. [1995, c. 516, §1 (amd).]

[1995, c. 516, §1 (amd).]

3. Distribution of proceeds. Funds received by the Land for Maine's Future Board under the agreement with the financial institution, credit union or other credit card issuer must be deposited in the Land for Maine's Future Fund.

[1995, c. 516, §1 (amd).]

Section History:
1995, c. 358, § 1 (NEW).
1995, c. 516, § 1 (AMD).

Wednesday, February 17, 1999

Call from David Heidel 920-994-4044
W6174 Highway SS
Random Lake, WI 530375

Town of Sherman (town board or some commission or committee)

In the Town of Sherman they are getting a new auto dealership and he is interested in lighting restrictions. Knew you had a Dark Sky Bill. Wondered about having fixtures that cut off at a certain time (say 9 PM in evening).

Wants some info. Feels those fellow members of town board or commission is not aware of lighting control or restrictions.

Wants Info & may want to have Jim call him.

He is dairy farmer and is generally available in morning, or call and wife is home & he will call back.

Henderson, Patrick

From: Knutson, Tryg
Sent: Monday, January 25, 1999 8:58 AM
To: Sen.Baumgart
Subject: FW: Light pollution Bill

-----Original Message-----

From: Knutson, Tryg
Sent: Monday, January 25, 1999 8:56 AM
To: 'stargal@spacestar.net'
Cc: Romanski, Randy; Templeton, Carrie
Subject: RE: Light pollution Bill

Hey Laura -

I have moved....but to Senator Erpenbach's office (Sen. Joe Wineke's replacement) - not Sen. Baumgart.....Sorry I can't help you with the legislation.....am forwarding your message up to the Clausing office....I'm sure they can help you with it, or will forward it to Baumgart's office if necessary.

Good to hear from you.

Tryg.

-----Original Message-----

From: Laura Furtman [<mailto:stargal@spacestar.net>] <[mailto:\[mailto:stargal@spacestar.net\]](mailto:[mailto:stargal@spacestar.net])>
Sent: Saturday, January 23, 1999 10:41 AM
To: Knutson, Tryg
Subject: Light pollution Bill

Dear Tryg,

I hear you are working for Senator Baumgart these days. I hope he knows how lucky he is to have you. Congratulations! My husband, Greg, and I are interested in supporting a bill that I believe Senator Baumgart introduced when he was a Representative. It has to do with controlling light pollution. My husband is an amateur astronomer and belongs to the Chippewa Valley Astronomical Society, based in the Eau Claire area. I believe this group would be interested in generating support for this bill, as would I. Is Senator Baumgart still interested in this piece of legislation? Could we get a copy of the bill he had introduced earlier?

Thanks,
Laura Furtman

Laura Furtman
27426 County Rd H
Webster, WI 54893
715-635-7928

1-26-99
PAT:
KEEP NAME
ON BILL ✓
E MAIL BACK, SAY WE
ARE ~~CHANGING~~ LEGIS
LEGISLATION +
CREATING LEGISLATION
NOW FOR FUTURE
INTRODUCTION

Headwaters Group of Northern Thunder
PO Box 124
Fairchild, WI 54741
715/334-2271 resenergy@aol.com

November 20,

Dear Barbara,

Thought you might be interested in the enclosed. We are working to try to get our local electric co-op (Jackson electric) on board. It's a win/win for them and their customer services rep is an amatur astronomer!

Sincerely yours,



Tom Wilson
encl.

Environmental Building News TM

The Leading Newsletter on Environmentally Responsible Design & Construction

Volume 7, Number 8

September 1998

Light Pollution: Efforts to Bring Back the Night Sky

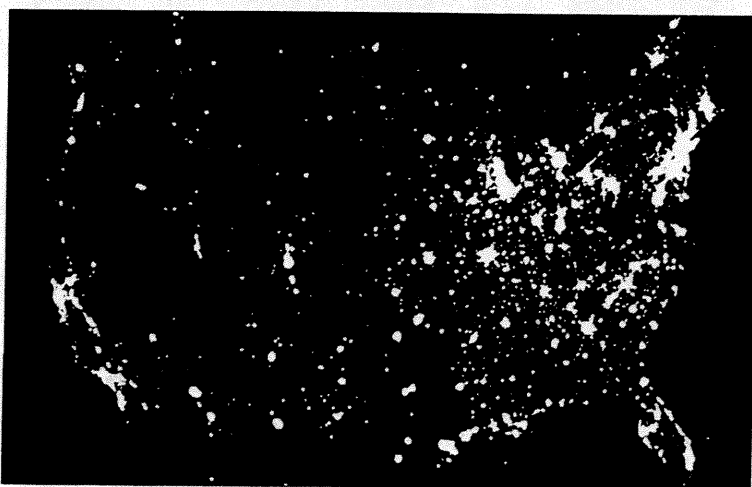
WHEN I BEGAN THINKING about an article on light pollution, three very different experiences came to mind. The first was 25 years ago, sleeping under the stars in Alberta, Canada. I can still picture that night sky: resplendent with tens of thousands of sparkling stars on a solid black background and the Milky Way's broad band stretching from horizon to horizon. The second experience was here in Vermont about a year ago. Following a planning commission meeting, I watched a rare luna moth—the first I had seen in quite a few years—circle the bright mercury-vapor light outside our town office. I knew that this large, pale green moth would be alive only a few hours (adults live just long enough to find a mate) and would likely perish circling the brilliant globe of blue-white light. The third experience was a few weeks ago in Boulder, Colorado. Late one night, from the porch of a house perched on the foothills above the city, we scanned

the nightscape below. As far as the eye could see, there were artificial lights starting up at us—the few hundred visible stars were losing the battle for visibility above the burgeoning metropolis.

Light pollution is something that few of us give much thought to. Astronomers have championed the call for limits to our night-sky pollution because it impinges on their ability to study celestial bodies; some poets mourn the loss of a spiritual connection to the heavens—but for most people light pollution is not even an aesthetic affront. Three-fourths of Americans grow up never having seen the Milky Way. The man-made wonders of fireworks and laser light shows have replaced the natural wonders of a brilliant night sky for children today. But light pollution is about more than astronomy and aesthetics. It is wreaking havoc in certain natural systems—from sea turtle nesting in Florida to migrating birds in Toronto and sycamore trees in urban parks.

There are some who suggest that human health is affected by lack of darkness. And because light pollution is really a symptom of waste, we are also paying a price for it in resource depletion and the multifarious impacts associated with generating the electricity to power it. This article reviews some of the issues involved with light pollution

(continued on page 8)



Light pollution is clearly evident in this composite nighttime satellite photo of the United States (1978).
Source: International Dark-Sky Association

In This Issue:

Feature Article 1
*Light Pollution:
 Efforts to Bring Back
 the Night Sky*

What's Happening ... 2
*Interface Prepares
 Revolutionary New
 Carpet*
*NAHB to Host Green
 Building Conference*
*The Beginning of the
 End of Cheap Oil?*
 Newsbriefs
 Awards & Competitions

Product News &
 Reviews 5
*Neil Kelly Offers Green
 Kitchen Cabinets*

Projects 6
*Alberta Sustainable
 Home/Office: Self-
 Sufficiency and Style
 in the Frigid North*

From the Library 14
*Introduction to
 Stormwater*
*Create an Oasis
 with Greywater*
*Builder's Greywater
 Guide*

Calendar 16

Quote of the month:

"World production of conventional crude oil will peak in less than ten years."

(page 3)

Light Pollution (continued from page 1)

and presents strategies for bringing back the darkness.

Understanding Light Pollution

Light pollution has been brought to our attention primarily by astronomers who are increasingly unable to view the night sky. Many of our most important research observatories built over the past century are severely compromised today. Mount Wilson's 100-inch (2.5 m) telescope near Los Angeles is virtually useless for deep-sky observations. The Palomar Mountain Observatory, with its 200-inch (5 m) telescope, was built 50 years ago far from any city, but it is now at risk of being unable to continue many key types of research due to light pollution from San Diego and Escondido. Even Hawaii's Mauna Kea observatory, at an elevation of 14,000 feet (4,300 m), is beginning to be affected by light pollution.

According to astronomy professor Arthur Uppgren of Wesleyan University, about 2,500 individual stars should be visible to the human eye in an unpolluted sky. In a typical suburb with moderate illumination, only 200 to 300 stars are visible. And in cities we can usually see only a few

dozen. The reason for this is that the light pollution competes with the light from the stars. Even in a rural village, artificial light is likely to be twice the brightness of the night sky; in a typical suburb, light pollution may exceed the night-sky brightness fivefold, and in a moderate-size city, such as Middletown, Connecticut, where Uppgren teaches, the difference is 20- to 25-fold.

Light pollution is the upward and outward distribution of light, either directly from fixtures or from reflection off the ground or other surfaces. *Glare* is direct light shining from a fixture (luminaire) that makes it difficult to see or causes discomfort—it is especially a problem for motorists. *Light trespass* describes the shining of light onto neighboring properties when that light is intrusive or objectionable. *Sky glow* refers to the composite illumination coming from towns, cities, and other developed areas—it is the yellowish glow you see in the sky when you look from a relatively dark area toward a nearby town or city.

In addition to looking at light pollution as an impact on others, it can also be thought of as a symptom of wasted energy. It is light that isn't going where it is needed. The Inter-

national Dark-Sky Association (IDA) in Tucson, Arizona estimates that about a third of the light we use out-of-doors escapes into the night sky where, instead of providing useful illumination, it causes glare, light trespass, and sky glow.

Among the most common sources of light pollution are streetlights that fail to deliver all of their light downward, outdoor security lights around buildings, billboard illumination directed upward onto the signs (some missing the signs altogether and a lot of the rest reflecting off the signs), landscape illumination directed upward or outward, and light escaping from inside buildings at night (including office buildings that are left fully lit for cleaning, and convenience stores that operate at night with extremely high illumination levels). We will examine below how these and other sources of light pollution can be controlled.

Ecological and Health Risks of Light Pollution

The ecological impacts of light pollution have been studied extensively in a few situations, yet hardly at all in others. The most extensive research has been done on nesting sea turtles along the southern Atlantic and Gulf coasts. Four species of sea turtles nest along these coasts, all of



Source: International Dark-Sky Association

The level of light pollution in Los Angeles, California has risen dramatically from the beginning of the century to the recent past, as shown in photos of the nighttime cityscape in 1908 (left) and 1988 (right), taken from Mount Wilson Observatory.

which are either endangered or threatened: the loggerhead, green, leatherback, and hawksbill turtles. Sea turtle nesting occurs between May 1 and October 31. Female sea turtles go ashore to dig nests in the sand and lay eggs. When bright artificial light is present, females may avoid coming ashore altogether, or they may become disoriented, wandering onto roads where they are killed.

Sea turtle hatchlings, which almost invariably hatch at night, instinctively head toward light. Before the advent of electric lighting, the sea's surface was brighter than inland because of the moon's reflection on it or from bioluminescence, and sea turtles evolved to follow that light. Due to light pollution, hatchlings often head in the wrong direction. They may wander great distances along shore (exposing themselves to predation), or head inland toward lights and get run over by vehicles. In one tragic case in Florida, about 500 tiny green sea turtle hatchlings followed the light of an abandoned beach fire to their chary deaths.

The impact of light pollution on migrating birds has also been examined in some detail. Small migrating songbirds, especially warblers, are apparently the most affected by light pollution, probably due to their pattern of migrating at night at low altitude. The report *Collision Course: The Hazards of Lighted Structures and Windows to Migrating Birds*, published by WWF - Canada (Toronto, 1996), examines the impact of lighted structures and windows on migrating birds. "In the dark, and especially in foggy or rainy weather," according to the report's authors, "the combination of glass and light becomes deadly. Confused by artificial lights, blinded by weather, and unable to see glass, birds by the hundreds and even thousands can be injured or

LAMP CHARACTERISTICS

Lamp Type and Color	Common Wattages	Mean Lumens	Lumens per Watt EFFICACY	Rated Avg Lamp Life HOURS	CRI COLOR RENDERING	CCT COLOR TEMP
Incandescent warm white	100	1,200	12	1,000	100	2,900
	150	2,000	19	1,000	100	2,775
Compact Fluorescent cool green-white	16	600	38	10,000	82	2,800
	28	1,485	53	10,000	82	2,700
Mercury Vapor cool blue-white	175	7,200	47	24,000	50	3,900
Metal Halide icy white	70	3,400	78	12,000	70	3,200
	175	12,100	94	15,000	75	4,000
	250	15,000	100	15,000	70	3,600
High-Pressure Sodium yellow-orange	70	5,050	85	24,000	22	1,900
	150	13,500	100	24,000	22	2,000
	250	23,400	110	24,000	22	2,100
Low-Pressure Sodium orange	35	4,000	180	18,000	-44	1,800
	90	11,095	180	16,000	-44	1,800

Lamps (light bulbs) vary tremendously in energy use and performance properties. Understanding these properties will help the designer specify the right light source for a given project

Source: *Outdoor Lighting Manual for Vermont Municipalities*

killed in one night at one building." Illuminated structures often "trap" nocturnal migrants. Light pollution reflecting off of low clouds may contribute to the disorientation, according to professor Sidney Gauthreaux of Clemson University.

