

Assessment of Energy Consumption in Cluster Redevelopment: A Case Study of Bhendi Bazar in Mumbai

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ABSTRACT: Cluster Redevelopment is a new concept in the city of Mumbai. Its regulations were laid down by the government in 2009. The concept of cluster redevelopment encompasses a group of buildings defined by a boundary as specified by the municipal authority (in this case, Mumbai), which may be dilapidated or approved for redevelopment. The study analyses the effect of cluster redevelopment in the form of renewal of old group of buildings as compared to refurbishment or restoration - on energy consumption. The methodology includes methods of assessment to determine increase or decrease in energy consumption in cluster redevelopment based on different criteria such as carpet area of the units, building envelope and its architectural elements. Results show that as the area and number of units increase the Energy consumption increases and the EPI (energy performance index) decreases as compared to the base case. The energy consumption per unit area declines by 29% in the proposed cluster redevelopment as compared to the original settlement. It is recommended that although new development is spacious and provides more light and ventilation, aspects such as glass type, traditional architectural features and consumer behaviour are critical in the reduction of energy consumption

KEYWORDS: Cluster Redevelopment; Energy Consumption; Energy Efficiency

1. INTRODUCTION

Cluster Redevelopment, a new concept introduced by the Urban Local Body (ULB) governing Mumbai was introduced in 2009. The scheme entails the clubbing together of buildings for redevelopment on a site which has to be strategically planned and designed leading to redeveloped residential and commercial spaces. The minimum plot size required for cluster redevelopment is 4000 sq.m, defined by a road boundary or drainage line on all its four sides (Mehta, 2011). The cluster redevelopment is applicable in South Mumbai at present and is being considered for implementation in the Eastern and Western Suburbs.

Bhendi Bazaar, which houses a dense and historic urban settlement in South Mumbai, is one of the first projects undergoing Cluster Redevelopment in the city. The developer, Saifee Burhani Upliftment Trust (SBUT), has proposed the project with the aim of upgrading the lifestyle of people, currently residing in dilapidated low-rise structures spread over an area of 16.5 acres. The proposed scheme has 9 sub-clusters and is expected to develop high-rise buildings and open spaces along with provision of a luxurious lifestyle in the existing congested locality. Bhendi Bazaar was developed in the 'Chawl' or dormitory fashion designed to house single men who had moved to the city for earning a livelihood.

2. AIM AND SCOPE OF STUDY

In a redevelopment scheme, existing tenements are accommodated in larger spaces while a new saleable area is also constructed to make the project viable. This will lead to an increase in energy consumption. If the

Cluster Redevelopment scheme is approved for the suburbs, the energy consumed may affect Mumbai's total electricity supply scenario. This study aims to assess the energy consumption in Cluster Redevelopment Scheme in comparison to the existing settlement through the case of Bhendi Bazaar.

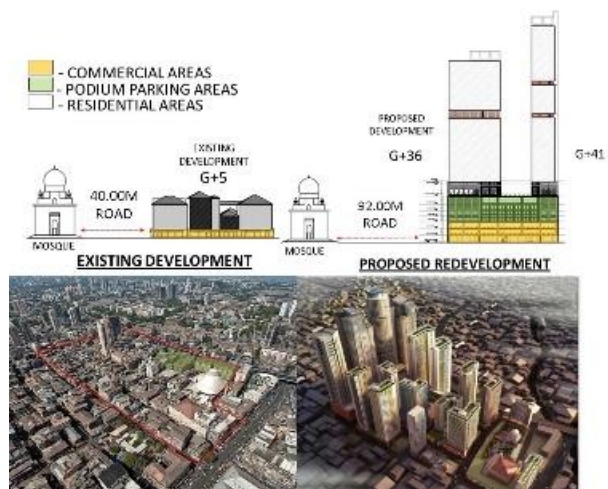


Figure 1: Existing settlement (left); Proposed redevelopment (right)

3. METHODOLOGY

For the study, Cluster 3, which is undergoing construction and whose magnitude of increase in built-up area is proportional to the total proposed redevelopment, was chosen. Different typologies were identified in the residential and commercial sector and a sample of 44 houses and 5 shops was selected based on the number of existing buildings in Cluster 3. The

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assessment comprised of two parts – analysis of the typologies with respect to change in energy consumption, and analysis of change in the building envelope. Stratified random sampling of the commercial and residential typologies was conducted through administration of house-to-house survey questionnaire. People’s aspirations, observation of the existing spaces, photographs and analysis of electricity bills formed a major part of data collection. Interviews of major stakeholders such as SBUT CEO, were also conducted. The total energy consumption – existing and projected - was calculated based on above data.

