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Light Pollution in Hong Kong

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1 General Introduction

1.1 Definition of light pollution

According to Hong Kong night sky brightness monitoring network, "Light Pollution" is a kind of environmental degradation in which excessive artificial lightings sources like street lights, neon signs, illuminated light boards etc. which affects the environment, the ecosystem and human health. The wasteful light emitted would reflect and spread upward directly and lead to the brighter night and a drop of stars visible in the sky.

1.2 Current Situation of light pollution in Hong Kong

Hong Kong is known as the most serious light pollution in the world and the level in Tsim Sha Tsui is 1,200 times brighter than a normal dark sky. According to the data collected by HKU, the brightness of the Hong Kong night sky in urban areas like Mong Kok and Wan Chai are 500 times higher than in country sides in Sai Kung. And the overall brightness of the Hong Kong night sky is at least 30 times higher than that in other countrysides. This situation is so serious that it would bring negative impact to the environment and also the citizens. And the data below from Hong Kong night sky brightness monitoring network are found consistent.

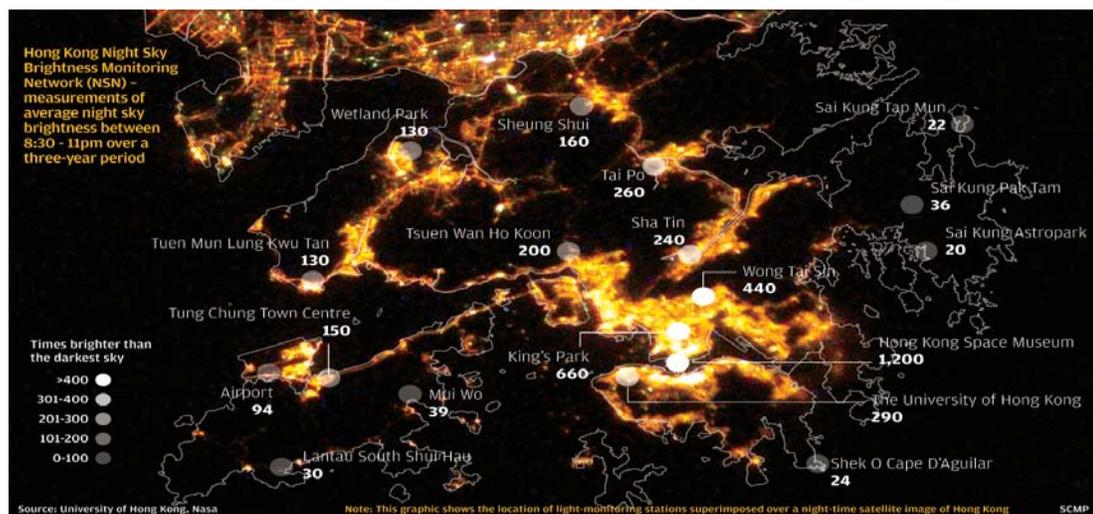


Figure 1: Measurements of average night sky brightness between 8:30-11pm over a three-year

period The above data supports that most of the districts are 100 times brighter than the darkest sky as you can see, light pollution In Hong Kong is very serious and the problem in all round Hong Kong, but not particularly in part of the district.

1.3 Main Sources leads to light pollution

Street Lights and light from sports field and construction sites:

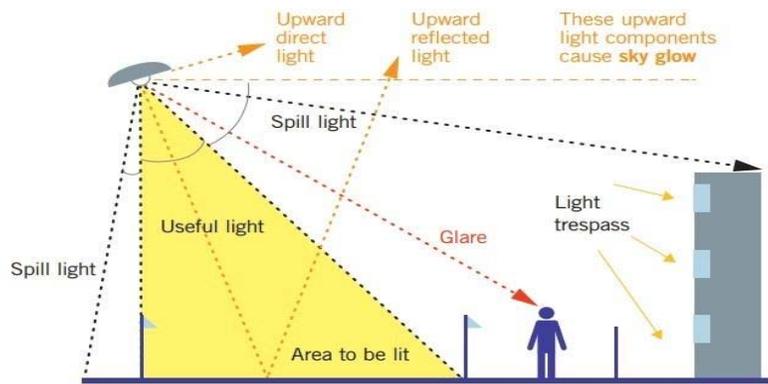


Figure 2: Different types of light nuisance

This diagram shows that the outdoor lightings, like lighting for street lights, sports field and construction sites, will be reflected through the ground and spill light to the surrounding and thus causes light trespass to the indoor and leads to light nuisance to residents. Most importantly, in Hong Kong, there are over 130,000 streetlights. Each streetlight will produce certain amount of light pollution. Hence, it is a main source of light pollution. And the government should bear the responsibility to fix the angle of the streetlight to reduce unnecessary light spilt.

Apart from streetlight, there are different sources that also increase light pollution.