From 1993 through 1995, volunteers in Toronto recorded 100 different species killed or injured by flying into buildings at night. A single building in Chicago, which was checked daily by volunteers during the migrating seasons, killed 20,697 birds over a 14-year period—an average of 1,478 per year. A smokestack at an Ontario Hydro power plant near Bath, Ontario killed a total of 22,779 birds between 1972 and 1982. The birds were attracted by floodlights; once those lights were replaced with strobe lights, the numbers of migrating birds killed dropped to just a few per year.

In addition to death and injury from flying into illuminated structures, the daily cycles of some birds are being altered by light pollution. According to the book *Night Has a Thousand Eyes* by Arthur Upgren, birds that sing at dawn are sometimes tricked by streetlights: "The British Trust for Ornithology esti-

mates that at any given hour on any given night, 10,000 English robins are serenading a false dawn."

Insects are also affected by outdoor lighting, as noted at the beginning of this article. Lepidopterists (scientists who study moths and butterflies) have long blamed outdoor lighting for declines in several species of North American moths, particularly saturniids (the giant luna, cecropia and polyphemus moths) in the northeastern United States, though few if any detailed studies have been done. It is unknown whether the lights interrupt mating, kill individuals directly, or have other effects. It appears that populations of some moths are affected more than others. Also, some species may have adapted to bright lights as a selection strategy (i.e., individuals who were less affected by outdoor lights tend to survive and pass on their genes).

An article in a newsletter of the Astronomical Society of Wakabadai (Japan) describes ecological impacts of artificial light on fireflies, noting impacts of light on firefly communication, mating and larva. Due perhaps to the spiritual significance of fireflies in Japanese culture, the Japanese Environment Agency and the Illuminat-

ing Engineering Institute of Japan are working on guidelines to stop light pollution, according to the newsletter.

Plants can also be affected by light pollution, though little research has been done on this issue. It is well known that certain frequencies and intensities of light regulate the development and flowering of plants—a process referred to as photoperiod response. “Many trees and shrubs go dormant and lose their leaves in response to shortening days,” explains plant physiologist Dr. Winslow Briggs of the Carnegie Institution of Washington in Stanford, California. “Extending the day length (or interrupting the night) will prevent—or at least delay—that response.” He told *EBN* that there are sycamores in the Central Valley towns of California that don’t properly lose their leaves when they are too close to streetlights.

While not all plants respond to photoperiod, those that do can be affected by very low light intensities, according to Briggs—well within the range of outdoor lighting. This is borne out by research being done by NASA at the Kennedy Space Center in Florida. Researcher Neil Yorio was trying to grow wheat and potatoes together—as potential food sources for a space station—but found that the long day length required for optimal wheat production blocked tuber formation in potatoes. Subsequent experiments found that irradiance levels as low as 3 footcandles (fc) block tuber formation. Whether extended “day length” from light pollution in urban and suburban areas might be killing off trees, shrubs, and certain flowering plants by delaying dormancy is not known, but it is certainly a real possibility that warrants further investigation.

Even human health may be affected by light pollution—or rather, by the absence of long enough periods of darkness. At issue is the influence of light on hormone production. An

article in the July 3, 1993 edition of *Science News* suggests that nighttime illumination can affect estrogen levels in women, which in turn can increase susceptibility to breast cancer. According to the article, the high incidence of breast cancer in highly industrialized nations could result from the higher lifetime dose of estrogen. One theory is that bright lights somehow restrict the brain’s nocturnal production of melatonin, which is a regulator of estrogen production. Whether such a connection between light levels and breast can-

ILLUMINANCE VALUES

Full Moonlight	.01 to 0.1 footcandle
Predawn	0.1 to 1 footcandle
Windowed Room on a Cloudy Day	6-8 footcandles
Beach in Bright Sunlight	30,000 footcandles

The human eye has tremendous capacity to adapt to varying light levels—from less than a tenth of a footcandle to more than 30,000 footcandles.

Source: *Outdoor Lighting Manual for Vermont Municipalities*

cer (or other human health impacts) will be borne out by future research is unknown. Nor is it clear whether the levels of light we are exposed to through *light pollution* are high enough to affect hormone production.

Outdoor Lighting, Safety, and Crime

Conventional wisdom is that the more light we pour onto an outdoor space, the safer it will be. We illuminate convenience stores, gas stations, and parking lots at light levels up to 100 footcandles (fc) in the guise of safety. But increasingly this conventional wisdom is being challenged. More light doesn’t necessarily mean greater security.

Russell Leslie, of the Lighting Research Center (LRC) at Rensselaer Polytechnic Institute in Troy, New

York and co-author of *The Outdoor Lighting Pattern Book*, points out that there is a difference between providing security through outdoor lighting designs and providing a sense of security. “All you can do,” he said, “is get people to feel that they’re safer.” Studies by LRC researchers have shown that about 3 fc is a reasonable limit to the amount of light needed for security purposes. Just as important as the illuminance level, however, is the uniformity of that light, the coverage (whether there are gaps with no light), and the color of the light. Light coverage influences whether there will be dark shadows, which can reduce the perception of safety. An important requirement of security lighting for police is the ability for potential crime witnesses to identify criminals—and that requires being able to distinguish color (clothing, vehicles, hair, etc.), which is almost invariably listed in crime reports by witnesses.

Nancy Clanton, P.E., of Clanton Engineering in Boulder, Colorado (who chairs the outdoor Environmental Committee for the Illuminating Engineering Society of North America (IESNA) and sits on the board of directors of the International Dark-Sky Association), believes that the outdoor lighting levels recommended by IESNA for various functions (see checklist, page 13) are fairly reasonable, but that we should use them as *average* levels rather than minimum levels. She concurs with Leslie that we should try to increase the uniformity of outdoor lighting, even though it may mean a larger number of fixtures for a given area. “Uniformity should be the driving force,” she says. She also shares with Leslie a strong leaning toward whiter light, such as that from metal halide lamps. Dave Crawford and some others with IDA argue that white light is *not* essential. “At low light levels,” he says, “the eye doesn’t see color anyway. For such lighting levels high-pressure sodium or low-

pressure sodium are just fine—and very energy efficient.”

Clanton argues that outdoor lighting levels, in general, should be reduced. “We are way overlighting our outdoor spaces,” she told *EBN*. At gas stations and convenience stores, she says, it is not uncommon to see light levels that are 3 to 10 times the levels recommended by IESNA. Many franchise operators require that their franchisers keep their outside spaces at 100 fc or more, while the IESNA-recommended levels are between 10 and 30 fc. The argument is made that such high light levels are provided for safety, she notes, yet studies show that bright light can be very hard to adjust to and from—particularly for elderly drivers. “It takes the elderly two to five minutes to readapt to low light levels,” she says. During the first few minutes back on the road, therefore, the potential for accidents is significantly increased. It takes the human eye longer to adapt to a change from light to dark than from dark to light.

A practice that can both increase security and reduce light pollution is to make use of motion-sensing light controls. In a location where the lighting is strictly for security and usage is low, it may make sense to put lights on circuits controlled by infrared motion sensors. This option requires that rapid-start lights be used—which usually rules out the most efficient high-intensity discharge (HID) lamps—but the usage is low, so even incandescent can be acceptable.

A number of school districts are turning conventional wisdom on its head by keeping all background lighting off. This so-called “dark campus” approach has been adopted by a number of schools nationwide and is both saving money and reducing vandalism. The basic approach is to turn off all lights for an extended nighttime period—typically from 11 p.m. to 5 a.m.—and instruct all students and staff that the school grounds are off-limits during that

period. Local law enforcement officials are informed of the blackout period, and thus any lights arouse suspicion. In San Antonio, Texas, for example, the school district adopted this practice in 1973. Not only has the school realized impressive energy savings, but the cost of repairing damage from vandalism has dropped from \$160,000 to \$41,000 per year. Sam Wolf, director of security for the district, provided this explanation of the benefits of darkness in an article

REFLECTANCE FACTOR

New Snow	75%
White Painted Surface	70%
Concrete	40%
Old Asphalt	35%
New Asphalt	7%
Grass	6%

Ground surfaces differ widely in their light reflectance properties, which should be accounted for in lighting designs.

Source: Outdoor Lighting Manual for Vermont Municipalities

by Bruce Sullivan in *Building Operator* (Iris Communications, 1991): “I remember as a kid, we never hung around in the dark. We hung around a streetlight. We wanted to see who was with us.” The article suggests that the thrill of vandalism disappears if you can’t see the window break or the paint on the wall. Schools in Eugene, Oregon; Cupertino, California; and Tucson, Arizona have also experienced success with this approach.

Putting a Price Tag on Light Pollution

Just how much energy (and money) we waste on light pollution is very difficult to quantify. Crawford of the International Dark-Sky Association estimates that more than \$2 billion dollars per year in the U.S. are wasted through outdoor light pollu-

tion. This estimate is based on a common outdoor light fixture: the 175-watt mercury vapor lamp that is on from dusk to dawn using 860 kilowatt-hours (kWh) per year (worth \$69 at an electricity cost of 8¢/kWh). Tucson has 20,000 such lights and a population of 600,000 (1990 data). Because the U.S. population is 500 times that of Tucson, IDA deduced that this type of mercury vapor lamp costs about \$700 million to operate per year. The study further assumed that 30% of the light coming out of the fixture is wasted, an estimate they call conservative (it may be significantly more), so the waste from this type of lamp nationwide is \$200 million dollars. Finally, he estimates that 175-watt mercury lights represent one-tenth of outdoor lighting, bringing the total annual energy waste to about \$2 billion per year.

Pursuing these numbers from a different angle, *EBN* came up with about the same answer using data on lighting energy use compiled by Barbara Atkinson at Lawrence Berkeley National Laboratory (LBNL). Using various sources, she estimated that in 1990 streetlighting accounted for 15 terrawatt-hours (TWh) per year (one terrawatt equals 10¹² watts) and commercial outdoor lighting consumed 62 TWh, for a combined 77 TWh per year or 15% of the total U.S. electricity consumption of 515 TWh. If we assume the same 30% loss that IDA assumed, then we arrive at 23 TWh of wasted light energy. At 8¢/kWh, the cost of that wasted energy would be \$1.8 billion. This estimate still seems conservative, because it is likely that (a) significantly more than 30% of the commercial outdoor lighting used for billboards is lost as bottom-lighting that misses its target or is reflected into the night sky; and (b) some of the 254 TWh of commercial indoor lighting and 103 TWh of residential lighting either is outdoor lighting or results in light pollution via losses through windows. Thus, we reached the same conclusion that light pollution probably costs at least



Source: Kim Lighting

Full-cutoff luminaires direct nearly all of their light downward, thus reducing light pollution. This Archetype® luminaire from Kim Lighting is available in various styles and ballasts for 70- to 175-watt metal halide and high-pressure sodium lamps.

\$2 billion per year in the United States.

That \$2 billion or 25 TWh of wasted electricity produces something on the order of 19 million tons of carbon dioxide per year (metric), assuming the average U.S. mix of electricity generation—plus commensurate production of other air pollutants.

These numbers are clearly fairly crude, and the need for more careful analysis should be a high priority. If it can be demonstrated that very good economic arguments exist for reducing light pollution (wasted light energy), then bringing about change will be easier. Like many other pollution-related problems, dealing with light pollution is a win-win situation: light trespass and sky glow are reduced at the same time that money is saved—potentially very large amounts of money. Unlike most other pollution problems, there is no long-term legacy with light pollution; when the wayward light source is fixed (i.e., turned off or corrected), the light pollution ends, and that's

the end of the story.

Regulating Light Pollution

Hundreds of municipalities around the country—from Tucson, Arizona to Kennebunkport, Maine—have adopted or are considering the adoption of ordinances designed to limit light pollution. Tucson was the first city to tackle this issue, primarily because of the significant observatories surrounding the city, including the Kitt Peak National Observatory. But many municipalities have followed suit, and new resources (see listings at the end of the article) are making it easier and easier.

