

Our urban future

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.

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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

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

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 addi-



tion 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,

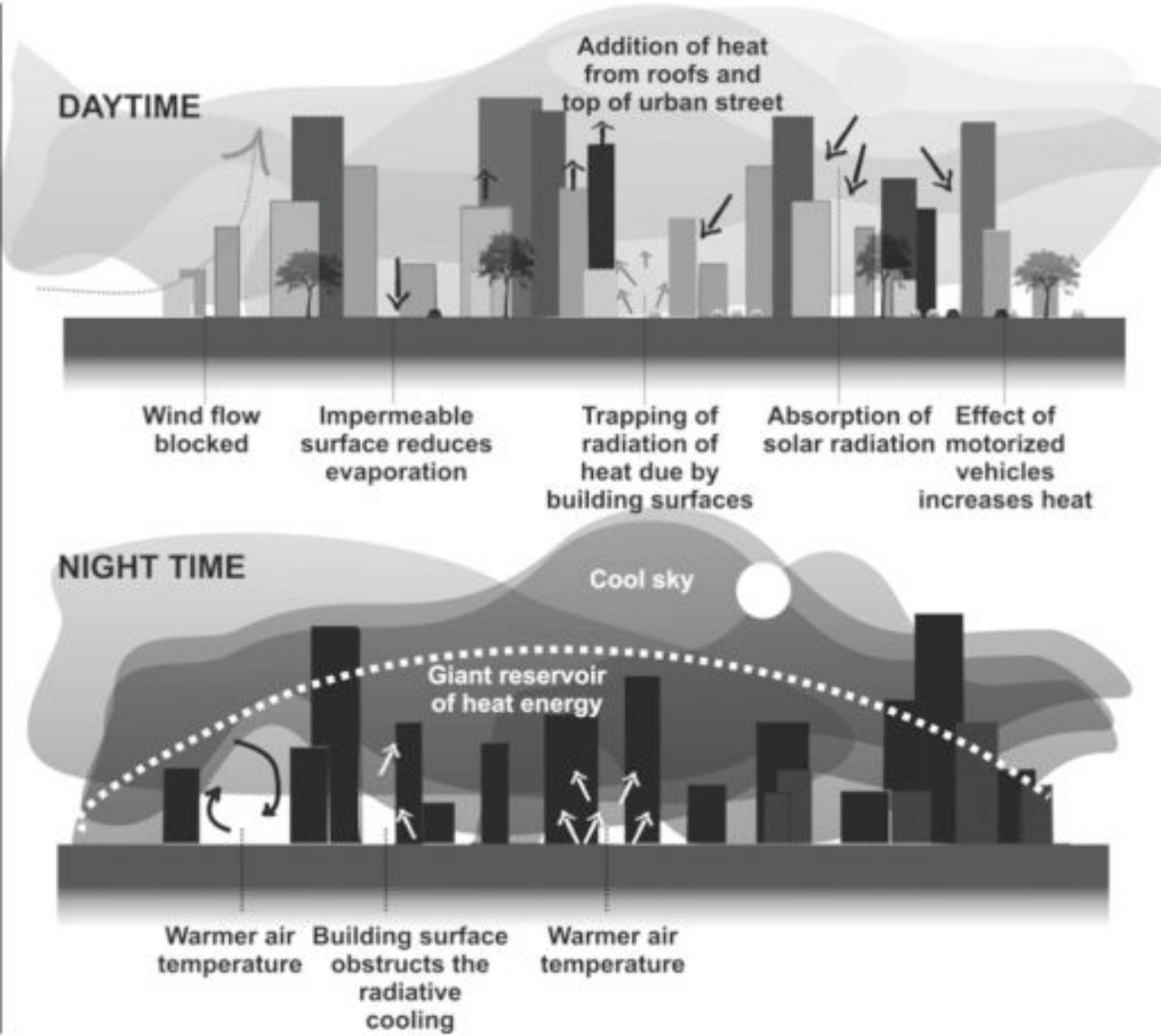
which is subsidized. PV installations in urban areas are based on the concept of solar home systems, where energy is stored in batteries for use when needed. Electricity thus produced is not cost-effective based on current market price and when compared with gas or coal based generation. Battery is the 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

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,

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



Urban heat island effect

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).

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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



Narrow gaps between buildings and no greenery



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



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

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

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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CLIMATE CHANGE IMPACTS

Adaptation priorities in agriculture

There is an immediate need to address the climate change effects on cropping pattern and introduce new crop cultivars in the existing cropping systems to improve crop production and livelihood of the farmers in disaster prone areas.

