
**submission to: Nova Scotia's *Renewed Energy Strategy and Climate
Change Action Plan***

**Responsible Outdoor Lighting – Energy Consumption
and Environmental Impact**

Royal Astronomical Society of Canada
Halifax Centre
December 2007



halifax.rasc.ca

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1.0 Executive Summary

The purpose of outdoor lighting is to create a safe environment for persons that must be outside after dark and to ensure the security of property. All stakeholders in Nova Scotia win by correcting the problems of wasteful and inefficient outdoor lighting.

Nova Scotia has approximately 150,000 streetlights at an estimated energy consumption of 70 million kW hours (2005). The greenhouse gas emitted in the process of powering streetlights alone represents about 53,000 tonnes annually. The estimated annual operating cost is over \$20 million.

Approximately 30% of the light is wasted from most existing street and roadway lighting through light shining where it serves no purpose: projected up into the sky, glaring into the eyes of drivers and pedestrians, and spilling into areas adjacent to roadways and properties. This unused light represents not only wasteful consumption of energy and needless operating costs for all levels of government, but it detracts from the quality of life of inhabitants (both domestic and wild) by:

- unnecessary greenhouse gas (GHG) emissions and air pollution from hydrocarbon-powered generating stations, contributing to global climate change,
- degraded safety and security from glare and light trespass, and
- washout of the starry night sky (part of our heritage) behind the reflected glow of wasted light.

The Royal Astronomical Society of Canada (Halifax Centre) strongly believes that the Province of Nova Scotia can in part achieve its goals of reducing energy consumption, improving energy efficiency, and reducing GHG emissions by responsibly evaluating and changing its lighting practices and by formulating policy for itself and for other levels of government. Further savings would follow from a similar policy governing commercial lighting. Such a strategy would yield collateral benefits such as energy cost savings, enhancement of quality of life, improvement in safety and security, and protection of the environment.

In addition to the aesthetic benefits of responsible lighting, Nova Scotia taxpayers can realize significant real dollar savings as well as a reduction in greenhouse gas emissions of about 16,000 tonnes per year, by only considering street lighting. These reductions would increase considerably if unnecessary street lights were removed or residential and commercial outdoor lighting were included.

This submission is in line with Nova Scotia's *Renewed Energy Strategy* and *the Climate Change Action Plan*, particularly with respect to the focal points "using less energy", "leading by example", "air quality", "government action", and "government intervention".

The RASC is a society that deals with light. In pursuing their studies, astronomers—both professional and amateur—have become expert at gathering and interpreting information from very faint and distant light sources. Naturally, astronomers notice the negative aspects of bad lighting long before anyone else, and have become champions of responsible outdoor lighting. In a sense, we have become "the canaries in the coal mine".

2.0 The Royal Astronomical Society of Canada: Who Are We?

National Organization

The beginnings of The Royal Astronomical Society of Canada (RASC) go back to the middle of the 19th century. The Society was incorporated within the province of Ontario in 1890, received its Royal Charter from King Edward VII in 1903, and was federally incorporated in 1968. The National Office of the RASC is located at 136 Dupont Street in Toronto. The business office and library are also housed there.

The RASC is devoted to the advancement of astronomy and allied sciences, and its members are from many countries and from all walks of life. Its 4000+ members belong to one of 28 Centres located in cities across the country. The Society is unique in accepting both professional and amateur astronomers as members. The RASC is highly regarded internationally and many RASC members have received distinctions for their activities.

<http://www.rasc.ca/>

Local Organization

The Halifax Centre of the RASC was established in the 1950s. Since that time, Centre members have been involved in many public education projects in the field of astronomy. Planetarium shows, public viewing sessions, school presentations, continuing education classes, radio and television appearances, and public lectures are just some of the ways that the Centre and its members have contributed to the quality of life in Nova Scotia. The Halifax Centre has an active Responsible Lighting Committee, who collectively worked on this submission.