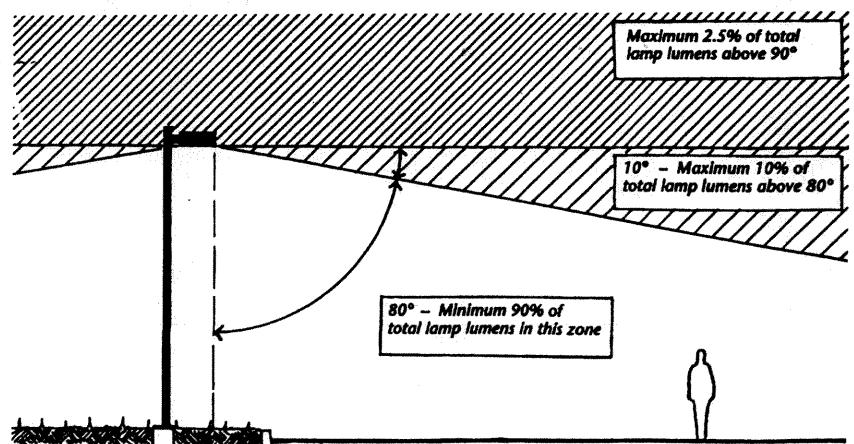
In some cases, outdoor lighting regulations were developed for very specific purposes. That is the case with sea turtle nesting areas along the Atlantic and Gulf coasts. Sandy MacPherson, the National Sea Turtle Coordinator for the U.S. Fish & Wildlife Service in Jacksonville, Florida, told *EBN* that as much as 70% of the Florida coastline is now protected by outdoor lighting ordinances, and spottier regulations are in place further up the East Coast. Most are countywide ordinances, though individual towns sometimes pass even stricter standards. Some of these ordinances are comprehensive, addressing light pollution generally; others are limited to the immediate

beachfront area and are designed solely for the protection of sea turtle populations. MacPherson cautions that “just having a lighting ordinance on the books does not mean that it will be enforced,” but she feels that the laws have had a tremendous impact.

Outdoor lighting ordinances, including a model ordinance available from IDA (see address and Web site at the end of the article), have been refined over the past decade and are very clear and understandable. Most are designed to do the following:

- Control glare by requiring luminaires that are shielded to direct light downward;
- Limit the height of luminaires relative to the property boundary, thus preventing light trespass onto adjoining properties;
- Require top-lighting for advertising signs that are externally illuminated;
- Prohibit certain types of advertising lights, such as searchlights and laser lights;

The model ordinance *EBN* examined provides for grandfathering of most existing lighting, exemptions for both emergency lighting and low-lumen lighting (such as around houses), and other measures to make the law as easy as possible to use and as palatable as possible to the community.



Cutoff fixture as defined by IESNA. “Full-cutoff” fixtures do not allow any light above the horizontal plane.

Source: *Outdoor Lighting Manual for Vermont Municipalities*

Several states, including Connecticut, New Jersey, Iowa and Texas, are considering statewide laws to control light pollution. Also, the Outdoor Environmental Committee of the Illuminating Engineering Society of North America is working on recommendation standards for outdoor lighting that will, for the first time, clearly address light pollution.

Because the regulation of light pollution is a relatively new issue that few people have thought about, it is often possible for a single individual or small group of individuals to bring about very significant change. When local planning commissions and residents understand the issues of light pollution and the advantages and ease of avoiding it, most are

fairly receptive, though companies and lobbies involved with outdoor advertising may be vocal in opposition to new regulations.

With passage of its stringent lighting regulations, Sanibel Island, on the Gulf Coast of Florida, now has no streetlights, and at night the municipality is as dark as some of the most

Minimizing Light Pollution: A Checklist for Action

Avoid outdoor lighting. Avoid outdoor lighting where it isn't needed—but don't sacrifice nighttime safety or the perception of safety. With schools and other facilities where vandalism is a problem, experiment with eliminating all lighting between 11 p.m. and 5 a.m.

Use timers. Where acceptable, use timers to turn outdoor lights off during those hours when they are not needed (e.g., in parking lots after stores close and employees have left).

Use motion-detector controls. For security applications, especially around residential buildings, specify motion-sensing controls so that lights will turn on when somebody walks by. Infrared sensors are recommended over ultrasonic sensors for outdoor lighting. Rapid-start lamps (typically fluorescent or incandescent) are required where motion-sensing controls are used.

Turn off interior lighting at night. Design interior lighting in commercial buildings to switch off automatically when spaces are not occupied or after work hours. Consider occupancy sensors for residential buildings if lights are commonly left on by mistake.

Minimize outdoor lighting levels. Carefully match outdoor lighting levels with the application and use no more than absolutely necessary. IESNA-recommended light levels are as follows (indicated in footcandles):

- Commercial building entrances (active): 5
- Commercial building entrances (inactive): 1
- General human safety: 0.5 – 5
(depending on hazards and activity level)
- Parking/pedestrian area: min. 0.2 – 0.9
(average to minimum ratio of 4:1)
- Pathways, outdoor steps: 1
- Service station (pump island): 20 – 30

Specify "full-cutoff" luminaires. Specify outdoor light fixtures (luminaires) that are "full-cutoff" to avoid uplight or glare. Note that these are different from "cutoff" luminaires, which, as defined by IESNA, still allow some uplight. Several manufacturers of full-cutoff luminaires are listed at the end of the article. Avoid the use of floodlights.

Keep lighting poles low and space more closely. For more uniform area lighting, such as parking lots, use a larger number of lower, pole-mounted luminaires instead of fewer, taller fixtures. Keep wattage below 250 watts.

Focus light downward. Outdoor lighting fixtures should focus light downward. Even full-cutoff fixtures can contribute to light pollution if they are not properly aimed. A good rule of thumb is to make sure that direct light shines a minimum of 20° below a horizontal plane and in no case above the horizontal plane.

Avoid uplighting. Wherever possible, avoid uplighting of trees and architectural facades. Lighting buildings from above, however, can be an important component of security lighting because it improves visibility on the streets and sidewalks below.

Test installations for glare. After installation, check to make sure that glare will not be a problem for neighbors, pedestrians, or motorists. If glare becomes evident, modify equipment or design.

Specify low-pressure sodium lamps near observatories. In applications where blocking light pollution is absolutely critical, specify low-pressure sodium lamps. These have the highest efficacy (lumens per watt) and their yellow, monochromatic light output has relatively low impact on astronomical observation.

Avoid mercury vapor lamps. Mercury vapor lamps are very common for streetlights and general outdoor lighting, but high-quality, full-cutoff luminaires are often not available for these lamps. Mercury vapor lamps also have relatively low efficacy. Metal halide or high-pressure sodium lamps are preferable for most applications.

Specify white light with good color rendering. For occupied spaces, specify energy-efficient lamps that produce relatively white light with high color rendering index (CRI). Putting *quality* light only where it is needed may enable less total light to be used.

Illuminate signs from above. Advertising signs and billboards should be illuminated from above only—not from below. Illuminating signs from below results in significant waste when the light beam overshoots or has a larger diameter than the sign being illuminated, and upward-reflected light bouncing off of a sign contributes to sky glow.

Avoid reflective surfaces beneath downlit signs. Whenever possible, design the surfaces beneath downlit signs to be light-absorptive rather than reflective. Landscape beneath signs with turf, for example, which has one of the lowest reflectivities of any ground surface.

Strengthen light pollution regulations. Work with local planning commissions, planning agencies, or municipal governments to establish or strengthen regulations that will help reduce light pollution. A few strong voices can make a huge difference! Even a letter to the editor in the local paper or a phone call to an elected municipal official can bring about considerable change.

remote observatories. In Tucson, a city of 600,000, you can now see the Milky Way from the center of downtown.

Final Thoughts

While few people other than astronomers—and perhaps poets—have given much thought to light pollution, it is an easy problem with easy solutions. Remember, light pollution equals waste. Eliminating waste saves money. Overlighting a space generally costs more both up-front and during operation—though specifying more, lower-wattage luminaires in a parking lot may increase first cost.

Any way you look at it, controlling light pollution is a winner. The building owner or occupants get better light, generally at lower operating cost. By reducing electricity use (through lowering light levels and directing that light where it is needed), fossil fuels are saved and the pollution associated with generating that electricity is eliminated. Finally, remember that light pollution is a lot different from PCB pollution in our rivers or CFC pollution in the upper atmosphere. Once the lights are turned off or properly directed, the light pollution ends—there are no residuals that we have to clean up.

By solving our light pollution problem, more of us may be able to appreciate the night sky—and work to ensure clear skies and a clean environment.

—Alex Wilson

For more information:

International Dark-Sky Association
3225 N. First Avenue
Tucson, AZ 85719
520/293-3198, 520/293-3192 (fax)
ida@darksky.org (e-mail)
www.darksky.org (Web site)

IDA offers a wide range of information sheets on their Web site, including sample ordinances to address light pollution.

Illuminating Engineering Society of North America
120 Wall Street, 17th Floor

New York, NY 10005
212/248-5000, 212/248-5017 (fax)
www.IESNA.org (Web site)

IESNA publishes manuals with recommended lighting levels. Limited emphasis on light pollution to date, but that should be changing.

Nancy Clanton
Clanton Engineering, Inc.
4699 Nautilus Court S., Suite 102
Boulder, CO 80301
303/530-7229, 303/530-7227 (fax)

A leading lighting design firm specializing in environmentally responsible lighting strategies that minimize light pollution.

Outdoor Lighting Manual for Vermont Municipalities (1996)

Available from:
Public Technology, Inc.
Distribution Center
P.O. Box 321
Annapolis Junction, MD 20701
301/490-2188
pubs@pti.org (e-mail)
pti.nw.dc.us (Web site)
Publication order #DG/95-308
48 pages, softcover; \$22 postpaid (\$17 for government agencies)

An excellent introduction to outdoor lighting, with extensive discussion of light pollution issues; includes sample language for municipal ordinances to regulate lighting—some material specific to Vermont, but most widely applicable.

The Outdoor Lighting Pattern Book
by Russell P. Leslie, AIA, IES and Paula A. Rodgers, IES
Lighting Research Center, RPI
McGraw-Hill, New York, 1996
220 pages, hardcover; \$59.95

Comprehensive treatment of outdoor lighting design, with emphasis on use of full-cutoff luminaires and other strategies to minimize light pollution.

Night Has a Thousand Eyes: A Naked-Eye Guide to the Sky
by Dr. Arthur R. Upgren
Plenum Press, New York, 1998
300 pages, hardcover; \$27.95

Two chapters (out of 20) address issues of light pollution and the night sky.

Sampling of outdoor lighting fixture manufacturers that specialize in full-cutoff luminaires:

Kim Lighting
818/968-5666

Sterner Lighting Systems, Inc.
612/906-7300

Thomas Outdoor Lighting, Inc.
800/477-8653

From the Library

Introduction to Stormwater: Concept, Purpose, Design

by Bruce K. Ferguson, 1998. John Wiley & Sons, Inc., New York. Hardcover, 260 pages, \$59.95

Stormwater management is a vitally important component of almost any green building project (see *EBN* Vol. 3, No. 5). Environmentally responsible stormwater management can even be an economic driver of a broader green building agenda: using the savings achieved by finding alternatives to conventional storm sewers and detention ponds to pay for other green features in a large project. Given the importance of stormwater, it is surprising that there are so few information resources that are written to be accessible to the typical architect, builder, or developer. With Ferguson's *Introduction to Stormwater*, we finally have such a resource. The book is reasonably comprehensive, yet you don't need an engineering degree to understand it. Plus, there is a strong emphasis on the many environmental benefits of thoughtful stormwater management—which is not surprising, as Ferguson studied landscape architecture under Ian McHarg in the 1970s.

Introduction to Stormwater addresses hydrologic concepts, the water balance, methods for calculating stormwater runoff, and the primary components of stormwater management: conveyance, detention, extended detention (sometimes called "retention"—a term Ferguson avoids due to its ambiguity), and infiltration. In any stormwater management design, providing for infiltration is the optimal primary control strategy in almost all circumstances (see also our review of Ferguson's more technical book, *Stormwater Infiltration*, in *EBN* Vol. 4, No. 4). Lots of good information is presented on pollutant removal through stormwater infiltra-

Light Pollution - A Problem for All of Us

Information Sheet 2



International Dark-Sky Association
3225 N. First Ave., Tucson, AZ 85719 U.S.A.
E-mail: ida@darksky.org
WWW: <http://www.darksky.org>

Introduction:

Have you had a problem with light pollution? Of course. Whether you are a professional astronomer or an amateur astronomer or a member of the general public, you have undoubtedly been bothered by this scourge.