Shop sign and advertising board: With the name of pearl of the orient, there are shop signs and advertising boards everywhere, especially in places like Tsim Sha Tsui, Mong Kok. According to news from MingPao in 2013, some of the adverting boards spill light on the ground and recorded 3500 Lux, which are 8 times higher than the normal. More serious case like Time Square in Causeway Bay, there are 3 spotlight

around which cause 2500 Lux! While residents living nearby will suffer from high lux of light and would cause health problem.

Video Wall: Some big shopping malls install video wall outside like Time Square, the LED light from the video wall causes light pollution.

1.4 Light pollution with Externalities

Light pollution, apparently, it is an environmental issue to many environmentalist and the general public. However, light pollution, more than an environmental issue, is also an economic issue. Externalities exist when a party's action affects other parties but it does not pay or receive payment, it can be harmful or beneficial to the third party. Because of light pollution, it brings different impact to the household, society and business sector.

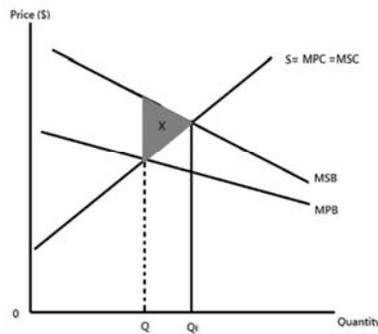


Figure 3: Divergence between private and social costs

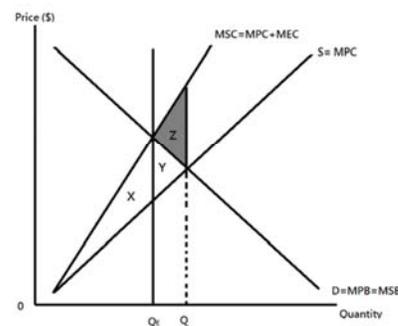


Figure 4: Divergence between private and social benefits

Due to light pollution, both positive and negative externalities existed. In the following sections, we will discuss more on externalities on different stakeholders.

2 Stakeholders' view towards light pollution Issues

2.1 Environmentalist

Light nuisance and energy wastage are two of the major concerns expressed by Friends of the Earth (Hong Kong) which in 2008 launched its Dim It campaign to raise awareness of light pollution.

Director of General Affairs Edwin Lau Che-feng said the worst offenders were the big neon signs, flashing LED screens and advertisements with spotlights.

"We are not opposed to neon signs that are switched on during operating hours to attract people. That is normal business. What we really disagree with is excessive lighting that is too bright and which stays on outside business hours," he said.

Figure 5: Major sources of light pollution

Environmentalists suggested that light pollution is caused by the misuse of those external lightings, for example, the big neon signs, flashing LED screens and advertisements with spotlights. They are totally discontent with those excessive usage of lightings during off-peak hour, which caused serious light nuisance and energy wastage problems. Those external lightings also make the sky so bright that stars cannot be seen.

The excess of neon lights, floodlights and other lights near residential buildings is not good for the city. **They consume a lot of electricity which in turn increases carbon dioxide emissions and these emissions are a cause of global warming.** They disturb residents living nearby who have difficulty sleeping.

Figure 6: Excessive use of lightings

Besides, as those excessive lightings required a large amount of electricity, it fastens the use of the fossil fuels and emits more carbon dioxide, which would worsen the global warming problem. Also, as the whole world were under energy crisis, misusing and overusing energy are not environmental-friendly, which violate the principle of sustainable development, thus the environmentalists prefer a more intense solution in solving light pollution problems.

Friends of the Earth's Edwin Lau called the current guidelines on external lighting "toothless" and said the only way of tackling light pollution was for the government to introduce legislation setting out the specifics to control the intensity of lights and the hours they could be illuminated.

"The (current) guideless are so weak and so general. They talk about lights not being so bright but there are no real specifics on things like maximum intensity for the industry to follow," he said

"We should be looking at ways to let our city in a more equal and sustainable manner," said Lau.

"The government is responsible for providing people with the environment for them to have a good sleep. That is why the government has the noise control ordinance that limits noise after 11pm. I see no reason why it shouldn't be the same with lighting."

Figure 7: Toothless guidelines provided by the government

Environmentalists think that the current guidelines suggested by the government are toothless and weak, they claimed that legislation should be used as an effective way to treat the problem. They think that similar control to noise control can be implemented into light pollution issues. They support to have strict laws to control the excessive lightings problem.

2.2 Tourists

From tourists' viewpoint, they think that these excessive lighting is attractive to them. Since Hong Kong is well-known for the 'Pearl of the Orient', and the show 'A Symphony of Lights' is famous around the globe too, which attracts millions of tourists. Bright and Colourful lightings make the city alive at night, which sounds encouraging for tourists to come to Hong Kong for vacation. With lights turning off or to a lower intensity, the tourists may feel less interested in visiting Hong Kong. They think these unique culture, features and phenomenon should be kept.