<http://halifax.rasc.ca/>

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3.0 Introduction to Responsible Lighting

Proper outdoor lighting enhances the safety of citizens and ensures the security of property. Outdoor lighting is used to illuminate roadways, parking lots, yards, sidewalks, public meeting areas, work sites, homes, and building exteriors. Good lighting increases the visibility of hazards, improves the safety of citizens, and provides a sense of security in the community. Visibility can be compromised by light pollution, but this can be mitigated by responsible lighting practices.

Definitions

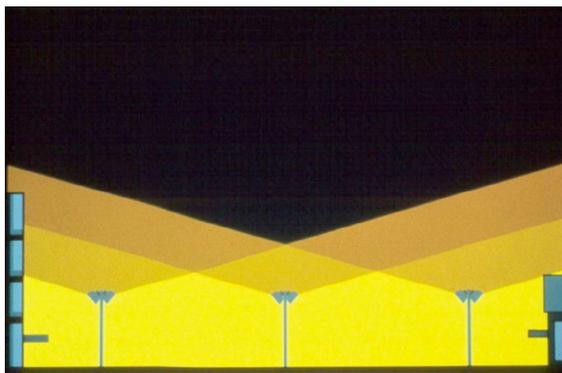
Light Pollution is the combined effects of glare, light trespass, and sky glow. In some cases, light pollution can actually reduce the safety and security it is intended to provide, since light may be directed where it was not intended. The associated energy waste is costly in terms of public expenditures, quality of life, and the environment.

Glare is the visual discomfort resulting from insufficiently shielded light sources in the field of view. The light source itself hinders a person's ability to see details not directly illuminated by the light. This degrades safety and security. One should see the hazards, not the light source. Glare will become particularly important as our population ages.

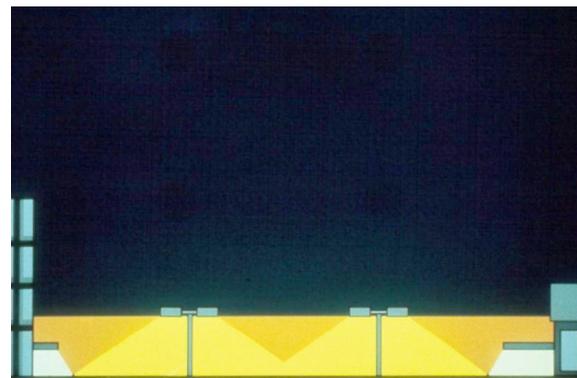
Light Trespass is misdirected light that invades neighbouring property. It creates a nuisance by shining into bedroom windows and other areas. Light should be directed to where it is needed.

Sky Glow is produced by two phenomena. Natural sky glow is produced at night by emissions from gases high in our atmosphere. Artificial sky glow dominates the natural form in and around urban areas. It is caused by light scattered off dust and large air molecules over a city. This light was intended to illuminate the ground but, due to poor design, it is misdirected upward into the sky. This wastes energy and obliterates the view of the night sky.

Responsible Lighting uses energy-efficient lighting fixtures that use shielding and lenses to direct the light to where it is needed, thereby providing adequate illumination at lower power, resulting in a reduction in energy consumption, real dollar savings, and reduced environmental impact. It can also mean controlling lighting by using timer or motion-control devices that ensure lighting is only on when it is needed.



poor lighting



responsible lighting

Discussion

- Reduction in energy consumption will contribute to reduction of GHG emissions, now believed to be a significant factor in global climate change.
- Many types of outdoor lighting designed for advertising, security and visibility are actually wasteful, invasive and sources of disabling glare.
- Light trespass, the poor control of outdoor lighting which crosses property lines, detracts from our quality of life, and confuses the instinctive daily and seasonal cycles of animals and plants.
- Public hazards have been created by the use of glaring, high wattage floodlighting along roadways and business parking lots, shining directly into a driver's line of sight. The Nova Scotia Motor Vehicle Act (section 95) presently provides the tools to enforce offending hazards.
- Public safety is also being compromised by commercial enterprises using excessive light levels to attract business. The eye's inability to adjust quickly to large swings from light to dark leaves a driver temporarily blind when exiting an overly lit business area at night. It is not uncommon to see businesses using three to six times the recognized lighting industry recommendations for site lighting.
- Because of light pollution, most of citizens today have already lost much of the starry night sky behind the glow of wasted light, limiting their imaginations to the man-made boundaries around them.