Write and tell me of your experiences. In detail. Include of course, whether or not you found any relief, and how. Be as specific as possible, please. I will compile the results and share the information, along with comments and suggestions where I can offer such.

Probably the problem had to do with:

- Light Trespass: Spill light bothering you.
- Glare: Bright, troublesome, always a bother.
- Urban Sky Glow: This item is the curse for many professional observatories.

What to Do?

Here are some specific suggestions:

1. Talk to the offender. Ask for their help. Be friendly. But be persistent. Constant push without making enemies.
2. Educate people to what can be done. Most people have no idea about lighting, what is available, what costs are, or anything.
3. Educate about energy waste.
4. Educate about the adverse problems of poor lighting: glare, clutter, light trespass, sky glow, energy waste. Show what quality lighting can do. Set a good example.
5. Join the **International Dark-Sky Association**, a non-profit organization recently formed to help. There is strength in unity. Share information. Write the author for details.
6. Learn about quality lighting. Educate others.
7. Talk to people, individually and groups. City officials, the media, utility staff, lighting "designers", and the public.
8. Develop "networks":
 = Helpers

= Awareness
= Solutions

9. There are few things in life where solving the problem saves money. Curing Light Pollution saves money, makes for a safer nighttime environment, and saves the dark skies. It's a Win/Win/Win situation. Everyone can win.

Solutions

1. Use the right amount of light, not overkill.
2. Shield the light, so it goes down, not up or sideways.
3. Use time controls when possible.
4. Use low pressure sodium sources whenever possible; it is also the most energy efficient light source.
5. Be aware of quality lighting. Educate others.
6. More information about the issue is available from **IDA**, Inc., through membership, or write anyway if you would like more help.

Summary

Dark skies are compatible with quality lighting, they require such lighting, in fact. Poor lighting has many adverse effects, including glare, clutter, light trespass, energy waste, and light pollution.

Dark skies are compatible with a safe, secure, and functional nighttime environment. As with astronomers, the public needs and deserves a quality nighttime environment. Glare, clutter, light trespass, energy waste, and light pollution are a major threat to the environment.

Solutions are possible and they work. Let's achieve them, and have a Win/Win/Win situation. The time is now. Let's do it.

[This is the text of a poster paper given by Dr. David L. Crawford at a meeting of amateur astronomers in California, in 1987.]

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[Go back to the IS list](#)

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Economic Issues in Wasted and Inefficient Outdoor Lighting

Information Sheet 26, February 1990



International Dark-Sky Association
3225 N. First Ave., Tucson, AZ 85719 U.S.A.
E-mail: ida@darksky.org
WWW: <http://www.darksky.org>

Let's consider the energy use of inefficient outdoor lighting fixtures. A very common fixture seen everywhere throughout the United States, in cities and in the country, the so-called 175 watt dusk-to-dawn mercury vapor light (13130 bytes). It is used for yard lighting, security lighting, even street lighting some places. It contains a photocell sensor switch to turn it on at dusk and off at dawn, hence the name commonly used for it. Quite a number of fixture manufacturers make such a unit, and many utility companies push its use for "security" or "safety" at night. We see ads proclaiming "Light Up the Night", all in the interests of security or safety or something. All this is in face of the fact that there is more crime in the daytime than at night, that there is more crime in well lit areas than in dark areas (compare the lighting of New York City to that in a typical rural Midwestern area, for example, and the crime level in the same locations).

Due to all this advertising, we have all (most of us anyway) come to relate lighting at night (good or bad) with safety. The world runs on perception, not on reality. IDA believes that quality lighting can and does promote safety, security, and utility at night. We are *definitely not* opposed to quality lighting. We are *definitely against* poor lighting, lighting that causes glare, light trespass, urban sky glow, and that compromises visibility rather than helping us see. Such poor lighting wastes light and energy and money.

Let's look at this 175 watt dusk-to-dawn mercury vapor light (13130 bytes) in some detail. It retails for \$29.95 or even less. The system uses about 210 watts of overall energy when we consider the ballast and other items. Most security lights and street lights are switched on and off by a photocell, as part of the fixture. They burn approximately 4100 hours a year ($4100 / 365 = 11.23$ hr per night), and this value is nearly independent of the latitude of the location, as the seasonal effects average out over the year).

Multiply: 210 watts x 4100 hours = 860 kilowatt-hours (KWH) per year energy used. (One KWH is 1000 watt-hours.) At 8 cents per KWH (the national average electrical energy cost; some places are lower, many are higher, even twice that high), the average cost of operating such a lamp is about \$69 per year. That is over twice what the fixture cost to purchase. In some places, it's over three times as much or more. The situation is a prime example of where those who look at the initial cost alone are killing themselves. We must take a longer term view.

Tucson (about 600,000 population) has over 20,000 such lights (They did anyway until a mass change-over to better lighting sources was accomplished. The local utility replaced the several thousand such mercury lights that they owned; think how many more are owned by private citizens.) So the annual operating cost of those mercury fixtures in Tucson alone was over 1.4 million dollars. The population of the United States is about 500 times that of Tucson. So the annual operating cost of that single type of fixture is over 700 million dollars. If all of these fixtures were replaced with quality 35 watt low pressure sodium fixtures (getting better lighting as well), the country would save over 500 million dollars per year.

Let us consider now the wasted light. At least 30 percent of the light coming out of the fixture is totally wasted (without even considering the energy inefficiency of the mercury lamps). It is light going up, to brighten the sky, and light coming out at nearly horizontal angles. Such light only causes glare and light

trespass, doing nothing to light up the owner's property, only to offend neighbors like you. Some have estimated the wasted light at well over 30 percent. Have a close look at one What do you think?

Thirty percent of \$700 million is about 200 million dollars. That is money totally wasted. The wasted light is doing nothing to provide security, safety, or utility at night. It is only burning coal (most of the power in the United States is produced by burning coal), producing additional air pollution and acid rain. We have enough of that already.

Consider now all the other bad lighting. Billboard lighting from below and other signs lit from below (in both cases, much of the light output is wasted, even if you like lit billboards; many people don't). Searchlights. Lighting up of buildings, with lighting fixtures that are not well controlled. Poor quality street lights, parking lots, and other area lighting. The many lights that burn all night whether they are used or not. How many lights do you see nightly that have too much glare or too much wasted light? Look around!

Let us conservatively assume that this added wasted light is five times the amount coming from the 175 watt mercury. Then the total wasted money being used to produce the totally wasted light is five times that of the mercury: *over One Billion Dollars a year!*

Let's look at the amount for coal or oil being wasted to produce the wasted light. It takes, on the average, 0.47 tons of coal (940 pounds) to produce 1000 KWH of electricity, so one ton of coal can produce 2100 KWH of electricity. It takes about 1.8 barrels (76 gallons of crude oil) to produce 1000 KWH of electricity, so one barrel of crude oil can produce 556 KWH. The wasted light therefore equates to a waste of at least six million tons of coal (think of the added acid rain and air pollution!) or over 23 million barrels of oil (think of the added oil imports). These are non-negligible amounts, to say the least.

While the wasted energy and money from any single person's poor fixture is not all that much (say about \$5 to \$10 a month, added to their utility bill), the overall amount is truly "astronomical" (mind boggling), and it is made up of the sum of all these individual contributions. The solution is for each individual to do better, to be aware of the issues, and to try to do better. We will save money and energy as a nation by doing better as individuals, at home and at business. *We must.*

All this wasted light and energy is doing nothing to promote safety, or a better life at night. In fact, it does the opposite. It costs us money and energy to have a trashy nighttime environment and to wipe out our dark skies. Bright skies, glare, and light trespass help no one. Glare never helps visibility, never. Light trespass usually offends neighbors. Glare and light trespass are also factors in many accidents at night, by blinding or confusing drivers or pedestrians. All this costs the nation far too much in money and pain. We shouldn't tolerate it. We must stop such waste. *Now.*

If we were letting our water sprinkler systems waste much of their water by scattering water everywhere, onto the street, through our neighbor's windows, and upward (evaporation), we'd not tolerate it. If together we wasted over a billion dollars a year this way, we'd declare a national disaster and begin conservation measures immediately. We must build awareness of the adverse effects of poor lighting and get on with the goal of using only quality lighting.

For more information about the issues, contact the International Dark-Sky Association. Other *Information Sheets* are available from IDA address the issues of energy savings (for example, the retrofit of all street lights in San Diego to LPS is saving the city there about 3 million dollars a year), the 175 watt mercury, the operational efficiencies of different kinds of lighting sources, and other quality lighting issues. Join the cause of better lighting, and energy savings. We all can win. The International Dark-Sky Association is a tax-exempt, member supported non-profit organization.

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[Go back to IS list](#)

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Good Neighbor Outdoor Lighting

A GUIDE TO SELECTING AND INSTALLING EFFICIENT, COST-EFFECTIVE, AND UNOBTRUSIVE OUTDOOR LIGHTING FIXTURES



Compiled by the
New England Light Pollution Advisory Group (NELPAG)
and the International Dark-Sky Association

May 1995

Why is there outdoor lighting?

Outdoor lighting is used to illuminate roadways, parking lots, yards, sidewalks, public meeting areas, signs, work sites, and buildings. It provides us with better visibility and a sense of security.

- When well-designed and properly installed, outdoor lighting can be and is very useful in improving visibility and safety and a sense of security, while at the same time minimizing energy use and operating costs.

Why should we be concerned?

If outdoor lighting is not well-designed and properly installed, it can be costly, inefficient, glary, and harmful to the nighttime environment. These are the issues:

- Glare:* Poorly-designed or poorly installed lighting can cause a great deal of glare that can severely hamper the vision of pedestrians, cyclists, and drivers, creating a hazard rather than increasing safety. Glare occurs when you can see light directly from the fixture (or bulb).

- *Light Trespass:* Poor outdoor lighting shines onto neighborhood properties and into bedroom windows, reducing privacy, hindering sleep, and creating an unattractive look to the area.
- *Energy Waste:* Much of our outdoor lighting wastes energy because it is not well-designed. This waste results in high operating costs and increased environmental pollution from the extra power generation needs. We waste over a billion dollars a year in the United States alone lighting up the sky at night.
- *Sky Glow:* A large fraction of poor lighting shines directly upwards, creating the adverse sky glow above our cities that washes our view of the dark night sky, taking away an important natural resource. In addition to the cost savings, less sky glow will allow future generations to enjoy the beauty of the stars, and children will be inspired to learn and perhaps to enter fields of science.

What is Good Lighting?

Good lighting does its intended job well and with minimum adverse impact to the environment. Good lighting has four distinct characteristics:

1. **It provides adequate light for the intended task, but never over-lights.**

Specifying sufficient light for a job is sometimes hard to do on paper. Remember that a full moon can make an area seem quite bright. Some modern lighting systems illuminate areas to a level 100 times as bright as does the full moon! Brighter is not always better, so try to choose lights that will meet your needs without illuminating the neighborhood. If you can't decide what to do, consulting a good lighting designer is usually your best bet.

2. **It uses "fully-shielded" lighting fixtures, fixtures that control the light output in order to keep the light in the intended area.**

Such fixtures have minimum glare from the light-producing source. "Fully-shielded" means that no light is emitted above the horizontal. (High-angle light output from ill-designed fixtures is mostly wasted, doing no good in lighting the ground, but still capable of causing a great deal of glare. Of course, all the light going directly up is totally wasted.)

Fully-shielded light fixtures are more effective and actually increase safety, since they have very little glare. Glare can dazzle and considerably reduce the effectiveness of the emitted light.

3. **It has the lighting fixtures carefully installed to maximize their effectiveness on the targeted property and minimize their adverse impact beyond the property borders.**

Positioning of fixtures is very important. Even well-shielded fixtures placed on tall poles at a property boundary can cast a lot of light onto neighboring properties. This "light trespass" greatly reduces and invades privacy, and is difficult to resolve after the installation is complete.

Fixtures should be positioned to give adequate uniformity of the illuminated area. A few bright fixtures (or ones that are too low to the ground) can often create bright "hot spots" that make the less-lit areas in-between seem dark. This can create a safety problem. When lighting signs, position the lights above and in front of the sign, and keep the light restricted to the sign area; overlit signs are actually harder to read. Buildings ought to be similarly lit in a way to offer an attractive, safe

environment without overkill.

