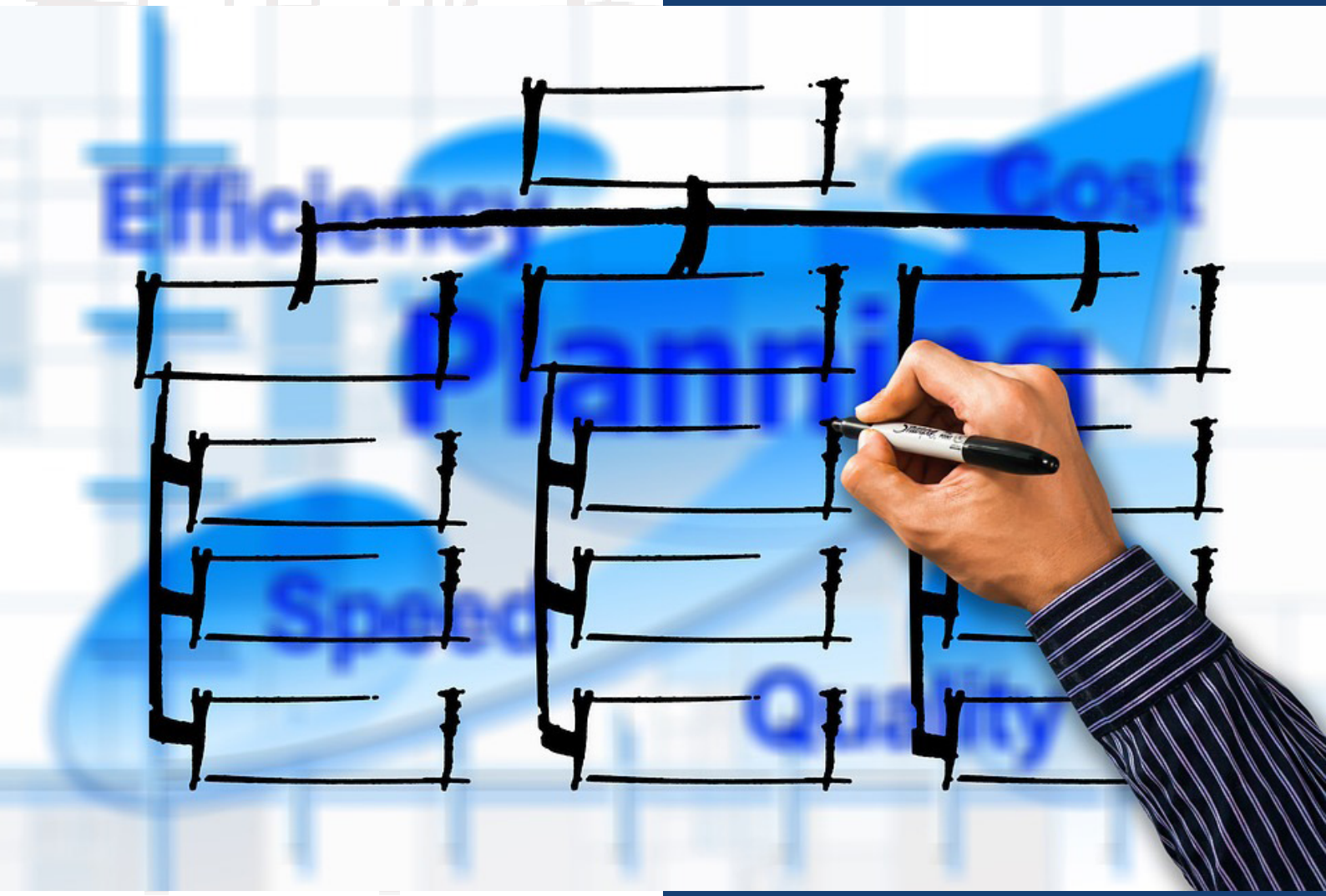
Urban Pathways

FACTSHEET on Energy Efficient Buildings 2018



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Authors/Contributors:
Shritu Shrestha

Editor: Stefan Werland,
Layout/Design: Barbara Lah

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In brief

Buildings account for almost 30% of global CO2 emissions. Promoting energy efficient buildings (new building and retrofitting existing buildings) and environmentally friendly building techniques that aim at reducing energy demand for cooling, heating and lighting, is an essential approach to reach municipal climate goals (Hatch 2017). The initial approach to minimize energy (and resource) use in buildings is to focus on sufficiency, energy efficiency with passive design strategies and then to incorporate efficient active technologies including renewable energy. These passive and active measures to enhance building energy efficiency are:

- 'Passive strategy' includes a building design that is adapted to climate zones (hot and humid, hot and arid, temperate and cold climate). Basic design strategies for any energy efficient building include optimising its form and shape, its orientation and building envelope technologies (e.g. glazing and insulation) in order to achieve/maintain indoor thermal comfort.
- 'Active strategy' intends to reduce or limit non-renewable energy use in buildings through efficient heating, ventilation, and air conditioning (HVAC), lighting and the use of building automated systems and increase the use of renewable energies.