A Symphony of Lights is a famous laser lights and music show in Hong Kong. It is presented by the Hong Kong Tourism Commission through organizing 44 skyscrapers and landmarks that lie on the sides of the Victoria Harbor. Through interactive lighting and music show, it shows the vibrancy and glamorous night view of the city. The local Tourism Commission initiated the project in 2004, and it was formally included in the "Guinness Book of World Records" as the world largest lighting and music show on Nov. 21, 2005.

Figure 8: A Symphony of Lights

2.3 Astronomers

For astronomers like Pun the wish most probably would be for less artificial light so Hong Kong could enjoy some starry starry nights.

Figure 9: Viewpoint of astronomers towards light pollution

Light pollution makes the sky much brighter than the natural night sky. It has significant impacts on astronomy, drowning out the light from faint objects like galaxies and nebulae and increasing the sky background for faint stars. The astronomers found that the views will be very different in a dark country sky versus a light-polluted city. There are fewer and fewer visible stars if they grew up viewing a night sky blocked by light pollution. Because the stars are blocked by light pollution, astronomers find it hard to search the cosmos for new galaxies or planets. So, they tend to ask for a better solution in solving light pollution problems, for example, better design of lighting and introduce law to restrict the use of external lighting after 11:00pm.

2.4 Entomological and Zoological specialist

The study found that even rural areas of Hong Kong, including the nearby island of Lantau and the city's Wetland Park to the north -- a world famous staging post for migratory birds -- were also being affected by man made lighting. The Wetland Park was on average 100 times brighter than the standard, the study found.

Figure 10: The impact of light pollution on rural areas

Figure 11: Threat to animals that rely on light signals to navigate

Hong Kong Entomological Society chairman Yiu Vor said he feared the brightness would affect the breeding of fireflies, including the endemic bent-winged firefly, which relied on light signals to mate.

"They might not be able to notice the signals in a bright environment or they simply release the signal less frequently. This would affect their continuing survival." Yiu said insects that relied on moonlight to navigate could also be affected.

The problem of light pollution caused certain negative impacts on animals, for example, shorten the life expectancy of the firefly and also affect their continuing

survival. Also, as the rural areas, e.g. the Wetland Park also suffering from light nuisance, which will affect the daily life of the birds and also the life of the migratory birds in Hong Kong. Nocturnal animals are especially sensitive when it comes to the intensity of some lights. When the lights are too bright, their life cycle may be affected. For example, it will be very difficult for owls to survive and live, as they hunt when it is dark. So, they tends to support stronger solution to confront the light pollution, e.g. by legislation.

2.5 Health specialist

Even at the Astropark stargazing facility near High Island Reservoir - where most would expect a natural dark sky - the brightness was still 20 times the standard. Health specialists say light pollution could disrupt the biological clock and affect brain and hormone function.

Figure 12: Disruption to human's health

"In order for humans to function, light photons must hit the retina. However, when there is too much artificial light at night, there may be an overexposure of photons to the retina, disrupting circadian rhythm." said Dr. Li Li, a professor of cognitive psychology at the University of Hong Kong.

The sleeping aspect of the circadian cycle is largely controlled by melatonin, a hormone produced in the pineal gland of the brain.

Naturally, the body's internal clock controls the time you wake up and the time you sleep by raising or lowering levels of melatonin.

"Melatonin levels usually rise in the mid to late evening, remain high for most of the night, and then drop in the early morning hours," Dr. Li said.

However, this normal process is affected by light. The more light there is, the less melatonin your body produces.

Eventually, if there is too much exposure to light at night, the body may not be able to produce enough melatonin to sleep.

And, in fact, this deficiency is not only affected on a day-to-day basis. The body may permanently be unable to produce enough melatonin, leading to insomnia.

The consequences of melatonin depletion are potentially far-reaching.

According to Professor Samuel Ho of the University of Hong Kong, melatonin is also a hormone that slows the risk of cancer.

"Melatonin impacts the endocrine system and prevents cancerous growth formation and development," Ho said.

In women, decreased melatonin could put them at an increased risk of breast cancer and large intestine or rectal cancers.

Beyond increased risk for cancer, an irregular circadian rhythm may also lead to weight gain, impulsive behaviour and slower cognitive functions.

Figure 13: Serious impacts by light pollution on human's health

Health specialist suggested light pollution will lead to great health problems to us, especially to those who lived near-by. With light pollution, it will disrupt our biological clock and affect our brain and hormone function. Furthermore, when there are more lights, the less melatonin our bodies can be produced, especially for people who lived near-by, may result in insomnia due to the insufficient melatonin. Without sufficient melatonin, it may increase the risk on having cancer, especially for the breast cancer and large intestine cancer or rectal cancer. Light pollution may lead to people having mental problem more easily too, as facing insomnia, people may feel tired and frustrated and even lower their productivity in their daily working. With stressful life and insufficient rest, depression, anxiety, bipolar disorder may be resulted too. So, the Health specialist strongly advised the government to take stronger pressure to treat and lower the negative impact to the residents. As in long term, more and more patients may resulted by light pollution and increase the burden of the medical system of the government.

"There is all kinds of research showing brighter is not safer. For old people, bright lighting can create glare which is damaging to their sight.

