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Our urban future

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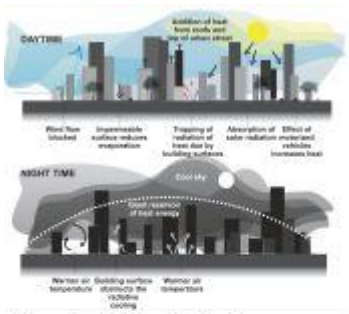

Urban heat island effect

Narrow gaps between buildings and no greenery

Arcaded street: One rare example in Dhaka and an example from Italy

Dhaka is growing at a pace that services and infrastructure are unable to cope with. From energy to transport and water - all that a city relies on for its survival are stretched past the breaking point, as existing provisions are insufficient to meet the burgeoning demand. Looking closely, one cannot ignore the fact that we got to this point by our collective and wilful blindness to the negative impacts of unregulated and unplanned urban development. Buildings, the primary unit of habitation and organization of a city, are one of the key contributing factors to the woes of today's urban life.

We continued to build higher within the small confines of the city, particularly in the last two decades, primarily to cope with the growing demand for domestic, commercial and industrial spaces. This expansion was at the expense of the already limited green lands and water bodies, which were replaced at an alarming rate by hard surfaces such as concrete, asphalt, etc.These have significantly different thermal bulk properties than that of vegetation and soil, resulting in a change in the energy balance of the urban area, leading to higher temperatures than surrounding rural areas. This effect of localized warming of urban areas is known as urban heat island (UHI).

Urban heat island affects the microclimate and eventually our health and wellbeing in different ways. Compared to the surrounding countryside, hard surfaces in urban areas heat up quickly in the morning and retain much of the heat throughout the day. The tall buildings in a city also provide multiple surfaces for the reflection and absorption of sunlight. They often block wind, thereby reducing the loss of heat through convection. At night, when the excess heat needs to be released back to the atmosphere via radiation, the tall buildings hinder the cooling process by blocking the view to the sky.

The topics of energy demand, lack of generation and subsequent load shedding are a national concern. One, therefore, needs to look at what role buildings play in all this. We looked at how densely packed buildings result in increased temperature and consequently increased need for cooling. They also reduce the ability of a building to employ natural ventilation by blocking wind. Often closely spaced buildings reduce the penetration of daylight in a building, requiring artificial lighting, even on a clear sunny day. This is unfortunate when the country is blessed with adequate sky illumination 20,000- 30,000 lux on an average day and up to 120,000 lux on bright cloudless days. The typical requirement for an office environment is between 300-500 lux, almost 100 times less than what is available and we still need to consume electricity for lighting during the day. Apparently, when illumination-poor countries in the Western Europe are developing ways to bring more natural light indoors we seem to be going backwards, by making buildings that have dark interiors.

Collectively, as a nation, we are not known for our keenness on the concept of efficiency in any aspect of our lives, be it buildings or electricity generating plants. We do not necessarily link the design and operation of a building with its energy efficiency. Take, for example, instant power supply (IPS) systems that we install in homes and offices. They are one of the most inefficient energy storage systems available and probably have a large impact on the national grid. Energy is lost every time the IPS' battery is charged from the grid and subsequently discharged, mainly via conversion from AC to DC and vice versa, as well as the conversion of voltage. Another obvious example is the use of electric heaters (locally known as geysers) for hot water and we install one each in every bathroom or toilet. Again, this is another unfortunate example when a more renewable system, e.g. solar thermal could have been used when the country is blessed with a consistent solar radiation, even about 3 kWh/m2-day during December.

Needless to say, the demand for electricity is growing and will continue to grow until the grid coverage is close to 100%. We will have to continue to increase our generation capacity but in a sustainable way. Dependency on fossil fuels such as coal, gas, diesel, etc. has to be reduced. These resources are not endless and increasing generation based on them will only serve very short-term goals. We do not need to look too far to see the effect of myopic vision of energy policy. For example, generation capacity has increased over the past few years by more than 3 GW but a significant part of this new addition is based on imported fossil fuel such as high speed diesel and heavy fuel oil, price of which is dependent on volatile international energy market. Despite having enough capacity to meet most demand, some of the generation plants remain switched off because of repairs and also because of our inability to pay for the fuel. We met all of the peak demand (6065.5 MW) on 22 March, when Bangladesh met Pakistan in the recent cricket match.

