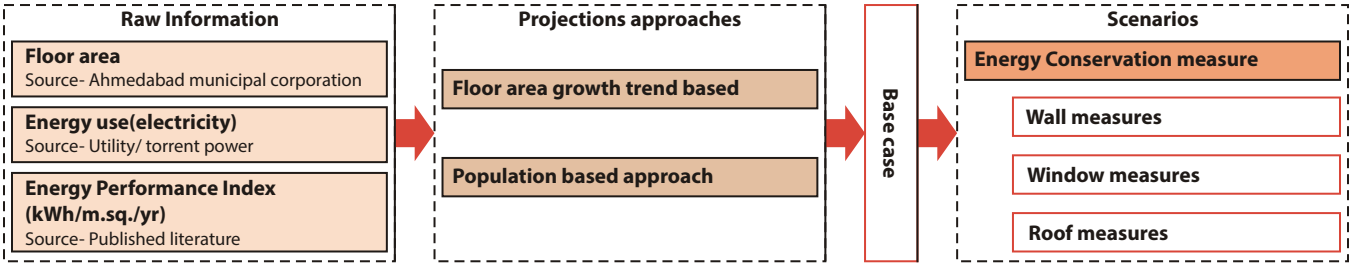
Potential Energy Saving due to ECBC Implementation

A case study of Ahmedabad

Energy savings by Energy Conservation Building Code (ECBC) implementation with regards to estimation of floor space at city level had been a challenge. Precise understanding of current floor space stock along with its historical growth pattern can help estimate floor space at city level. The study attempts to evaluate present floor stock at city level with the help of tax data base. Tax data base is one of the accurate and trusted source for building floor space information at city level. Tax database is a widly used instrument to collect annual property tax within city, which is a reliable source to understand amount of floor space, its associated use, building characteristics and age relying on vintage value of floor space. All Urban Local bodies (ULB's) across India have this mandate of collecting and maintaining property tax database. Understanding of present and future floor space is significant parameter to quantify ECBC impact.

Study Approach

Brief methodology-Floor space and energy saving potential for building sector-Case of Ahmedabad



Present status

Currently in year 2015 Ahmedabad have 1.86 million properties with 51.81 million square meters of commercial and 81.21 million square meters of residential floor space. On average every 15 years, floor space has almost increased 100% in Ahmedabad since four decade. 37.94 million Square meters (26.91%) of Ahmedabad floor space are below 10 years of age. Ahmedabad at present have 33.67 (23.88%) million square meters of floor space having age 40 years or higher. Electricity consumption in Ahmedabad in FY 2014-15 was 5165 million KWh and 2419 million KWh in commercial and residential sector respectively.

Results

Scenario description

Floor space has been projected till 2050, based on the following two approaches-

a) Approach 1- Floor space growth trend dependent: Floor space projections are based on compounded annual growth rate (CAGR) of 3.18 for commercial floor space and CAGR of 3.61 for residential floor space projections.

b) Approach 2- Population growth dependent: Floor space projection are based on elasticity / sensitivity of population and floor space. With 1 percent increase of population, we expect an increase in 1.2 percent of residential floor space and 1.08 percent increase in commercial floor space.

1. Floor space and Energy projections

a) Approach 1- Floor space growth trend based projections

The commercial floor are grows with compounded annual growth rate (CAGR) of 3.18 for commercial and 3.61 for residential floor space. In the year 2020 commercial and residential floor space will be 60.60 million square meters and