Figure 14: Disruption to old people's sight

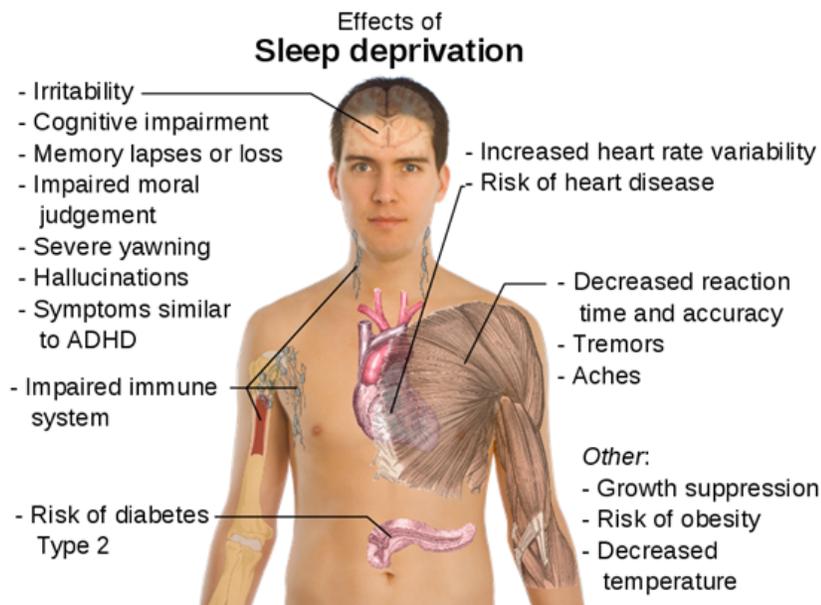


Figure 15: Effects of sleep deprivation

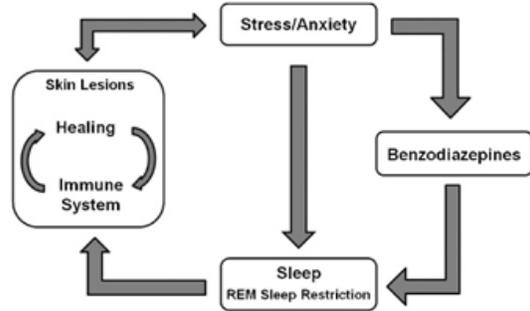


Figure 1 - The proposed model for the interplay between the use of BZD and healing in patients with skin lesions. In this case, the immune system and healing continue to be mutually dependent and are presented in relation to the bidirectional immune profile and psychological profile of the patient because large lesions cause anxiety and stress, and these effects directly affect healing and inflammatory capacity. Finally, BZD compounds are ultimately responsible for alterations in healing and tissue regeneration.

Figure 16: The proposed model for the interplay between the use of BZD and healing in patients with skin lesions

Last but not least, the advanced of lighting technology make the light even brighter and brighter, e.g. LED, but it is not safer to us. It will be even harmful to our eyes, especially for old people, bright lighting create glare which is damaging to their sight. In order to maintain better health and lower the future burden of the medical system, which was overloaded already due to the aging problem, tough ways, such as setting up laws, should be concerned.

3 Household view towards light pollution Issues

3.1 Stance and concerns towards light pollution issues

For general households, they may not feel and think that light pollution is an urgent and significant problem that they need to put any eye on it. As they were only slightly affected by the light pollution, for example the loss of starry night, they tend to take limit or even no action towards light pollution problem. What generous household concerns more may be the air pollution problem! As they are one of the immediate victims of the poor air quality, especially for those have certain respiratory diseases. However, they haven't ever think that those beautiful and colourful external lighting in the street nowadays are one of the culprit of worsening the air pollution in Hong Kong. By over-using the electricity, more and more fossil fuels have to be burned, and more and more carbon dioxide will be emitted. When one day general households figure out this relation between light pollution and air pollution, they might ask for further and massive ways to solve the problem too.

In contrast, those residential lived near-by will be the first and most eager party ask for an immediate and effective solution to solve the problem and save them from never-ending suffering. For example, those residential lived in Nathan Road and South Sai Yang Choi Street, they have kept on seeking the help from the district officers in recent years. Their life was heavenly affected by those bright lights, which was never being turned off. As they were having such hard time, they strongly requested the government to set certain control and laws to protect them and save them from such cruise.