It is evident that having enough generation capacity is not enough to solve our problems in the immediate future. Demand from buildings and industries need to be reduced, as well as micro-generation needs to be encouraged if we are to have any shot at tackling the problems of load shedding.

Plans are afoot to increase energy production. There is also uninformed interest in renewable energy sources. Rules require that new buildings meet a certain percentage of their electricity consumption through photovoltaic (PV) panels and all new buildings are required to install PV

panels (whether they are real or if they work is another question). Solar energy is quite expensive compared to electricity off the grid, which is subsidized. PV installations in urban areas are based on the concept of solar home systems, where energy is stored in batteries for use when needed. Electricity thus produced is not cost-effective based on current market price and when compared with gas or coal based generation. Battery is the key element here, which is quite expensive, when the price of PV panel is $1/Wp. Batteries also require maintenance and replacement every couple of years increasing the balance of system costs.

Any reasonable policy would have eliminated this redundant component (battery) in an on-grid area and should have opted for grid-connected solar PV systems. In a grid-connected system, electricity generated from PV is first used in the place of installation and the remaining electricity is exported to the grid, which becomes a virtual storage system. When there is no sunshine, hence no PV electricity, one gets power from the grid.

What is visibly absent from all this is a conscious effort to reduce domestic energy consumption. Yes there are expensive low energy bulbs available, and also distributed free by the government. But has anybody thought about reducing lighting or cooling loads in buildings? On the issue of heat, we know that Dhaka of the 60's didn't use much air conditioning and people lived quite comfortably. This was because buildings were spaced sparsely and there was plenty of vegetation. Air flow allowed ventilation of indoor spaces as well as removal of heat accumulated by buildings and hard surfaces. The principle of building design in tropical climates is very simple. Protect from solar gain, allow air flow and promote heat loss. In building terms this can be translated as wide overhanging roofs, lots of windows and orientation to the breeze and space between buildings.

But the above is unlikely to happen in Dhaka in the future. There are too many people and not enough land. Buildings will be tall and close to each other and built of concrete and steel. Heat and ventilation will continue to be a problem.

One answer to this is adaptation, and one of the ways of adapting is through sensible building design. Previous research on indoor and outdoor temperature conditions in domestic buildings in Dhaka show in worse cases, indoor temperatures to be 3-4°C higher than the outdoors during mid afternoons on hot days. Some buildings constantly have higher indoor temperatures all along. Rooms on top floors with uninsulated roofs suffer serious heat problems at night. Buildings that tend to perform better are ones that are in open surroundings and/or heavily shaded by trees or overhangs or where the building depth is narrow.

Had these buildings been better designed energy consumption would be far less.

There are many ways that this can be done. From simple measures as insulation and shading to complex manipulation of building geometry, materials, opening sizes, light shafts etc. There are tools available to carry out relatively simple to complex simulation studies that allow manipulation of building design parameters to arrive at guidelines for better environmental conditions vis a vis low energy consumption. While the recent building laws allow for more spacing between buildings, more land available for water recharge of the ground, these can be further complemented by guidelines for suggested thermal values of walls and slabs. Building

designs that allow for solar access to neighbouring structures have been in place in Europe since the days of the Hellenistic period of the Greek civilization; in our climate we can call for wind or breeze access. In the Mediterranean region, pavements are arcaded to provide shade to pedestrians; we may ask tall buildings to cantilever their floors above street level to provide shade to the pavement below (One such example exists in the Jibon Bima building in Motijheel designed in the 60's by Muzharul Islam).

The task is neither impossible nor difficult; it calls for us to be sensible and use common sense. The idea of energy conservation can be addressed by a mass publicity campaign, which certainly worked for oral saline. With certain measures in place, it is certainly possible to have a better urban environmental future.

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