4.0 Values and Principles

It is hoped that the following values and principles proposed for planning and policy-making with respect to responsible lighting are seen to be fully in line with the goals of Nova Scotia's *Renewed Energy Strategy* and will find a home in the *Climate Change Action Plan*.

Experiences in other parts of the world have shown that the primary drivers around the issue of responsible lighting fall into three broad categories: Fiscal Responsibility, Environment Stewardship, and Ensuring Safety & Security.

Fiscal Responsibility

The Province of Nova Scotia and its counties and municipalities have undertaken many initiatives to realize efficiencies and cost savings in their budgetary processes. Regardless of how much is done, there will continue to be pressure from many quarters to save every available dollar. Roads must be maintained, police and fire services must be expanded as the population grows and settlements spread, recreational facilities must be maintained, and so on. Real dollar savings can be achieved without compromising the effectiveness of lighting systems by simply re-evaluating and changing lighting practices. Municipalities that have already done so find they recoup the changeover cost through reduced energy costs within the first several years. The value the benefit earned can be multiplied by directing the revenue into alternate clean energy sources and the development of other energy-saving measures. Thus, implementing responsible lighting practices will produce

net benefits in several areas affecting the quality of life in our province. These will be explored further.

All stakeholders in Nova Scotia win by correcting the problems of wasteful and inefficient outdoor lighting at night. Nova Scotia has approximately 150,000 streetlights at an estimated annual energy consumption of 70 million kW hours (2005). The greenhouse gas emitted in the process of powering this lighting represents 53,000 tonnes annually. The estimated annual operating cost is over \$20 million.

Approximately 30% of the light from outdoor lights is wasted through light shining where it serves no purpose: projected up into the sky, glaring into the eyes of drivers and pedestrians, and spilling into areas adjacent to roadways and properties. By using lower-wattage bulbs, lenses, and shielded reflectors, the electrical costs can be significantly lowered, while useful light intentionally reaches the place where it is needed

If the 30% of energy that is wasted by current street lighting practices were recovered, Nova Scotia taxpayers would realize significant real dollar savings as well as a reduction in greenhouse gas emissions of about 16,000 tonnes per year. These reductions would increase considerably if unnecessary street lights were removed or residential and commercial outdoor lighting were included.

Environmental Stewardship

It should no longer be necessary to repeat the facts and figures linking GHG emissions to climate change. In its most recent (2007) Synthesis Report, the International Panel on Climate Change states "Most of the observed increase in globally-averaged temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic GHG concentrations". In very unlikely event that it were shown that there is no link between emissions and warming, there would still be excellent reasons for Nova Scotians to reduce our reliance on non-renewable fossil fuels, to conserve energy and to ensure a clean environment for our future.

Nova Scotia produces approximately 23 Megatonnes of greenhouse gas emission annually. It is the highest of all the Atlantic Provinces, and is increasing annually. One of the largest contributors is electric power generation. Nova Scotia generates a significant portion of its electrical energy from fossil fuels.

One of the largest of these power plants is located at Tufts Cove in the heart the Halifax Regional Municipality. When the plant at Tufts Cove is operating and burning Bunker "C" the exhaust plume is highly visible. Since the plant is located on the harbour, and the surrounding land increases in elevation away from the harbour, the citizens of HRM are at times living in this exhaust plume.

The City of Calgary estimates that their recent efforts at responsible lighting through their EnviroSmart Streetlights program reduce carbon dioxide emissions by as much as 25,000 tonnes a year.

By implementing a responsible outdoor lighting policy and by aiding other levels of government and commercial operations in complying, the Province of Nova Scotia has the opportunity to significantly reduce greenhouse gas emissions and other air pollutants, joining the international efforts to mitigate climate change and improve air quality.

Ensuring Safety and Security

Everyone wants safety and security for their homes, businesses, and families. It is for these reasons that we light our streets, walkways, building entrances, parking lots and other outdoor areas. These goals may actually be compromised when we fail to make the correct selections for outdoor lighting fixtures.