3.2 Impact to Household caused by light pollution

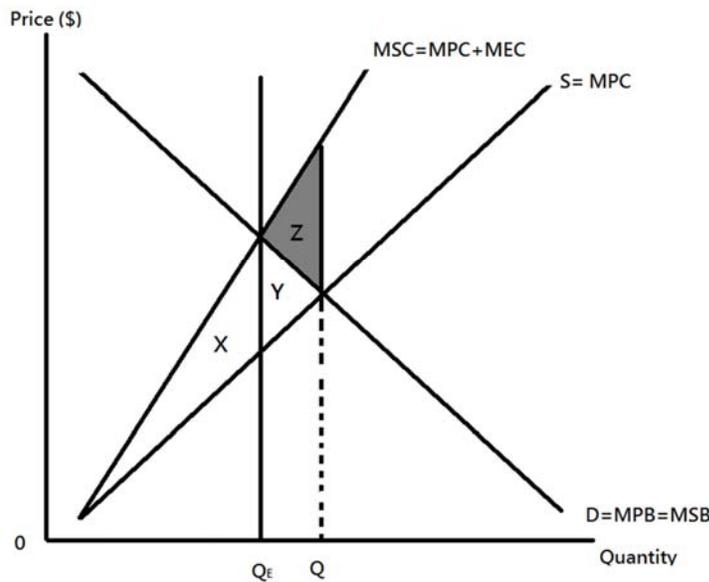


Figure 17: Negative externalities caused by light pollution

As the light pollution problem has serious bad impact on both people and the environment, there is an external effect that generates costs to a third party, which is called negative externalities.

From the above diagram, the bad impact of light pollution can be addressed by the divergence between the marginal private cost (MPC) and marginal social costs (MSC). To reach the social optimum, the firm should produce when marginal social costs equals to marginal social benefit (MSB). However, the market is now producing at point Q , which is overproduced and not effective. Area Z represents the deadweight loss to the society caused by the negative externalities.

As the market is currently not producing at the efficient level, government policy and market negotiation can be made to correct the problem.

3.2.1 Nearby residents

Light pollution is a nightmare to the nearby residents, take Sai Yeung Choi Street South in Mong Kok as an example. Sai Yeung Choi Street South, a famous tourist's attraction in Hong Kong, are facing the serious light pollution problem now. According to a consultant's report commissioned by the Hong Kong Government in 2011, invasive light from outside is a form of environment harassment to nearly 80% of the residents on Sai Yeung Choi Street South.



Figure 18: External lightings in Sai Yeung Choi Street South, Mong Kok

Light pollution comes in many forms, including sky glow, light trespass, glare, and over illumination. Sky glow is the bright halo that appears over urban areas at night, a product of light being scattered by water droplets or particles in the air. Light trespass occurs when unwanted artificial light from, for instance, a floodlight or streetlight spills onto an adjacent property, lighting an area that would otherwise be dark. Glare is created by light that shines horizontally. Overillumination refers to the use of artificial light well beyond what is required for a specific activity, such as keeping the lights on all night in an empty office building.

Figure 19: Description of different types of light pollution

The nearby residents need to torture different forms and types of light pollution, which made them feel annoyed and unbearable. The huge neon signs and billboard have seriously affected the quality of sleep of nearby residents. Their windows need to be covered by an opaque and thick curtain to have a dark and comfortable place to sleep. Some of them may even suffer from insomnia. However, they did not get any compensation from the advertising company. This caused a negative externality to the nearby residents.

3.2.2 Environment



Figure 20: Brightness of Hong Kong night sky in different regions

According to a report by the Physics Department from University of Hong Kong in 2013, the brightness of Hong Kong night sky is 100 to 1200 times over the international dark sky standard.

Why is dark sky so essential to the environment and us? For those astronomy enthusiasts, they are affected by the light pollution. As an astronomy enthusiast, the dark sky is an essential for stargazing. Without a completely dark sky, the stars cannot be observed clearly. The leisure activities of the astronomy enthusiast are affected by the light pollution and no compensation is guaranteed.

More than the astronomy enthusiast, the general public and the environment are affected too. To make the advertisement more attractive and eye-catching, the neon signs and billboard need to be as bright as possible. What's wrong with the super bright light? The bright required lots of electricity. Other than light pollution, the generation of electricity will also cause lots of pollution. This results a great harm to our environment.

Furthermore, Light pollution may also cause adverse effects on environment and ecosystem. Excessive outdoor lightings may disorient physiological cycles and the

movements of animals. In the worst scenario, it would even influence the entire ecological balance of the local living environment.

The light pollution has bring lots of harmful and negative effect on the general public and the environment without any proper compensation.

3.3 Solutions to Households

Light pollution has created serious effects to households. For example, the loss of starry sky, the bad quality of sleep, insomnia, or even some serious respiratory diseases. However, there is no laws or ordinance to help with the light pollution problem. Hence, in order to remedy the side effects that are created by light pollution, there are some solutions for households to follow.

First and foremost, to reduce the use of energy, households can follow the guidelines that are provided by the Hong Kong Government. The government has provided many sets of tips regarding saving the environment. For households, they can also help save the environment by leading a green lifestyle. Residents can follow the tips on the government website in an effort to help reduce light pollution and energy wastage. For instance, switch lightings on only when it is necessary, choose light bulbs that can maximize the efficiency, etc.