4. RESULTS AND FINDINGS

The Cluster Redevelopment Scheme led to an increase in carpet area of 64% from the existing settlement for the full Bhandi Bazar project. Residential typologies were established based on carpet areas ranging from less than 100 sq.ft to 1500 sq.ft and more. The houses with carpet area between 100 – 450 sq.ft comprised the highest number of units and also the maximum energy consumption. In the proposed scheme, minimum size of tenement will be 350 sq.ft and more (Master & Dravid, 2015).

Existing commercial typologies were found to comprise of 21% foam and upholstery shops, 18% retail cloth stores and 11% office spaces. Heavy-duty repair and hardware and Eateries consumed 34% of the total commercial energy consumption. The energy consumed by air conditioners, refrigerators and fans was the highest in the existing settlement. As per survey, demand load for the existing residential sector is more than the designed demand load in the proposed redevelopment by 2%.

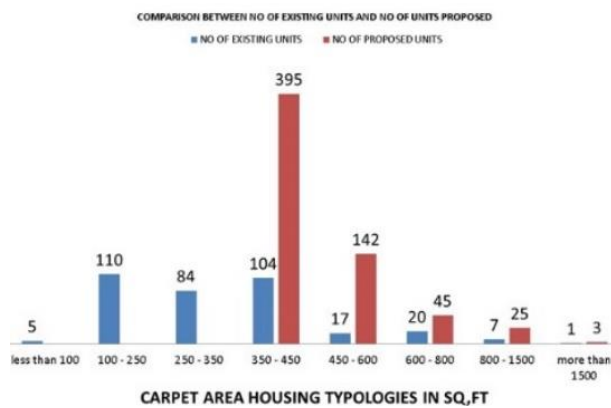


Figure 2: Total number of housing units in Residential Sector

With increase in carpet area of 61% in cluster 3, the Energy Consumption increased by 38% inclusive of common area loads and aspirations in the proposed redevelopment but the Energy Performance Index (EPI) in proposed redevelopment (31.85 kwh/m2/year) decreases by 37% as compared with existing development (50.53 kwh/m2/year).

It was found that if the use of energy efficient appliances (BEE star-rated) are considered to be used by residents and if the number of appliances increases with addition of aspirations, then the Energy Consumption increases by 56% in the proposed redevelopment whereas the EPI in Proposed Redevelopment (35.64 kwh/sq.m/year) decreases by 29% of the existing development.

As per the calculations, the building envelope analysis showed that Window to Wall Ratio (WWR) of the proposed development is 50% which are within norms specified by the Energy Conservation Building Codes (ECBC) 2007. As per envelope survey, in the existing settlement the lower carpet area tenements, on lower floors had higher occupants and poor comfort conditions, increasing use of air conditioners and subsequent energy consumption and vice versa for the houses with large carpet areas, on higher floors with sloping roofs and better ventilation.

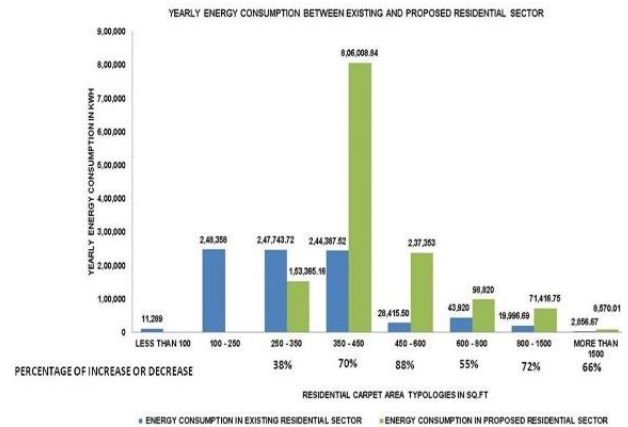


Figure 3: Energy Consumption in Residential Sector

5. CONCLUSION

From the study of cluster 3 of Bhandi Bazaar, it can be concluded that cluster redevelopment in a land parcel can lead to a net increase in energy consumption of up to 56% of existing development; but there is also a subsequent increase in carpet area to the extent of 61% providing more habitable spaces. With increased open spaces and better light and ventilation, as well as use of energy efficient appliances by users, the energy consumption per unit area actually declines by 29%. Thus the scheme can be considered for redevelopment in the suburbs of Mumbai.

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