4. **It uses fixtures with high-efficiency lamps, while still considering the color and quality as essential design criteria.**

High-efficiency lamps used for lighting not only save energy - which is good for a cleaner environment - but reduce operating costs. Most high-efficiency lamps last a long time, reducing costly maintenance. Highly-efficient fixtures usually cost more initially, but the payback time is very short, and such fixtures will save you lots of money in a short time.

Balancing against high-efficiency, though, is the quality of the light emitted. In some applications, the yellow light cast by low-pressure (LPS) or high-pressure (HPS) sodium lamps may not be as desirable as a less-efficient, but much whiter, compact-fluorescent, metal-halide, or even incandescent light source. In other applications, color is not of importance, and LPS or HPS lamps do a very good job at very low cost. Well-designed shielded lights can usually be lower in wattage, saving even more energy and money. They will actually light an area better than unshielded lights of higher output, because they make use of all the light rather than wasting some (or much) of it.

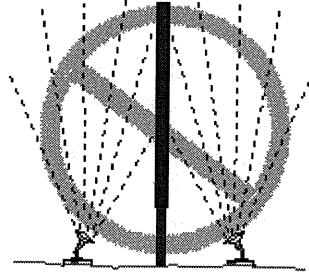
Why are these characteristics so important? How do they factor into a design?

Good lighting means that we save energy and money, and we avoid hassles. A quality lighting job makes a "good neighbor." And we have a safer and more secure nighttime environment.

Always remember that lighting should benefit people. Controlled, effective, efficient lighting at a home or business will enhance the beauty, while providing visibility, safety, and security. Poorly-installed, bright lighting is offensive and gives a very poor image.

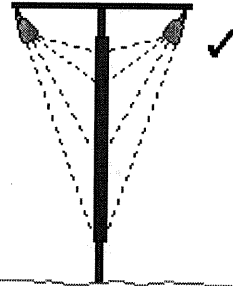
EXAMPLES OF SOME COMMON LIGHTING FIXTURES

POOR

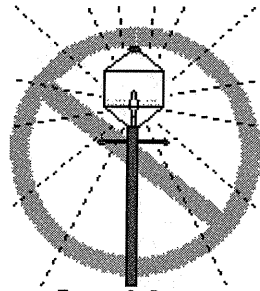


Ground-mounted
Billboard Floodlights

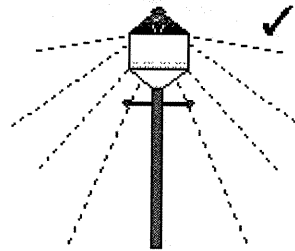
GOOD



Top-mounted
Billboard Floodlights
(carefully focused onto billboard)



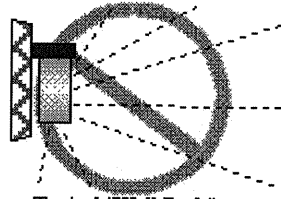
Post-style Lamp
(more than 1,800 lumens)



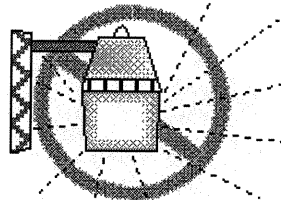
Post-style Lamp
(lamp set in opaque top)

EXAMPLES OF SOME COMMON LIGHTING FIXTURES

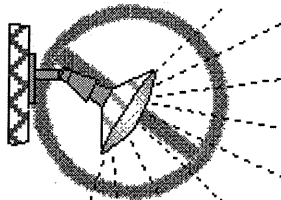
POOR



Typical "Wall Pack"

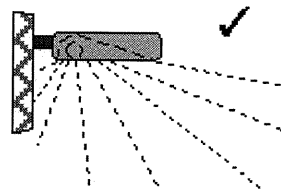


Typical "Yard Light"

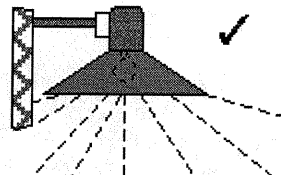


Area Flood Light

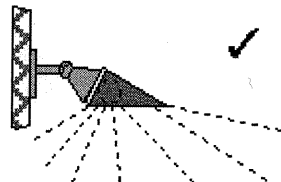
GOOD



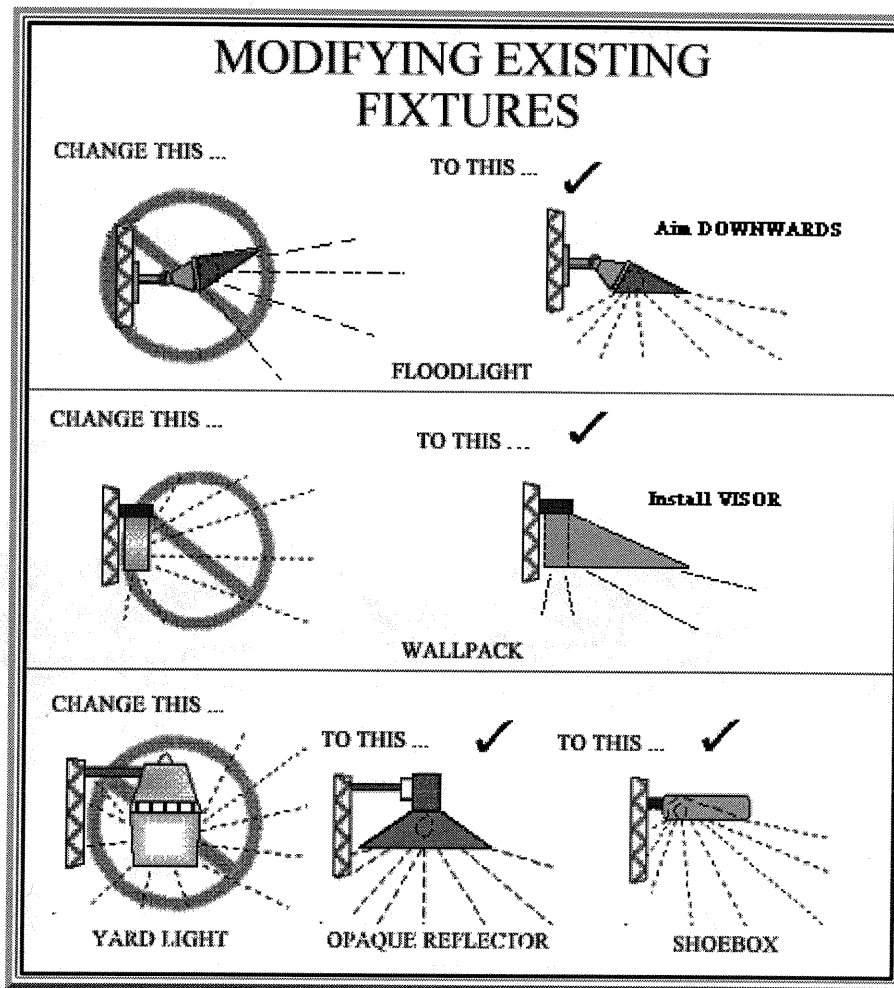
Typical "Shoe Box" (forward throw)



Opaque Reflector (lamp inside)



Area Flood Light with Hood

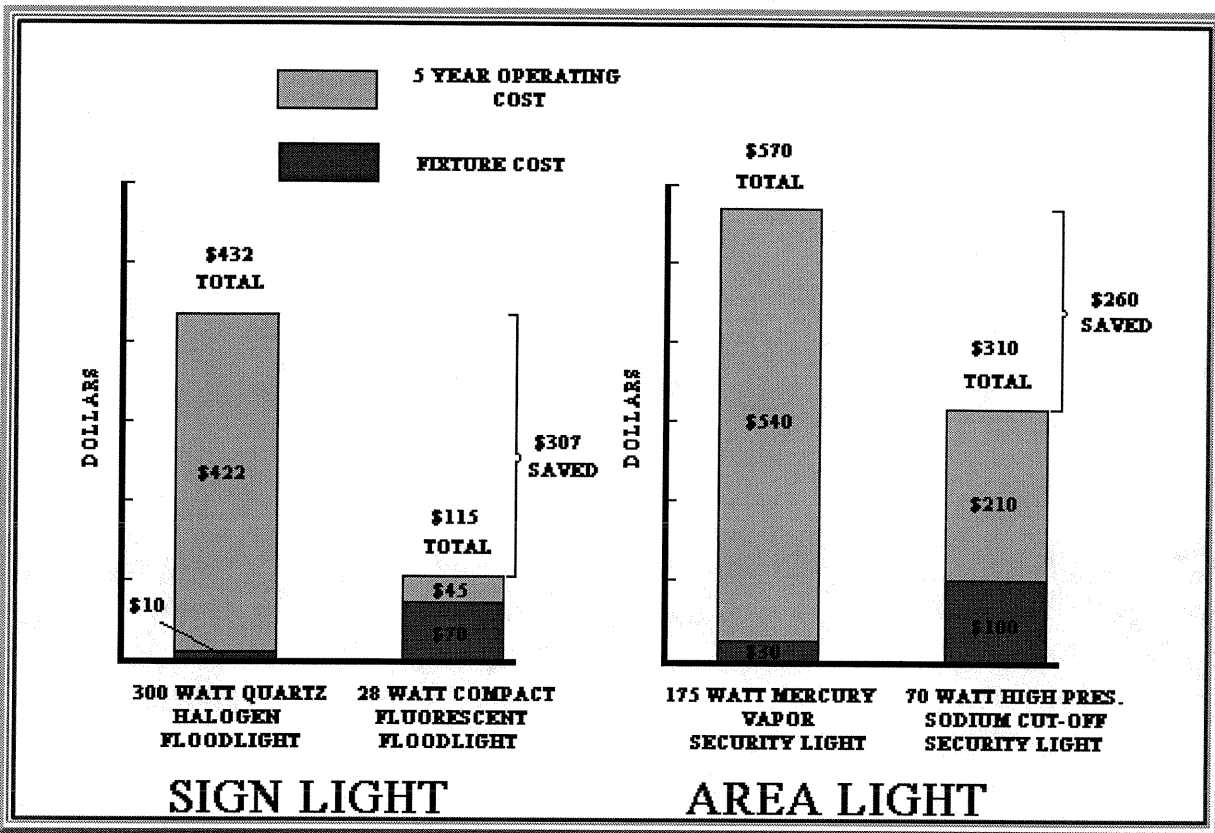


Some Thoughts on Cost: Money Talks!

There are many cheap lighting fixtures available from most discount warehouse stores and from electrical suppliers. Are these good deals?

- Most cheap fixtures have poor control of the light output, and they produce a lot of glare. It usually takes better and more-costly internal reflectors to get light out without glare and to give better light distribution. Modifying installed fixtures to reduce glare, or installing more fixtures to better coverage can be expensive.
- Cheap fixtures often have inefficient lamps and short lamp life, so they use far more energy than needed. Paying for more electricity than needed is expensive, as is the higher maintenance costs of these so-called "cheap" fixtures.

Some cost comparisons



Some Basic Considerations

- Always remember that lighting should *benefit people*. Controlled, effective, efficient lighting at your home or business will enhance the surroundings and give a sense of safety and security. People don't appreciate poorly-installed, overly-bright lighting.
- Check your site at night before installing lighting and note the existing light levels. If the area has low levels of lighting, then modest levels of light will work well for you and will fit more hospitably in the neighborhood.
- Try to keep the lighting uniform and *reduce glare* as much as possible. Lights that make bright "hot spots" and ones that have glare make it hard to see well - especially for older people.
- Be aware that light fixtures can have different lighting patterns. (Some patterns are long and narrow light cones, while others are more symmetrical.) Some fixtures have internal adjustments that can change the lighting pattern to a modest extent. Pick the right pattern for your job.
- Consider using lights that turn on by motion detection. Not only will you reap big savings in operating costs, but you will have a far more effective security light due to its "instant-on" characteristics. Note that these lights can also be turned on manually. These light fixtures are not expensive, and they use very little energy. Higher-priced motion-detection units will prove more reliable.

Manufacturers and Suppliers

A Selection of Manufacturers and Suppliers of Good Lighting Equipment

- Any lamp - no matter how faint - can be annoying in certain circumstances, so it is encouraged that all outdoor lights be fully shielded. However, with fixtures that use dazzling lamps (typically all HPS, mercury vapor, and metal-halide lamps, and clear incandescent lamps of 150 watts or greater), the requirement for shielding is imperative. Here is a list of some good lighting fixtures, with manufacturers or suppliers names, product numbers, and addresses (with telephone numbers in parentheses).

