Urbanization and Global Warming

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31 Mar 2014

Impact from Urbanization

According to a 2010 publication released by the International Energy Agency, existing buildings are responsible for more than 40% of the world's total primary energy consumption and for 24% of global carbon dioxide emissions. In the UK, it is estimated that the building industry is responsible for over 50% of the carbon emissions with much of the emissions contributed by space heating and hot water provision. In emerging countries, this figure could be higher as these countries are accelerating their urbanization programmes.

Last week, the World Bank released a 280-page study entitled "Inclusive Urbanization and Rural-Urban Integration" with the Development Research Centre of China's State Council. The study is focused on the country's urbanization programme over the next 15 years that plan to move 100 million farmers to cities and to better integrate another 100 million who are living in urban areas but lack full access to schools and hospitals.

The study estimated that the China government could save as much as US$1.4 trillion of the estimated US$5.3 trillion on urban infrastructure if the country's cities are better-planned in a more rational and dense manner. For instance, Guangzhou with 8.5 million residents could accommodate 4.2 million more in the same space if it were as densely developed as Seoul, South Korea. If the current urban planning approach continues, the study indicated that in the next decade, cities will consume up land equal in area to the Netherlands, leading to longer commutes, higher energy consumption and continued high levels of air pollution.

Urban Heat Islands

While the World Bank's study called for more compact and dense urban cities, there is also the need to be mindful of urban heat islands that are created within urban cities.

What are urban heat islands?

Although the concept of an urban heat island has been well documented since the first study was carried out 200 years ago by a scientist, Luke Howard; let's quickly review it.

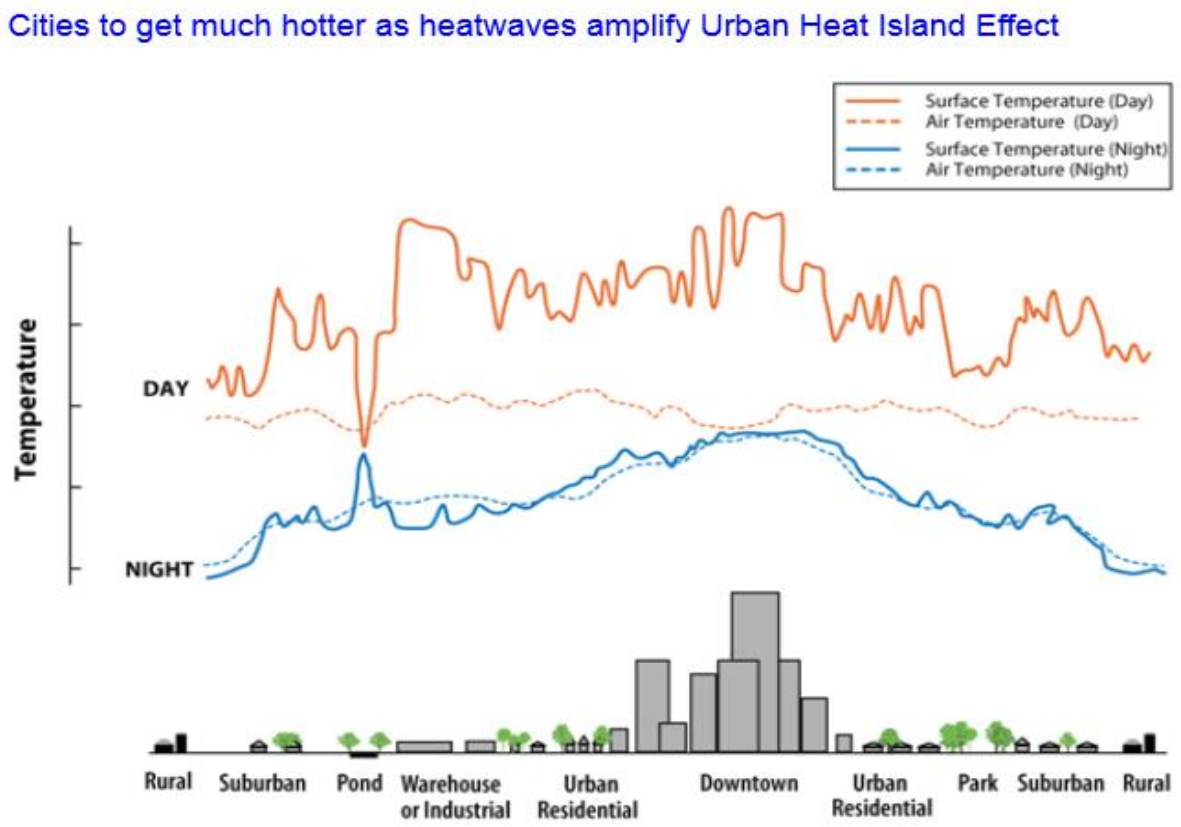
According to Luke Howard's measurements (1818-1833), he noted a difference of 2 degrees Celsius in temperature between rural areas surrounding London and temperatures in the built environment of the city. The report that is over 280 pages can be downloaded from this link: http://urban-climate.com/wp3/wp-content/uploads/2011/04/LukeHoward_Climate-of-London-V1.pdf Subsequent studies carried out in and around London in the 1960s noted a difference of about 4 degrees Celsius and by 2003, the difference between the urban and the rural areas of London had reached 9 degrees during a hot summer with heat wave conditions.