The eye adapts to the brightest object in the field of view, and if this happens to be a glaring light fixture, all other areas with reduced illumination will appear dark or very hard to see. The best lighting reduces harmful glare by shielding the source so the illumination is directed only where needed: on the ground and not into your eyes! A rule of thumb: if you can see the bulb, the lighting fixture has poor design.

Lighting for crime prevention is achieved through uniform illumination at an appropriate intensity. It is the uniformity and coverage of the lighting that improves visual performance and contributes to safety and security, NOT the brightness! Properly adjusted and shielded sensor-activated lighting may be a good option to improve security for homes, buildings, and storage yards, reducing energy consumption and cost at the same time.

5.0 Action Plan

In order to develop options for consideration and action, the RASC Halifax Centre recommends that the Province of Nova Scotia allocate resources to study the cost, extent, and consequences of wasteful and inefficient outdoor lighting. Furthermore, a responsible lighting policy should be formulated and implemented for public, commercial, and residential outdoor lighting. Such a policy should include education and outreach.

For new installations, procuring and installing the newer, energy-efficient luminaires should be made mandatory. Existing lighting installations and illumination standards need to be audited to identify instances of over-lighting and these should be corrected.

In Nova Scotia Bill 146 (Environmental Goals and Sustainable Prosperity Act) it is stated that "A government facility will be constructed as a demonstration facility in accordance with a leading standard for building energy efficiency and sustainability, such as the Leadership in Energy Efficiency and Environmental Design standard by the year 2015." Responsible lighting should be a part of this project.

The Province may want to collaborate with some initiatives already underway:

UNSM Smart Street Lighting Strategies Project

In September 2007, The Union of Nova Scotia Municipalities announced the *Smart Street Lighting Strategies Project*, which they are hoping will "shed some light on ways to cut costs and help the environment." The study will examine energy efficient street lighting practices and technology. The study is funded by Conserve Nova Scotia, Halifax Regional Municipality, Nova Scotia Power, and the UNSM. The report, expected in January 2008, we hope will point the way to a provincial strategy on responsible street and roadway lighting.

<http://www.unsm.ca>

HRM Community Energy Plan

In December, 2007, Halifax Regional Municipality announced its Community Energy Plan. This plan contains seven goals HRM wants to reach to reduce greenhouse-gas emissions and save money on energy spending, including efficient street lighting.

<http://www.halifax.ca/environment/energyplan/index.html>

6.0 Sources of Information

Because of the importance of responsible lighting to the healthy growth of our communities, we here provide some samples of the wealth of information available from accredited sources.

The Illuminating Engineering Society of North America

The IESNA is the recognized technical authority on illumination. For over ninety years its objective has been to communicate information on all aspects of good lighting practice to its members, to the lighting community, and to consumers through a variety of programs, publications, and services. The strength of the IESNA is its diversified membership: engineers, architects, designers, educators, students, contractors, distributors, utility personnel, manufacturers, and scientists, all contributing to the mission of the Society: to advance knowledge and disseminate information for the improvement of the lighted environment to the benefit of society.

The IESNA is a forum for the exchange of ideas and information and a vehicle for its members' professional development and recognition. Through its technical committees, with hundreds of qualified members from the lighting and user communities, the IESNA correlates research, investigations, and discussions to guide lighting experts and laypersons via consensus based lighting recommendations.

The Society publishes nearly 100 varied publications including recommended practices on a variety of applications, design guides, technical memoranda, and publications on energy management and lighting measurement. The Society, in addition, works cooperatively with related organizations on a variety of programs and in the production of jointly published documents and standards.

In addition, the Society publishes *Lighting Design and Application* (LD+A) and the *Journal of the Illuminating Engineering Society* (JIES). LD+A is a popular application-oriented monthly magazine. Every issue contains special feature articles and news of practical and innovative lighting layouts, systems, equipment and economics, and new of the industry. The *Journal* contains technical papers, most of which are presented at the Society's Annual Conference. IESNA has a strong education program with basic and intermediate level courses and seminars offered through its Sections. The Society has two types of membership: individual and sustaining. Applications and current dues schedules are available upon request from the Membership Department. IESNA local, regional, and international meetings, conferences, symposia, seminars, workshops, and lighting exhibitions (LIGHTFAIR INTERNATIONAL) provide current information on the latest developments in illumination.