Earth Hour, which is organized by the Worldwide Fund (WWF) in Hong Kong every year, also helps to reduce the energy usage, and thus educates the public the importance of saving energy. This activity is about to switch off the lights for an hour, either at home, at office or at school. What the WWF wants to advocate is that there is only one Earth, in order to save the Earth we are all living in, each and everyone of us should save this planet with concerted action. There are thousands of companies and schools supporting the event each year. And iconic buildings and landmarks like IFC go dark across the Victoria Harbor. Besides, WWF also provides some useful information for individuals to save the Earth. For instance, the importance of saving energy and water.

Earth is the place we are all living in. Each individual can start saving the Earth with a little change, whether or not it is a small or big one. With concerted efforts, it is believed that the problem of light pollution can be alleviated.

4 Business' view towards light pollution Issues

4.1 Stance and concerns towards light pollution issues

For Business sector, actually apart from pollution problem, what they concern most is the profit and his/her company's development. Many large and famous corporates do not really care about what is light pollution. During their off-peak hour and midnight, they still keep all their lights on for the entire shop. Big and famous company didn't really care about the electricity fee problem, and those externalities that may be caused to others because of his/her efforts. For those external lighting advertising, they simply keep them all on although it was already midnight and no one on the street will attract and put an eye on it. As they won't have any immediate problems and negative impacts because of these light pollution.

So, when the general public and many different stakeholders were asking for a tougher way to confront the light pollution problem, they tend to oppose due to their own economic interest. Business worried their promotion will be hindered when once the law is passed. They cannot promote overnight but with a limited time. Extra expenses are required to promote their companies, which will increase their cost and lower their profit. With nearly zero benefit for them, they tend to oppose and give no hand in solving light pollution problem in Hong Kong.

Tourism industry has shared their concerns by raising a question that legislation may affect tourism as Hong Kong is famous for night view which attracts millions of tourists. With lights turning off or to a low intensity, the vibrant culture of Hong Kong will be diminished. Hong Kong may lose her competitiveness. As we all known, tourism industry is a major source of Hong Kong's GDP nowadays, which make his/her concern sound reasonable, which the government should consider about that.

4.2 Impact to Business caused by light pollution

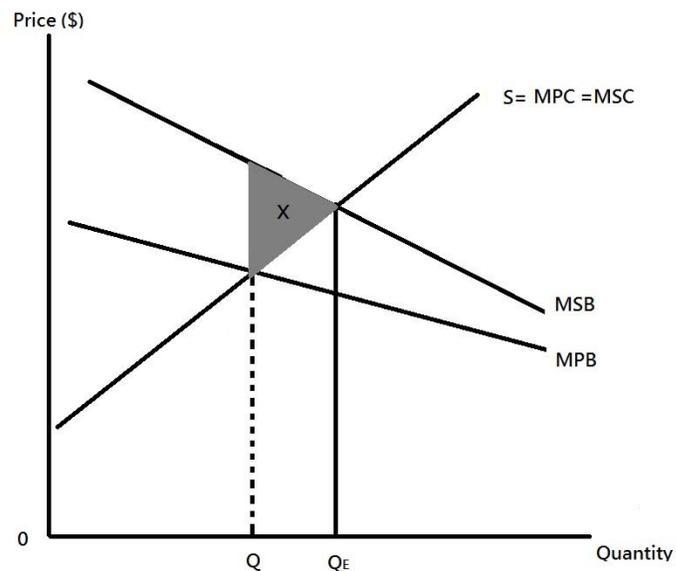


Figure 21: Positive externalities brought by light pollution

In the viewpoint of the household, light pollution definitely brought many bad impact on them. However, the lights are one of the business opportunities for both companies and tourism industry.

From the above diagram, the positive impact gained from light pollution can be addressed by the divergence between the marginal private benefit (MPB) and marginal social benefit (MSB). To reach the social optimum, the firm should produce when marginal social costs (MSC) equals to marginal social benefit. However, the market is now producing at point Q , which is under produced and not effective. Area X represents the deadweight loss to the society caused by the positive externalities.

As the market is currently not producing at the efficient level, government policy and market negotiation can be made to correct the problem.

4.2.1 Tourism industry

Tourism is one of the four key industries in Hong Kong, it contributed to 4.5 per cent of Hong Kong's GDP in 2011. Apparently, there are no relationships between light pollution and the tourism industry. However, they are inter-related.

Victoria Harbor is one of the most beautiful and popular harbors around the world, many visitors are attracted by the beautiful view.



Figure 22: The Light Show, The Symphony of Lights in Hong Kong

The Symphony of Lights; the nightly multimedia show, which involves more than 40 buildings on both sides of the harbour. It even becomes one of the must-go tourist attractions of Hong Kong. The tourism industry has benefited from the light show. However, the light show also caused serious light pollution to the environment. Light pollution not only bring harmful effect to the society, also bring some positive effect to the tourism industry.

4.2.2 Other Companies

To run a successful business, advertising and promotion is an essential element to gain public attention and brand awareness. Many companies in Hong Kong will choose outdoor billboard to promote their product or services. As a result, there are outdoor billboards and neon signs everywhere in Hong Kong.