So what causes the built-up of urban heat islands within cities?

Primarily, heat islands are attributed to the size and proximity of buildings – the large expanse of buildings is rather efficient in absorbing and reflecting heat. And as a result, these tall and large buildings are capable of trapping significant amount of heat at street level that bounces back and forth between buildings. Adding to this heat built-up is the blockage of wind flow around these buildings that restrict the natural cooling effects from convention.

Moreover to prevent flooding in urban spaces, drainage system has been designed to carry water away efficiently thereby preventing evaporation. Other contributing factors that add to the urban heat island formation are waste heat from air-conditioning system, industry-related activities and vehicles.

Recent studies have also shown that heat waves that occurred in countries as part of their overall climate system exacerbate and amplify the urban heat island effect so that its impact is magnified.



Taking Actions

Unlike in the case of developing countries where urban city planning could take into considerations the lessons learned from developed countries in minimising the creation of urban heat islands, existing urban cities would have to look for other mitigation actions.

In this regard, communities around developed urban cities looked at four main strategies namely:

1) Increase tree and vegetation coverage in city areas
2) Install green roofs (rooftop gardens or eco-roofs)
3) Install reflective roof tops and
4) Provide "cool" pavements

The benefits from increased coverage of trees, vegetation as well as green roofs are quite apparent and these include reducing overall ambient temperature that would lead to less use of energy for cooling which in turn reduces greenhouse gases emissions. In addition, besides acting as barriers against noise pollution, trees and vegetation are also natural carbon storage. With proper planning and selection of the appropriate types of tree and vegetation species could also help to control storm water and improve quality of surface run-off into storm water drainage system.

Reflective roof tops help minimise built-up of heat in the building which will lead to overall reduction in energy use for cooling of the building interiors. Less usage of energy, coolant mean less carbon emissions and waste heat generation.

There are various types of cool pavement technologies available but most of them help to reduce heat transfer from the heated concrete pavement through the use of solar reflective admixtures. By reducing heat built-up, cool pavements indirectly help to reduce energy usage, air pollution and carbon emissions. Some cool pavement technologies help improve storm water management, increase surface durability and even increase comfort for pedestrians.

However, these mitigation measures require the co-operation of the larger communities including city planners, building authorities, architects, engineers, building developers, residents and building users. Moreover, the benefits to be derived may not be immediately visible vis-à-vis the investment made. Hence, medium to longer term planning, commitments and co-operation are required.

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