<http://www.iesna.org/>

The City of Calgary

In Calgary, Alberta, the streetlight system is the single largest electricity consumer. In response to rising energy costs, The City of Calgary initiated a series of pilot projects in 2000 to install lower-wattage, flat-lens, streetlight fixtures on several streets. The pilot projects successfully demonstrated that the retrofit fixtures use less energy and cut down on light pollution, while maintaining safe levels of lighting in Calgary neighborhoods.

In July 2001, City Council approved a proposal to retrofit most of the residential streetlights to lower-wattage, flat-lens fixtures over the following four to five years. By November 2004 the city retrofitted 37,000 street lights out of a total of 73,000. On residential roads the wattage was reduced from 200W to 100W and on collector roads it was reduced from 250W to 150W. This power reduction allows for energy savings of about 30-35%. This corresponds to a yearly energy savings of 25,000 MWh and 25,000 fewer tonnes of GHG emissions. The yearly cost savings is \$1.7 Million. (Note: these Calgary figures may not apply directly to the Nova Scotia situation, as the source and cost of the electrical power generation must be considered.)

<http://tinyurl.com/yq6mmx>

Light Pollution Awareness Website

This site is a comprehensive reference on issues associated with the control of light pollution. This site has been selected as one of the best educational resources on the Internet for students and teachers.

On October 25, 2001, the Light Pollution Awareness Website (LiPAW) was granted the Griffith Observatory Star Award for presenting useful, thorough, and accurate information in a well-organized and attractive way, making the night sky more available to everyone.

<http://amper.ped.muni.cz/light/ctstarwchr/>

The International Dark Sky Association

The International Dark Sky Association was incorporated in 1988. IDA's goals are to be effective in stopping the adverse environmental impact on dark skies by building awareness of the problem of light pollution and of the solutions, and to educate everyone about the value and effectiveness of quality nighttime lighting. The IDA does not manufacture responsible lighting fixtures, but does evaluate and endorse commercial products that meet its criteria.

<http://www.darksky.org>

The Royal Astronomical Society of Canada

The mission of the National Light Pollution Committee of the RASC is to advise, local, provincial and national governments and organisations on the abatement of light pollution, for the advancement of astronomy and the preservation of dark skies.

The RASC maintains a web site with useful information concerning responsible lighting:

<http://www.rasc.ca/lpa>

7.0 Conclusions

The purpose of outdoor lighting is to create a safe environment for persons that must be outside after dark and to increase the security of property. It is also used to enhance the architecture of the urban nightscape. This is accomplished by illuminating hazards and by discouraging theft and vandalism as well as illuminating surfaces to produce a "sense of place" for motorists and pedestrians. These goals are met by selecting appropriate luminaires that minimize glare and provide well-defined illumination.

In addition to the aesthetic benefits of responsible lighting, Nova Scotia taxpayers can realize real dollar savings and a significant reduction in greenhouse gas emissions of about 16,000 tonnes per year. These reductions would increase considerably if unnecessary street lights were removed or residential and commercial outdoor lighting were included.

The Royal Astronomical Society of Canada (Halifax Centre) strongly believes that the Province of Nova Scotia can in part achieve its goals of reducing energy consumption, improving energy efficiency, and reducing greenhouse gas emissions by responsibly evaluating and changing its lighting practices and by formulating policy for itself and other levels of government. Further savings would follow from a similar policy governing commercial lighting. Such a strategy would yield collateral benefits such as energy cost savings, enhancement of quality of life, improvement of road and property safety, and protection of the environment.

In Bill 146 (Environmental Goals and Sustainable Prosperity Act) the government has pledged that "The long-term environmental and economic objective of the province is to fully integrate environmental sustainability and economic prosperity and to this end to demonstrate international leadership by having one of the cleanest and most sustainable environments in the world by the year 2020...."

Here is an opportunity for the Province of Nova Scotia to be the first in Canada to recognize the environmental effects and waste of energy caused by poor lighting practices. The province would show leadership by legislating, implementing, and educating the public about responsible lighting.