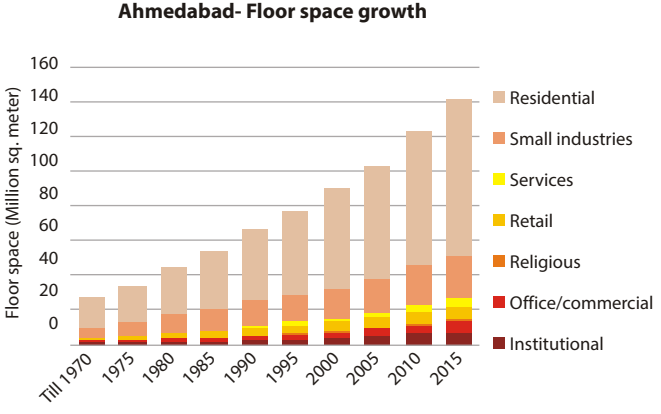


Figure1 : Ahmedabad- Floor space growth

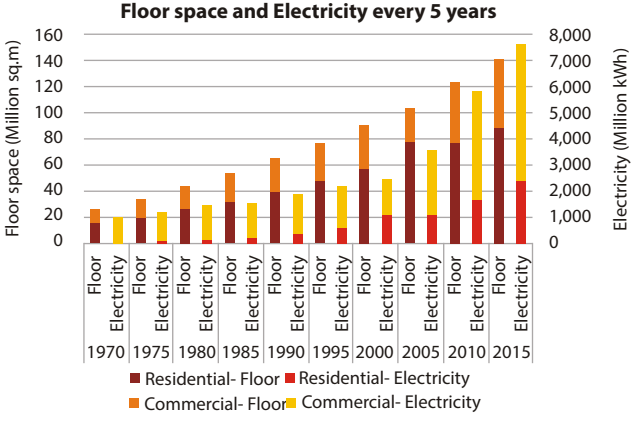


Figure2 : Floor space and Electricity growth every 5 years

106.47 million square meters respectively. Current ratio of residential and commercial floor space at 60:40 will remain constant across 2050. At constant CAGR, commercial and residential floor space will be 155.13 and 308.76 million square meters with a population of 16.64 million population in Ahmedabad.

Projected energy consumption for Ahmedabad including both commercial and residential sector for the year 2020 is 26769 GWh. There is an increase of 0.89 percent of energy consumption with an increase of 1 percent of the total floor space of Ahmedabad. In the year 2050 estimated energy demand is 37387 GWh at city level. ECBC implementation can help annually reduce 82 GWh by 2020 and can increase at the rate of 11.6 percent per annum considering 2020 as savings as base year. The savings can rise to 2198 GWh in the year 2050. Commercial buildings will save 70 GWh in 2020 which will rise to 913 GWh by 2050. For residential buildings the savings will be 12 GWh in 2020 and raise to 1285 GWh in 2050.

b) Approach 2- Population growth trend based projections

Under this approach percentage increase in the floor space is a function/depends of percentage increase of the populations in Ahmedabad. In year 2020 projected commercial and residential floor space under this are 59.05 million square meter and 92.57 million square meters respectively. Commercial floor space will increase to 102.66 million square meters in 2050, whereas residential floor space will be 161.03 million square meters in year 2050.

Projected energy consumption for Ahmedabad including both commercial and residential sector for the year 2020 is 29404 GWh. There is an increase of 0.99 percent of energy consumption with an increase of 1 percent of the total floor space of Ahmedabad. In the year 2050 estimated energy demand is 51125 GWh at city level.

ECBC implementation can help annually reduce 143 GWh by 2020. Savings can be 2166 GWh by the year 2050. Commercial buildings will save 123 GWh in 2020 which will rise to 869 GWh by 2050. For residential buildings the savings will be 20 GWh in 2020 and will raise to 1297 GWh in 2050.

2. Savings- Energy, Cost and Carbon-di-oxide (Co_2)

By year 2020 energy savings can be up to 82 GWh or 143 GWh under the two projection approaches considered. These savings are expected to grow at the rate of 9 to 11 percent annually. The scenario projects savings of 2198 GWh and 2166 GWh in year 2050 for the two approaches.

Code implementation will have cost saving by not producing electricity due to reduction in energy demand. There can be savings of 0.49 Billion INR to 0.86 Billion INR in the year 2020, assuming energy cost at constant price of INR 6 per Kwh.