Figure 23: A street in Hong Kong with many outdoor billboards and neon signs

How can the company benefit from this situation? Generally, the billboards will be close to each other. Since the bright light is eye-catching, the strategy of having billboard as promotion is most effective one. Moreover, as they are close to each other, the advertising effectiveness will even be higher. The benefit of using outdoor billboards and neon signs is much higher than the cost, that's why more and more company will go for this type of advertisement.

4.3 Suggestions for Business

As light pollution is becoming a more severe problem in the society, what can the business sector do to help solve the problem?

The main source of light pollution brought by the business sector is from advertising. It is not hard to see buildings with big posters hanging on the wall. In the daytime, they can be displayed clearly under sunlight, but at night, several flashlights are needed to outstand the advertisement. It makes the roads keep bright for the whole day, which causes a great amount of light pollution. Suggestion is made that the companies can change the method of advertising. In this cyber generation, nothing is better than using multi-media. No matter in means of spreading speed, coverage of people, multi-media can easily arouse public's attention. Undoubtedly, the trends change fast in multi-media that companies may need to have frequent updates on their advertisement, it shows the passion of companies towards the market and favors target customer to follow the latest news of the companies. It can serve as an efficient marketing strategy, at the same time to reduce the damage to the environment.

Besides actions taken by the companies, government should do something. The government can impose regulations on controlling the light pollution. For example, set a limit on light used in each outdoor advertisement and the corresponding watts of lights used, or set period of using lights, and after a set time all lights should be closed, or encourage and educate companies to turn off lights when they are not in business hours. To implement the above regulations mentioned smoothly, the government needs to be really focus and strict on the implementation in order to help solve the problem effectively.

5 Government Solution towards light pollution Issues

5.1 Current approaches of Hong Kong Government on treating light pollution

The problem of light pollution in Hong Kong has been on the limelight in recent years. Often, there are different parties from the members of the general public express their concerns on the seriousness of light pollution. The Hong Kongers feel worried about the light pollution in their living place, so do the foreigners. Lights are the mixed blessings to Hong Kong – now that Hong Kong not only being called the Pearl of the Orient, but also one of the most polluted cities in the world.

5.1.1 Task force with voluntary guidelines

In eyes of the gravity of light pollution problem and the increase of public concern, the Hong Kong government promised to address the problem in 2008. In 2009, the Environment Bureau was assigned to conduct a study on external lighting. Three years later, in 2011, the Task Force on External Lighting was being set up.

Following the 2008-2009 Policy Address, the Environment Bureau(ENB) conducted a study on external lighting which focuses on light nuisances and energy wastage. The study includes some data and facts about the light pollution problem, stakeholders' views towards the lights in Hong Kong, comparison among countries which have the same light pollution problem and Hong Kong, and, suggestion about how to tackle the problem. According to the report written by the ENB, published in 2011, they proposed a few solutions to alleviate the problem, particularly to enhance energy efficiency and minimize the extent of nuisance caused by external lighting –

- Introducing a set of Guidelines on Industry Best Practices for External Lighting Installations
- Government taking the lead by setting example, such as switching off external lightings
- Setting up a Task Force composed of member from different sectors to give advices

Introducing a set of Guidelines on Industry Best Practices for External Lighting Installations

The guidelines were being introduced in an effort to encourage efficient use of energy and to reduce light nuisance. The suggested guidelines are about operating hours for lighting, automatic controls for lighting, light pollution control measures, energy efficiency measures, lighting project design planning, glare prevention to road users, and advertising signs. The abovementioned are only a draft of suggested guidelines in 2011, but are issued by the Hong Kong government on January 26 2012 in the Guidelines on Industry Best Practices for External Lighting Installations.

Government taking the lead by setting example, such as switching off external lightings

The government will take the lead by setting examples on how to reduce the light pollution problem. For instance, switching off external lightings from government venues after 11, in a bid to diminish the light nuisance. By taking the lead, the government can educate the general public how to protect our environment, and encourage the public, as well as any individual departments to follow the government guidelines and measures.

Setting up a Task Force composed of member from different sectors to give advices

As there is an increase of public awareness on light issues, in 2011, a Task Force on External Lighting has been set up for the development of technical standards and related parameters to tackle nuisance caused by and energy wastage of external lighting. It consists of expertise from different sectors, for example professional bodies, green groups, relevant trades, in order to have more different opinions from more perspectives. It is not a great success as consensus cannot be made among different parties.

The Task Force had taken other countries' regulation on light pollution into account when discussing which method can best fit Hong Kong. For instance, zoning is one of the many systems that foreign countries have been using to keep city lights under

control. However, due to the difference between Hong Kong and foreign countries in urban planning, after evaluation by the Task Force, zoning, and other regulation systems, are not recommended to be used in Hong Kong.

The only suggestion that the Task Force made to the government is the Proposed Switch-off Requirement. That is, to switch off external lightings after a preset time. Nevertheless, some issues have to be discussed and clarified among the public –

- The appropriate preset time
- Scope of the switch-off requirement
- Exemptions to be granted
- Implementation approach

Meanwhile, the government departments and other organizations should observe the guidelines issued in 2012 on the industry best practices for external lighting installations, in an effort to remedy the light pollution problem.