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BANGLADESH is a deltaic plain developed under three big river systems of the Ganges, Brahmaputra and Meghna. The delta borders with the Bay of Bengal in the south. The fast growing population of the country is badly exposed to flood, drought, storms and sea-level rise. Among the 16 countries listed by Maplecroft, a British-based global risk advisory firm as being at "extreme" risk from climate change over the next 30 years, five are from South Asia with Bangladesh on the top of the list.

Bangladesh is flood-prone with high risk of drought and famine. The problem is compounded by a high degree of poverty and agriculture dependency of much of its populace. The serious impacts climate change are found in a group of developing countries like Bangladesh with socio-economic systems not well-equipped to address development challenges, such as food and water security.

The country has a large growing population, majority of whom are poor and depend on agriculture and natural resource bases for their employment, income generation and livelihood.

The people in general and the government in particular have very limited capacity to address the increasing impacts of the global climate change and vulnerability of the people to its associated risks. Although natural disasters due to climate change affect the overall development activities of the country, their effects are more pronounced in the crop sector.

Bangladesh is predominantly a rice growing country with rice-based cropping systems. Crop production in Bangladesh is largely determined by temperature, monsoon rainfall, humidity and normal flooding. But the change in rapid seasonal patterns and weather, rainfall and hydrological patterns, drought, and salinity intrusion affect soil fertility and productivity of crops. All these pose serious threat to food security and nutritional status of common people in Bangladesh. The farming community, however, needs current information, knowledge and technologies as well as resources to combat the adversaries of climate change and improve their adaptive capacity.

More than 60 percent of the populace of the country is engaged in farming and they are mostly poor. These poor people have to bear the burnt of the natural calamities. Traditional farming practices are being seriously affected due to erratic

pattern of climate change resulting in crop failure. The experience has quite upset the traditional pattern of agricultural farming which depends to a large measure on the knowledge of the farmers about the seasonal cycles. But the recent changes in that seasonal pattern due to climate change places the farmers in a difficult situation. Under the circumstance, coping and adaptation strategies have provisions to reduce the risk the poor are exposed to and build their resilience in the face of climate change disasters. Farmers have to adopt the new farming technologies some of which are already developed to cope with the changed situation in crop production.

Agro-technology intervention will be an important step in combating climate change impacts in crop sector. A number of new crop cultivars have been developed by Bangladesh Rice Research Institute (BRRI) and Bangladesh Agricultural Research Institute (BARI) to cope with the emerging situation. The southern coastal belt of the country, which comprises 30 percent of the total arable land, is affected by varying degrees of salinity. Normally only one major crop, Aman rice, is grown there with low yield (1.5 t/ha). A number of saline tolerant rice cultivars have been developed by BRRI (BRRI dhan-40, BRRI dhan-41, BRRI dhan-47, BRRI dhan-53, BRRI dhan-54), and also BINA (BINA-8, BINA-9) with high yield potential (4-6 t/ha). Many of these crop cultivars can be grown both in Boro and Aman seasons.

BRRI has developed flood tolerant rice cultivars as well. The rice cultivars BRRI dhan 51 and BRRI dhan 52 can survive flood water submergence up to two weeks. Monga areas and other places, where flash floods destroy rice crop such as in haor areas, it could be salvaged by

growing shorter duration rice varieties developed by both BINA (BINA-7), BRRI (BRRI dhan-33, BRRI dhan 39). The paddies can be harvested in only 100 days after sowing seeds or 115 to 118 days after transplanting of seedlings.

Sea water can reach far inland during natural disasters, like flood, cyclone, tidal wave etc., making it hard to cultivate staple food like rice. In September 2007, cyclonic-storm Sidr and in May 2009, cyclone Aila caused far-reaching damage with wide spread flooding, which left thousands homeless and killed many. Vast tract of land in the south-west was also inundated. Salt water intrusion would naturally disrupt rice production. The number of affected people rose

to millions.

Environmentalists predict that climate change will affect more than 375 million people every year globally by 2015 with natural disasters and rising sea levels. There is an immediate need to address the climate change effects on cropping pattern and introduce new crop cultivars in the existing cropping systems to improve crop production and livelihood of the farmers in disaster prone areas of the country and thereby alleviating the poverty level of the farming community.

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Salinity tolerant crop variety is the answer