Please note that this is not a comprehensive list of all good lighting fixtures; these are a sample of those fixtures that have come to the attention of NELPAG as of the winter of 1995. As other quality fixtures are brought to our attention, they will be included in future updates. Please do give us your suggestions.

ABOLITE: 10000 Alliance Road; Cincinnati, OH 45242 (513-793-8875)

GENERAL ELECTRIC: Hendersonville, NC 28739 (800-626-2000)

GUTH LIGHTING: 2615 Washington Blvd.; St. Louis, MO 63103 (314-533-3200)

HADCO: P.O. Box 128; Littlestown, PA 17340 (717-359-7131)

HUBBELL LIGHTING: 2000 Electric Way; Christiansburg, VA 24073 (703-382-6111)

KIM LIGHTING: P.O. Box 1275; City of Industry, CA 91749 (818-968-5666)

LUMINAIRE TECHNOLOGIES, INC.: 212 West Main St.; Gibsonville, NC 27249 (910-449-6310)

THOMAS & BETTS LIGHTING DIV.: 1555 Lynnfield Rd.; Memphis, TN 38119 (901-682-7766)

THOMAS OUTDOOR LIGHTING (formerly McPhilben Outdoor Lighting): 2661 Alvarado St.; San Leandro, CA

PEMCO LIGHTING PRODUCTS: 150 Pemco Way; Wilmington, DE 19804 (302-892-9003)

RUUD LIGHTING: 9201 Washington Ave.; Racine, WI 53406 (414-886-1900)

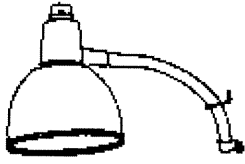
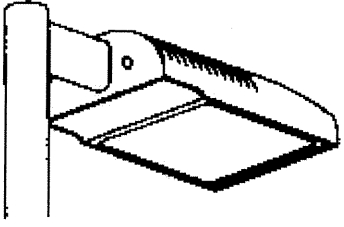
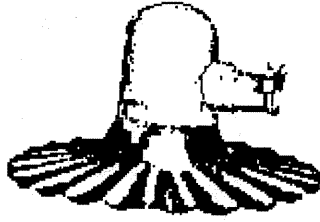

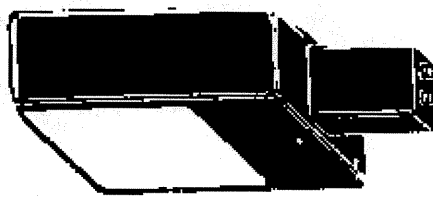
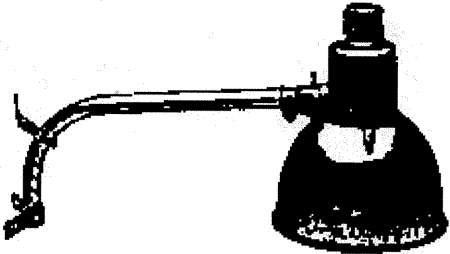
SPERO LIGHTING: 1705 Noble Rd.; Cleveland, OH 44112 (216-851-3300)

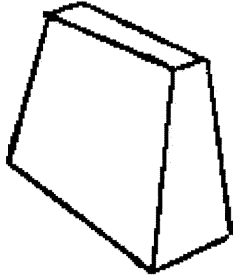

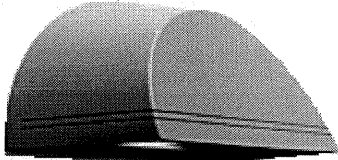
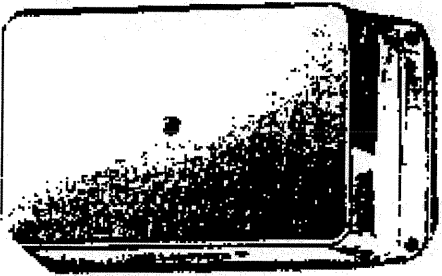
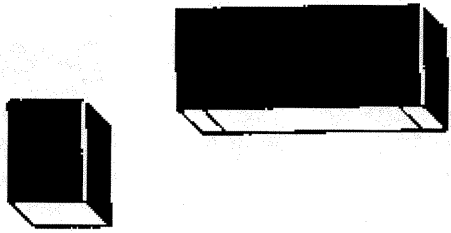
STONCO: P.O. Box 129; Union, NJ 07605 (908-964-7000)


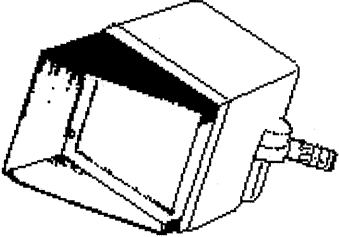
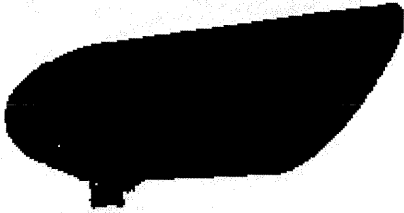


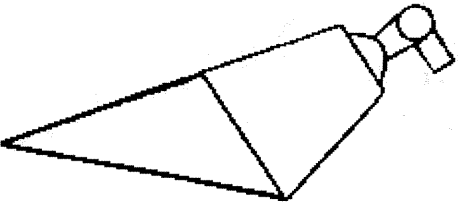
VOIGHT LIGHTING: 135 Fort Lee Rd.; Leonia, NJ 07605 (201-461-2493)


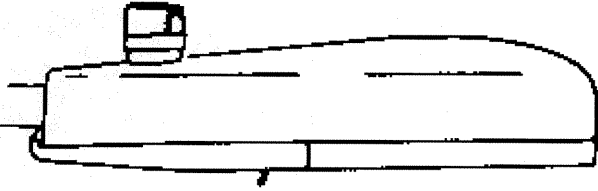
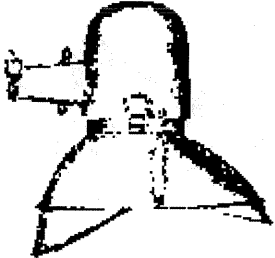

WESTERFIELD: 770 Gateway Center Dr.; San Diego, CA 92102 (619-263-6672)

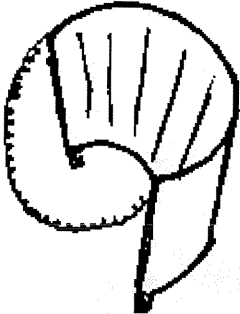

In the diagrams, the following abbreviations are used: INC = incandescent; HPS = high-pressure sodium; CF = compact fluorescent; MH = metal-halide; MV = mercury vapor

AREA LIGHTS - POLE or BUILDING MOUNTED	
<p>THOMAS & BETTS American Electric Lighting Package "C" (Cutoff) (HPS, MV) Low Cost</p> 	<p>KIM LIGHTING Series SAR (HPS, MH, MV) High Cost</p> 
<p>PEMCO Model 8908X-211-CO (HPS, MH, CF, INC) Medium Cost</p> 	<p>RUDD LIGHTING PR Series (HPS, MH, CF, INC) Medium Cost</p> 
<p>STONCO Series RLM3000 & RMS3000 (HPS, MH) Medium Cost</p> 	<p>HUBBELL LIGHTING Model NPU-BI NITE-TO-LITE™ (HPS, MV) Low Cost</p> 

AREA LIGHTS - BUILDING MOUNTED ONLY	
<p>GUTH LIGHTING SUNDOWNER Series B1870 (CF, HPS, MV) Medium Cost</p> 	<p>KIM LIGHTING Series WD14D (HPS, MH) High Cost</p> 
<p>McPHILBEN OUTDOOR Series 101 & 102 (HPS, MH) High Cost</p> 	<p>RUDD LIGHTING E8 Series (HPS, MH) Low Cost</p> 
<p>VOIGT LIGHTING PRAGMATIC Series 221 & 222 (HPS, MH, MV, CF, INC) Low to Medium Cost</p> 	<p>COST:</p> <p>LOW COST: under \$100 MEDIUM COST: \$100 - \$200 HIGH COST: over \$200</p>

SIGN LIGHTS - FLOODLIGHTS	
<p>ABOLITE Series RLM model DWB-1 (INC) Low Cost</p> 	<p>HADCO Series HF4000 with MGS-3H shield (HPS, MV) Medium Cost</p> 
<p>HUBBELL LIGHTING Series 308 bullet with 309-S shield (INC) Low Cost</p> 	<p>SPERO LIGHTING Model 705 reflector1 (INC) Low Cost</p> 
<p>STONCO Series 940 with 9455E shield (INC) Low Cost</p> 	<p>WESTERFIELD Series 500 with Glare shield (CF) Low Cost</p> 

ROADWAY LIGHTING	
<p>CROUSE HINDS Model RAL Series (HPS, MV) Medium Cost</p>	<p>GENERAL ELECTRIC Model M-250R2 with CUTOFF OPTICS (HPS, MV) Medium Cost</p> 
<p>HUBBELL LIGHTING Model RMC series (HPS, MH) Medium Cost</p> 	<p>PEMCO LIGHTING Model Admiral Hat (HPS, MH, CF, INC) Medium Cost</p> 
<p>THOMAS & BETTS American Electric Lighting Roadway Cutoff Series 113 & 125 (HPS, MH, MV) Medium Cost</p> 	

RETROFIT SHIELDS FOR "DUSK TO DAWN" SECURITY LIGHT	
<p>LUMINAIRE TECHNOLOGIES <i>Lite-Blocker</i>[™] Fits on all NEMA Head Luminaires Low Cost</p> 	<p>HUBBELL LIGHTING Model NPU-BI NITE-TO-LITE[™] SKYCAP Cutoff Optics Fits on all NEMA Head Luminaires</p> 

* * *

This pamphlet was produced by the New England Light Pollution Advisory Group (NELPAG), a volunteer organization established in 1993 to address outdoor-lighting issues locally in the northeastern United States. The chief architect of this pamphlet is Peter Talmage, an engineer residing in Kennebunkport, Maine. Numerous revisions have occurred in the past year, with the main editing by Talmage, Daniel Green, David Crawford, Steve O'Meara, and Joy Hoskins.

The NELPAG produces a *Circular* at irregular intervals, available either via postal mail - by sending self-addressed, stamped envelopes to Daniel Green (M.S. 18, Smithsonian Observatory, 60 Garden St. Cambridge, MA 02138) - or via computer e-mail (send your full name, postal address, and e-mail address to : NELPAG-REQUEST@harvee.billerica.ma.us via Internet). The NELPAG also meets occasionally in various locations in New England to discuss local lighting issues.

The NELPAG (<http://cfa-www.harvard.edu/cfa/ps/nelpag.html>) supports the International Dark-Sky Association (<http://www.darksky.org>) and recommends that all individuals/groups who are interested in the problems of light pollution and obtrusive lighting should subscribe to the IDA Newsletter (IDA membership costs \$30.00 per year; send check to International Dark-Sky Association, 3225 N. First Ave., Tucson, AZ 85719). IDA also issues useful "Information Sheets" and slide sets for use in educational presentations.

Glossary of Basic Terms and Definitions

Information Sheet 9, July 1996



International Dark-Sky Association
3225 N. First Ave., Tucson, AZ 85719 U.S.A.
E-mail: ida@darksky.org
WWW: <http://www.darksky.org>

We include in this information sheet definitions for a number of the basic terms and words used in the lighting community. For further information and formal definitions, see discussions in standard dictionaries, encyclopedias, the IES Lighting Handbook, and other lighting industry books. Note that some of these definitions are quite subjective, and are offered here as a guidance, not as a formal definition.

Accent lighting: Lighting used to emphasize or draw attention to a special object or building.

Ambient light: The general overall level of lighting in an area.

Angstrom: A unit of wavelength often used in astronomy, equal to 0.000000001 meter or 0.1 nanometer.

Baffle: An opaque or translucent element to shield a light source from direct view.

Ballast: A device used with a discharge lamp to obtain the necessary voltage, current, and/or wave form for starting and operating the lamp.

Beam spread: The angle between the two directions in the plane in which the intensity is equal to a given percentage (usually 10 percent) of the maximum beam intensity.

Brightness: Strength of the sensation that results from viewing surfaces from which the light comes to the eye.

Bulb or lamp: The source of electric light. To be distinguished from the whole assembly (see *luminaire*). Lamp often is used to denote the bulb and its housing.

Candela (cd): Unit of luminous intensity. One candela is one lumen per steradian. Formerly called the candle.

Candlepower distribution curve: A plot of the variation in luminous intensity of a lamp or luminaire.