6 Market solution

6.1 Light pollution emission tax

Light pollution is mostly produced by neon light advertising board as mentioned in Part 1.3 main sources lead to light pollution. Since the advertising boards are turned on during midnight and it would affect nearby residents living standard and their health. We believe that those enterprises should take the responsibility. Imposing a tax would be effective. For those enterprises who turn on their advertising boards during midnight and overnight would be responsible to pay the tax, just like carbon tax.

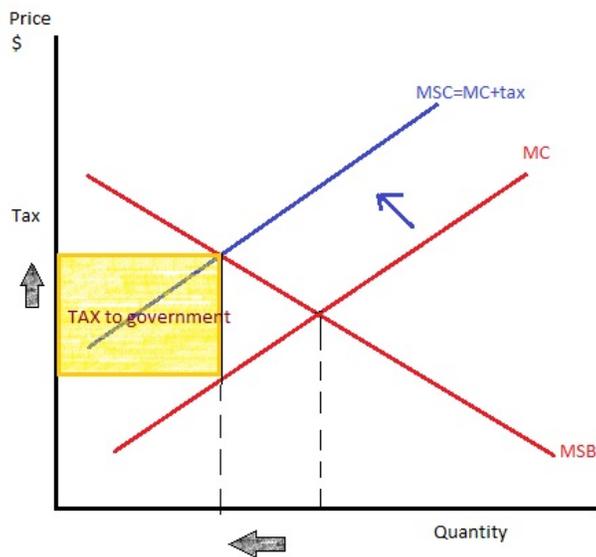


Figure 24: Imposing emission tax for light pollution

From the diagram above, you can see that since the original MC is larger than the MSC. Through an emission tax, MC will shift to MSC, the quantity of light pollution can be reduced. MSC will be equal to MSB. Moreover, the government can receive tax revenue form the companies. And the tax revenue can be used as the administrative and monitoring the situation in long term. As a result, imposing a tax on light pollution emission can reduce the pollution amount as paying tax would increase their cost and the profit maximizing companies may choose alternative ways for advertisement.

7 Light pollution in other countries

Well-developed countries usually have serious light pollution like United States. In US, urban area like New York City suffers. And New York City would be used as an example in this report.

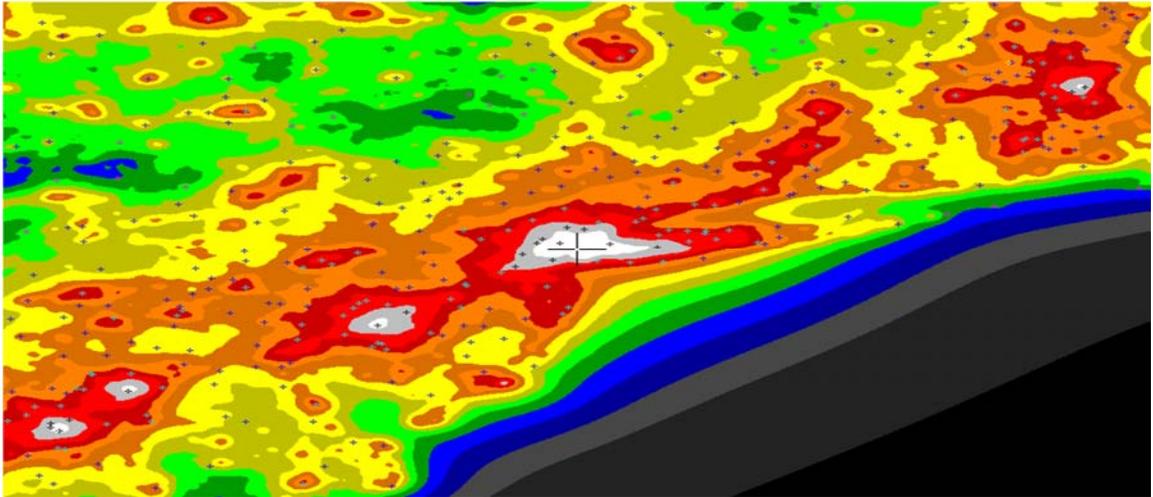


Figure 25: New York City Light Pollution Map

The above diagram shows the conditions of light pollution in New York. This map is a small part from the Light Pollution Atlas 2006 by David Lorenz. According to the index, the color of yellow, orange and red are showing that those districts have serious light pollution. Red is the most serious.

Although the light pollution in NYC is serious, the government takes policies try to reduce this problem. According to data from cleardarksky.com, in NYC, residential districts and commercial districts bans neon light board and advertising signs in order to reduce the light nuisance for citizens and reduce the pollution. Only central commercial areas are allowed for illuminated signs but required to follow the LPD requirement. So we can see that although light pollution occurs in US, the government do take actions to reduce this. And Hong Kong can learn from it to protect the earth

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