There can be a savings of 0.07 to 0.12 million tons of CO2 savings in year 2020 which can significantly increase to 1.80 to 1.78 million tons of CO2 by year 2050.

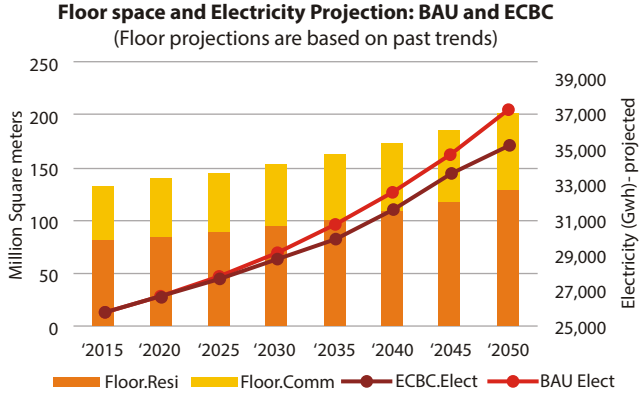


Figure3 : Floor space and Electricity Projections: BAU and ECBC (Floor projections are based on population growth)

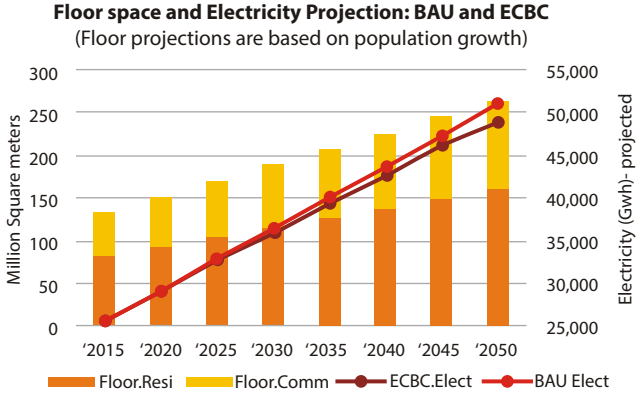


Figure4 : Floor space and Electricity Projections: BAU and ECBC (Floor projections are based on population growth)

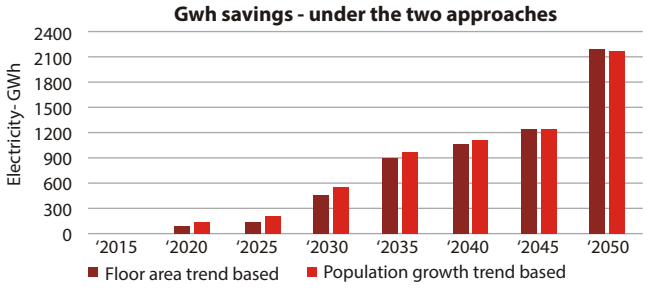


Figure5 : GWh savings- under the two approaches

3. Material demand

ECBC implementation will create market for building energy efficient material, specifically, energy efficient building blocks, wall insulation material and window assemblies. Amount of material are calculated for effective building floor space on which ECBC will be applicable. By year 2020 demand for wall insulation or energy efficient bricks will be 1.8 million square meters which is expected to grow at the rate 11 to 14 percent annually. Window assembly demand is expected to be 0.63 million square meters, with an annual growth rate of 8 to 11 percent.

Conclusion

Understanding of present and future floor space is significant parameter to quantify ECBC impact. This methodology is scalable and replicable to other cities with accuracy; as most urban local bodies across India have mandate to collect property tax based on unit of floor space mandated under 74th Constitutional Amendment Act. This can identify linkages between property tax data and building energy data as a norm. It can help identify which cities / ULB's need to prioritise Code implementation by assessing the impact of it, hence inform a targeted Code implementation strategy. From an urban planning and energy management view in cities- This approach can significantly contribute to Smart City vision plan, of which buildings & energy management are key components of it. State level ECBC implementation will saves energy, help reduce peak demand help expand market for building energy efficiency related technologies and products.

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