Candlepower: Luminous intensity expressed in candelas.

CIE: Commission Internationale de l'Eclairage. The international light commission. Sets many standards.

Coefficient of Utilization (CU): Ratio of luminous flux (lumens) from a luminaire received on the "work plane" [the area where the light is needed] to the lumens emitted by the luminaire.

Color rendering: Effect of a light source on the color appearance of objects in comparison with their color appearance under normal daylighting.

Cones and rods: Retinal receptors. Cones dominate the response when the luminance level is high, and

provide color perception. Rods dominate at low luminance levels. No rods are found in the central part of the fovea. Rods have no color perception ability.

Conspicuity: The capacity of a signal to stand out in relation to its background so as to be readily discovered by the eye (as in lettering on a sign, for example).

Cosine law: Illuminance on an surface varies as the cosine of the angle of incidence of the light.

Cut off angle, of a luminaire: The angle, measured up from the nadir (i.e., straight down), between the vertical axis and the first line of sight at which the bare source (the bulb or lamp) is not visible.

Cutoff fixture: A fixture that provides a cutoff (shielding) of the emitted light.

Dark adaptation: The process by which the eye becomes adapted to a luminance less than about 0.03 candela per square meter (0.01 footlambert).

Disability glare: Glare resulting in reduced visual performance and visibility. It is often accompanied by discomfort.

Discomfort glare: Glare that produces discomfort, but does not necessarily diminish visual performance.

Efficacy: The ability of a lighting system to produce the desired result.

Efficiency: A measure of the effective or useful output of a system compared to the input of the system.

Electromagnetic (EM) spectrum: The distribution of energy emitted by a radiant source, arranged in order of wavelength or frequency. Includes gamma-ray, X-ray, ultraviolet, visual, infrared, through radio regions.

Energy (radiant energy): Unit is erg, or joule, or kWh.

Fixture: The assembly that holds the lamp in a lighting system. It includes the elements designed to give light output control, such as a reflector (mirror) or refractor (lens), the ballast, housing, and the attachment parts.

Floodlight: A fixture designed to "flood" a well-defined area with light.

Flux (radiant flux): Unit is erg/sec or watts.

Footcandle: Illuminance produced on a surface one foot from a uniform point source of one candela.

Footlambert: The average luminance of a surface emitting or reflecting light at a rate of one lumen per square foot.

Full-cutoff fixture: A fixture that allows no emission above a horizontal plane through the fixture.

Glare: Intense and blinding light. Never helps visibility.

HID lamp: In a discharge lamp, the emitted energy (light) is produced by the passage of an electric current through a gas. High-intensity discharge (HID) include mercury, metal halide, and high-pressure sodium

lamps. Other discharge lamps are LPS and fluorescent. Some such lamps have internal coatings to convert some of the ultraviolet energy emitted by the gas discharge into visual output.

High-Pressure Sodium (HPS) lamp: HID lamp where radiation is produced from sodium vapor at relatively high partial pressures (100 torr). HPS is essentially a "point source".

Illuminance: Density of luminous flux incident on a surface. Unit is footcandle or lux.

Illuminating Engineering Society of North America (IES or IESNA): The professional society of lighting engineers, including those from manufacturing companies, and others professionally involved in lighting.

Incandescent lamp: Light is produced by a filament heated to a high temperature by electric current.

Infrared radiation: EM radiation just to the long wavelength side of the visual.

Intensity: The degree or amount of energy or light.

International Dark-Sky Association (IDA, Inc.): A non-profit organization whose goals are to build awareness of the value of dark skies, and of the need for quality lighting. (See Information Sheet No. 14.)

Inverse-square law: Illuminance at a point varies directly with the intensity of a point source and inversely as the square of the distance to the source.

KWH: Kilowatt-hour. A unit of energy equal to the work done by one kilowatt (1000 watts) of power acting for one hour.

Light pollution: Any adverse effect of manmade light. Often used to denote urban sky glow.

Light trespass: Light falling where it is not wanted or needed. Spill light. Obtrusive light.

Low-Pressure Sodium (LPS) lamp: A discharge lamp where the light is produced by radiation from sodium vapor at a relatively low partial pressure (about 0.001 torr). LPS is a "tube source". It is monochromatic light.

Lumen: Unit of luminous flux; the flux emitted within a unit solid angle by a point source with a uniform luminous intensity of one candela. One footcandle is one lumen per square foot. One lux is one lumen per square meter.

Lumen depreciation factor: Light loss of a luminaire with time due to the lamp decreasing in efficiency, dirt accumulation, and any other factors that lower the effective output with time.

Luminaire: The complete lighting unit, including the lamp, the fixture, and other parts.

Luminance: At a point and in a given direction, the luminous intensity in the given direction produced by an element of the surface surrounding the point divided by the area of the projection of the element on a plane perpendicular to the given direction. Units: candelas per unit area.

Lux: One lumen per square meter. Unit of illuminance.

Mercury lamp: An HID lamp where the light is produced by radiation from mercury vapor.

Metal-halide lamp: An HID lamp where the light is produced by radiation from metal-halide vapors.

Mounting height: The height of the fixture or lamp above the ground.

Nanometer (nm): 0.000000001 meter. Often used as the unit for wavelength in the EM spectrum.

Photometry: The quantitative measurement of light level and distribution.

Quality of light: A subjective ratio of the pluses to the minuses of any lighting installation.

Reflector: Controlling light output by means of reflection (mirror).

Refractor: Controlling light output by means of refraction (lens).

Semi-cutoff fixture: A fixture that provides some cutoff, but less than a full-cutoff fixture.

Spotlight: A fixture designed to light only a small, well-defined area.

Stray light: Emitted light that falls away from the area where it is needed or wanted. Light trespass.

Task lighting: Lighting designed for a specific purpose or task.

Ultraviolet "light": The energy output by a source which is of shorter wavelengths than the eye can see. Some photographic films are sensitive to ultraviolet energy, as are many electronic detectors. "Black Light."

Urban sky glow: The brightening of the night sky due to manmade lighting.

Veiling luminance: A luminance produced by bright sources in the field-of-view superimposed on the image in the eye reducing contrast and hence visibility.

Visibility: Being perceived by the eye. Seeing effectively. The goal of night lighting.

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Discussion and Partial List of Lighting Fixtures

Information Sheet 30, March 1990



International Dark-Sky Association
3225 N. First Ave., Tucson, AZ 85719 U.S.A.
E-mail: ida@darksky.org
WWW: <http://www.darksky.org>

We can look at fixtures in several ways:

- Shielding, or effective control of light output.
- Light source, effective and a good fit to the need.
- Suppliers. (See below for some details)

This information sheet gives some discussion of each of these.

1. **Light Control.** An efficient and effective lighting fixture must have included in it elements to control the light output, directing the light to where it is needed. These elements can be reflectors, refractors, louvers, or baffles. One wants the minimum of light loss within the fixture itself, so as to maximize the use of the light output

We strongly recommend "full cut off" fixtures. By this we mean that there is no light emitted above the horizontal (no up going light). There should also be not much light at angles greater than 75 degrees above the vertical. Such light causes a lot of glare.

When there is a need for some up light, such as a baseball park, then we recommend "sharp cut off" fixtures, ones in which there is very good beam control of the light output. This means that there will be very little spill light, up light, or light trespass.

Any building facade lighting, landscape lighting, or such should be with as low a wattage lamp as possible, and the beams should be tightly controlled, to minimize waste light.

2. **Lighting source.** Lamps differ greatly in the efficiency of their light output for the amount of wattage they use. **IDA *Information Sheet No. 4*** gives specifics, but we can say here that low pressure sodium sources are the most efficient, followed by high pressure sodium, then metal halide. Metal halide is a white light source; fluorescent lamp are also a fairly efficient white light source. For low wattages, there are a number of excellent white light sources, such as "PL" lamps. Neither LPS nor HPS give good color rendering, LPS giving none at all. Many applications of nighttime lighting do not require color rendering, and LPS is an excellent choice for such applications.
3. **Lighting suppliers.** There are many sources of lighting fixtures. Some stock many varieties, some only a few. Some stock a wide range of quality, some only the cheapest. As in anything else, you get what you pay for, and most of the cheap ones are not recommended. They produce much glare and wasted light, and they are not well suited for any lighting application. Buy lighting fixtures from knowledgeable sources. There are many manufactures of good lighting fixtures. Have your local lighting stores, distributors, or representatives consult the catalogs of, for example, Spaulding, Emco, WideLite, General Electric, Sylvania, and others. Be sure to buy only quality fixtures: ones that are energy efficient and that give excellent control of the light output, minimizing glare, light trespass, and urban sky glow.

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Unused Light, Overused Energy, Wasted Money

Information Sheet 110, August 1996



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Let's start this article about common-sense outdoor lighting with an "equation":

GLUT = Glare + Light Trespass + Uplight + Too Much Light

These are four negative factors often found with outdoor lighting. Not only does GLUT have a negative impact on our nighttime environment, the "nightscape" if you will, but it just doesn't make economic sense, either.

First, we'll take a brief look at each component of GLUT, and then we'll discuss some of the economic issues involved.

The 8th edition of the IESNA Lighting Handbook (1993) defines **glare** as *the sensation produced by luminance within the visual field that is sufficiently greater than the luminance to which the eyes are adapted to cause annoyance, discomfort or loss of visual performance and visibility*. It stands to reason, then, that any good outdoor lighting design will minimize glare. If the light source itself is more apparent than what it is illuminating, then you have bad lighting.

Light trespass is light that is distributed where it is not wanted or needed. Streetlighting, for example, should light streets and sidewalks, not shine into second floor bedroom windows or illuminate rooftops. Also known as spill light, light trespass occurs whenever light shines beyond the intended target and onto adjacent properties.

Uplight is, in the truest sense of the word, wasted light. Light that goes directly up into the night sky is "lost in space" and serves no useful purpose. Uplight is the bane of astronomers and the occasional stargazer because atmospheric scattering artificially brightens the night sky, making distant celestial light sources difficult or impossible to see. Uplight often results from light fixtures which also produce glare and light trespass.

Too much light results when light levels exceed that needed for the task. Too much light often results from an unexamined "more is better" philosophy, or less innocent motives such as businesses trying to outshine their competitors.

Glare, light trespass, uplight, too much light < all of these things waste energy. And energy costs money. And the money involved is significant, because the operating cost of a light fixture throughout its lifetime is usually much greater than the initial cost of the fixture. Besides, even when energy is cheap, each kilowatt-hour wasted produces the same amount of unnecessary environmental pollution due to the production of that energy, regardless of its cost.

It is interesting to note that a great deal of attention has been paid in recent years to light source efficiency, but relatively little consideration has been given to the equally important subject of light fixture efficiency. Granted, many lighting manufacturers and lighting designers are enlightened about the virtues of using

efficient light fixtures, but for some reason the message is simply not getting out to the majority of electrical contractors, lighting suppliers, builders, developers, architects, government officials, and homeowners.

It is also important to note that an inefficient light source used infrequently costs less to operate than an efficient light source operated dusk-to-dawn, 4100 hours per year. There are many situations where dusk-to-dawn lighting is often not required: security lighting, task lighting, parking lot lighting, to name a few. Time controls, occupancy sensors, or manual switches should be used whenever possible, with an appropriate light source, of course.

The most energy efficient light source available is low pressure sodium, but it is often criticized because of its monochromatic nature. But mix in a little metal halide or fluorescent light, and color rendering is much improved. The potential exists to utilize multiple light source types to achieve greater energy efficiency and a lower life cycle cost than with traditional single-source designs.

Finally, let's take a look at spectral power distribution as another dimension of lighting economy. Is it really necessary for a "white" light source to pump out photons at nearly every wavelength from 380 to 780 nm, as metal halide does? Our eyes are basically tetrachromatic: maximum sensitivity for red-sensitive cones is at 570 nm, green-sensitive cones at 535 nm, rods at 505 nm, and blue-sensitive cones at 445 nm. Could not an efficient pseudo-white light source be constructed that would emit virtually all of its spectral power at these four, or another set of wavelengths? Astronomers would love that, because most of the visible spectrum would be unaffected by our outdoor lighting, and a small number of narrow spectral lines would be relatively easy to filter out.

To summarize: maximum utilization of light output where and when it is needed at IESNA recommended levels makes good economic sense and will minimize adverse environmental impacts. Avoiding outdoor lighting GLUT (glare, light trespass, uplight, and too much light) will take us a long way towards that end.

The International Dark-Sky Association, a tax-exempt non-profit membership based organization, has been founded to help overcome this awareness problem and to help preserve dark skies while at the same time maximizing the quality and efficiency of nighttime outdoor lighting.

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*** ACTIVITY REPORT ***

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CONNECTION TEL 817156343906p26
CONNECTION ID
START TIME 04/15 13:37
USAGE TIME 03'04
PAGES 8
RESULT OK

History of Assembly Bill 88

http://www.legis.state.wi.us/billhist/AB88hst.html

History of Assembly Bill 88

An Act to amend 16.848 (1) (e), 66.949 (1) (e), 84.30 (4) (intro.) and subchapter IV (title) of chapter 101 [precedes 101.80]; and to create 101.815 of the statutes; relating to: the regulation of outdoor light fixtures and bulbs or lamps used in outdoor light fixtures and granting rule-making authority. (PE)

1997

- 02-12. A. Introduced by Representatives Baumgart, Powers, Black, Boyle, R. Potter and R. Young.
- 02-12. A. Read first time and referred to committee on Urban and Local Affairs57
- 03-24. A. Fiscal estimate received.
- 03-25. A. Public hearing held.

1998

- 04-02. A. Failed to pass pursuant to Senate Joint Resolution 1.

[Text of Assembly Bill 88](#)

[Search for another history](#)



Back to Legislation Page



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Post-It™ brand fax transmittal memo 7671		# of pages ▶ 8
To Eric Schuberting	From Rep. Jim Baumgart	
Co. WDJB	Co.	
Dept.	Phone # 608-266-0656	
Fax # 715-634-3906	Fax # 608-282-3626	

1-7-98

JAN - 9 1998

Dear Representative Baumgart-

I heard on Wisc. Public Radio last month, a portion of a news segment about a bill you tried to pass on lighting. I'm not sure of the context of the radio program, or your bill. If you have a copy / brief of this ^{bill}, I'd appreciate receiving a copy.

FYI, there is an association dedicated to responsible, socially acceptable lighting. As an amateur astronomer + dark sky enthusiast, I applaud your effort, and any effort destined to reduce night sky light pollution. I enclose a copy of Int'l. Dark-Sky Assoc. info sheet.

Good luck on this effort!

Sincerely,

Harvey Halvorsen

HARVEY HALVORSEN

1776-176th ST

NEW RICHMOND WI 54017

(D) 715-684-2914

1-13-98
about
with intensity
I will continue to my
know his lighting
copy of the
Bill
PMS

INTERNATIONAL DARK-SKY ASSOCIATION

3545 N. Stewart, Tucson AZ 85716 U.S.A.

Slide Sets and Other Items Available from IDA

One of IDA's goals is to prepare special items, available at cost, that illustrate the issues and can be used by members and others in their efforts to educate and inform others about the issues. We expect that all such will help IDA in its efforts to market the issues.

1. Standard ASP/IDA Slide Set. We have produced a standard set of 35mm slides that can be used by anyone giving talks on the issue of light pollution. They show bad lighting and good lighting and illustrate the solutions that can help greatly in minimizing the problems. Captions and an Introduction to the Issues are included. It can be obtained from the Astronomical Society of the Pacific, Sky & Telescope and other sources, as well as from IDA directly. We ask for \$25 a set (postpaid), to help defer costs. As volume goes up, costs will decrease, of course. The Astronomical Society of the Pacific lists the set in their annual catalog.

2. IDA has produced an additional 30 slides to supplement the above standard set of 20. It is especially useful for longer talks and for ones that require a more detailed treatment. This set is available directly from IDA for \$35 postpaid, including captions. An order for the "set" of 50 is possible, of course (\$60).

3. Individual slides are also available, usually at a cost of \$2.00 each plus postage, to supplement the above two sets, or for individuals needing only specialized slides. Inquire about what is available at any given time. An upcoming information sheet will list titles of all the slides available, including those in the two sets mentioned above.

4. We have available copies of the very effective poster "Earth at Night" produced by Woody Sullivan (an astronomer at the University of Washington, and an IDA member) in conjunction with Hansen Planetarium. We will send a copy to members and others for a donation \$10 (non-U.S.A. addresses for \$15, to cover the added postage. Note that these posters can also be obtained from Hansen Planetarium, the Astronomical Society of the Pacific, many planetaria gift shops, and others.). Slides of the Earth at Night or of individual continents are available from IDA.

5. There have been many queries about advice on approaching communities about lighting ordinances (and neighbors about their bad lighting) and about how to get better, more cost effective lighting. Some of these issues are addressed in Newsletters and Information Sheets (See the current list of information sheets, given in Information Sheet No. 15, which includes several that address just these questions.).

6. One can obtain a copy of Dave Crawford's helpful booklet on Light Pollution, from IDA, for a donation of \$5.00 to help cover costs of postage & handling. It contains advice on these topics and much useful information on the issues. The booklet also contains a basic bibliography and a thorough discussion of many of the major questions that are raised about the issues. Over 500 copies of it have already been distributed over the past few years. An upgrade and expansion of it is currently underway, and will be issued as a book, to be ready for press by the end of 1992.

7. Chest Works, P.O. Box 26751, Wauwatosa WI 53226, currently produces a T-shirt with Light Pollution as its theme. Chest Works donates \$1.00 to IDA for every such T-shirt sold. Future designs will also be produced. Such T-shirts will be available directly from IDA as well, at annual meetings and elsewhere. We thank Tom Gill for his interest and support.

8. Other sources are beginning to produce additional items, such as T-shirts, bumper stickers, and so forth. We welcome most all of these, of course, except those that say "turn off all your lights," as that is not IDA's philosophy. We are *for* quality lighting, as much as we are *against* poor lighting.

Finally, IDA membership, for non-members, may be the most useful and important of all. Basic individual memberships begin at \$20 per year (limited income or students at \$10), organizational ones at \$100. Gift memberships are most welcome, as are donations. Memberships and donations are tax deductible, for most people. IDA, Inc. is a 501(c)(3) tax-exempt, non-profit organization, incorporated in the State of Arizona.

List of Information Sheets as of the Date of This Edition

No.	Date	Title
1	Dec 88	Astronomy's Problem with Light Pollution
2	Dec 88	Light Pollution - A Problem for All of Us
3	Dec 88	Why We Don't Like the 175 Watt Mercury Fixture
4	Dec 89	Operating Data And the Economics of Different Lamps
5	Jan 89	Cities and Counties in Arizona with Outdoor Lighting Codes
6	Jan 89	Advice on Working with Community Leaders, Officials, and Others
7	Dec 89	As a Non-Profit Organization, IDA Needs Help
8	Jul 90	Local Sections for IDA: Why? How?
9	Jan 90	Glossary of Basic Terms and Definitions
10	Feb 89	Summary of the IAU Colloquium No. 112
11	Nov 89	Estimating the Level of Sky Glow Due to Cities
12	Dec 89	Recommendations about Effective Outdoor Lighting
13	Dec 89	Summary of the City of San Diego Street Lighting Conversion
14	Nov 90	Fact Sheet on the International Dark-Sky Association
15	May 92	List of Information Sheets Available as of This Date
16	Sep 91	Slide Sets and Other Items Available from IDA
17	Dec 89	Vast Orbiting Displays .. A Letter by Robert Dixon
18	Jan 90	Theft of the Night .. Text of a Dec 1989 NAS Op-ED Press Release
19	Jan 90	The American Astronomical Society's Position on Light Pollution
20	Jan 90	Sky Glow Effects on Existing Large Telescopes
21	Jan 90	Poster Paper: Light Pollution, Another Threat to the Environment
22	Jan 90	Sample Letter to Help Build Awareness and Ask for Help
23	Mar 90	Campus Lighting, and Other Such Applications (Libraries, etc.)
24	Mar 90	Security Lighting. Let's Have Real Security, Not Bad Lighting
25	Feb 90	How To Talk To Your Neighbor Who Has a Bad Light
26	Feb 90	Economic Issues in Wasted and Inefficient Outdoor Lighting
27	Feb 90	Control of Outdoor Lighting at Wesleyan University, by A. Uppgren
28	Jun 90	An Introduction to Light Pollution
29	Mar 90	Turtles and Outdoor Lighting in Florida
30	Jul 90	Partial List of Good Lighting Fixtures
31	Apr 90	'Does Stanford Need More Outdoor Lighting?' Letter by Dan Schroeder
32	May 90	Telling the Differences Between Different Lighting Sources
33	Jul 90	Talking Hasn't Worked. Shall I Sue Them?
34	Mar 90	We All Need Good Outdoor Nighttime Lighting
35	Jan 91	Billboards
36	Jan 91	Golden Bay Outdoor Lighting Control Ordinance
37	May 92	City of San Diego Outdoor Lighting Control Ordinance
38	Jan 91	Tucson/Pima County Outdoor Lighting Control Ordinance
39	Jan 91	Koyaanisqatsi -- Life Out of Balance
40	May 91	How to Get Started ...
41	Jan 91	Oh Beautiful for Spacious Skies -- Not Near a City !
42	Jan 91	Some Lighting Myths
43	Jan 91	Some Resolutions for the Coming Year -- by Frank Olsen
44	Oct 91	IAU Colloquium No. 112, Table of Contents
45	Oct 91	1988 IAU Resolutions About the Issues
46	Mar 92	State of Maine Act to Improve Outdoor Lighting
47	Mar 92	The IES -- Illuminating Engineering Society of North America (IESNA)
48	Mar 92	The CIE -- Commission Internationale de l'Eclairage (Intern. Comm. on Illumination)
49	Mar 92	Green Lights -- The EPS's New Program to Encourage Energy Efficient Lighting
50	Apr 92	The Earth at Night -- A Poster Showing a Satellite View of All of the Earth, at Night
51	Apr 92	Lighting and Crime
52	Apr 92	Efficient Outdoor Lighting
53	Apr 92	WARC-92: Principal Results of Importance to Radio Astronomy
54	May 92	Dark Campus Programs Reduce Vandalism and Save Energy
55	May 92	City of Tempe, Arizona, Lighting Ordinances
56	May 92	County of San Diego Lighting Ordinance

To order, please enclose a donation of \$1 for one to four information sheets, \$2 for five to nine, \$3 for ten to 14, \$4 for 15 to 19, \$5 for 20 to 24, \$6 for 25 to 29, or \$7 for 30 to 34, \$8 for 35 to 39, \$9 for 40 to 44, or \$10 for 45 to 56 (extra donations most welcome!) to help cover costs of reproduction and mailing. Write to IDA, Inc., 3545 N. Stewart, Tucson AZ 85716 U.S.A.



State Representative
James R. Baumgart

26th Assembly District:
City of Sheboygan-
Wards 1-3,5,6,9,11-16
City of Sheboygan Falls
Village of Kohler
Town of Sheboygan
Town of Sheboygan Falls
Ward 4

October 9, 1997

Representative Scott Gunderson
Chair
Assembly Committee on Urban and Local Affairs
Room 7 West, State Capitol
Madison, WI 53708

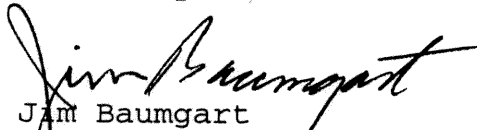
Dear Representative Gunderson:

Assembly Bill 88 which relates to the regulation of outdoor light fixtures and bulbs or lamps used in outdoor light fixtures had a public hearing by your committee on March 25, 1997. Since that time further action has been taken on it by the committee.

During the public hearing a number of concerns were raised. Enclosed is a copy of a Substitute Amendment (LRBs0212/1) which I have had drafted to address those concerns. I offer this Substitute Amendment to the committee for review, introduction and consideration.

Your consideration of this Substitute Amendment and an Executive Session by the committee on it and Assembly Bill 88 is requested.

Sincerely,


Jim Baumgart
State Representative
26th Assembly District

JB:wrc
c: Committee Members

JUN 13 1997

June 10, 1997

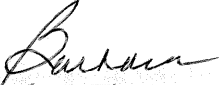
Rep. Jim Baumgart
P.O. Box 8952
Madison, WI 53708

Dear Jim:
RE AB 88

Thanks very much for keeping us up to date on AB 88. After your last correspondence I wrote again to Rep. Gunderson and all members of the Urban and Local Affairs Committee, and my own Representative Joe Plouff. I believe you are correct--with the anticipated energy crunch here in Wisconsin it may be just the right time for better lighting.

Please keep me updated. There is another voice here in Menomonie who is also writing to the Committee.

Thanks very much.


Barbara Thomas
E5190 650 Avenue
Menomonie, WI 54751