The construction of energy efficient buildings provide environmental benefits (lessen carbon footprint) to the city and social and economic benefits to the citizens with lower life cycle cost in the long run, higher sales and rental value, and good indoor environment quality.

Examples

There are different standards for assessing the energy efficiency of buildings (Shrestha, 2016):

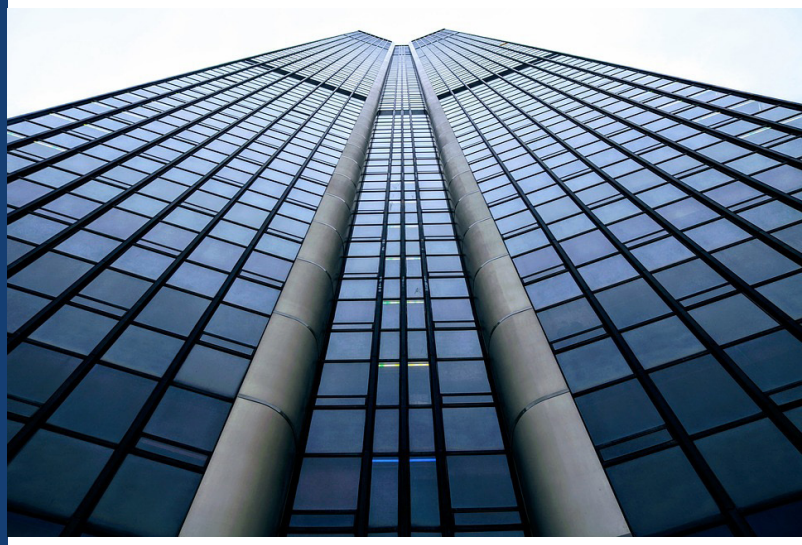
- Low Energy Buildings (LEB) use mainly passive strategies (such as thermal insulation) and a few efficient active technologies (such as air conditioning) to reduce energy demand;
- Ultra-Low Energy Buildings (ULEB) use passive strategies and most of the available energy efficient active technologies with renewable energies in part to meet energy consumption;

- In a Nearly Zero Energy Building (NZEB) net reduction in energy consumption is 100%; and
- A Plus Energy Building is an ULEB with on-site energy generation from renewable sources. The excessive energy produced by the Plus Energy Building can be fed into the grid and used for example for electric mobility (sector coupling).

LEB can be an appropriate target to aim for initially and ULEB are practiced in many cities (mostly in developed countries). Ultimately, cities should target for NZEB or Plus energy buildings in order to take action to achieve a sustainable built environment and to benefit from the opportunities resulting from saved energy.

Good practice examples for energy efficient buildings can be found worldwide. For example, Passive House (PH) standard buildings, a type of ULEB, are built in nearly all European countries, the USA, Canada and Japan (Passipedia, 2017). The 'Efficiency House Plus' is an example of a Plus Energy Building in Berlin, Germany. Both of them are briefly described below:

- Passive House (PH), a building with voluntary standard/certificate for ULEB, was developed in Germany by the Passive House Institute. It ensures comfortable temperatures in winter as well as in summer with only a minimal energy use (such as less than 15 kWh/sq.m annually for heating or a peak heating demand of less than 10W/sq.m) through the use of good insulation, airtight construction and mechanical ventilation. PH standard buildings are well practiced in the Central European climate region. The standard



has been adapted/constructed in other countries (e.g., China) with some adjustments to specific building traditions and climate boundary conditions, without changing the main principle. Brussels (Belgium), Hannover (Germany) and Tyrol (Austria) are Passive House frontrunner regions (PassREg, 2015), which have strong city's climate protection goals, and have developed and implemented ambitious policies to reduce energy consumption in the building sector.

- The 'Efficiency House Plus', is a pilot project for Plus Energy Building supported by Federal Government of Germany - BMVBS, was built in 2011. The building envelope components have low U-values and minimum thermal bridges. Such house would generate its own energy and makes it available to the residents for electro-mobility or feeds the energy back into the public grid. The photovoltaic system on roof and façade is estimated to produce about 16 MWh/year and the heating system contains an air-to-water heat pump (Build Up, 2014).

Results

Although investors/owners carry the burden of higher upfront cost (depending on the design and the technologies used) in energy efficient buildings than conventional ones, they prove to be more cost-effective over various payback periods. Investors receive price premiums, higher sale values and a potentially positive public image. Cities with more energy efficient buildings also contribute to improving the local economy through increased energy security, less dependency on oil imports and green job creation. Likewise, with increased thermal comfort and better indoor air quality, building users will also experience improved health benefits.

Technical and financial considerations

The feasibility of energy efficient building technologies depends on a number of factors, including the adaptability to local climate conditions; the local availability of technologies such as superinsulation; double/triple glazed windows; heat recovery systems; hybrid ventilation; heat pumps; LED lightings; renewables and class A+++ appliances etc.; and/or the availability of adequately skilled construction workers.

Thus, the success of energy efficient building strategies not only depends on the availability of technical solutions, but also on factors such as the awareness of

developers, planers, architects, and owners of buildings, or the availability of skilled workers. For example, BUILD UP Skills initiative, started under the Intelligent Energy Europe programme of the European Commission, help to boost education and training of craftsmen and other on-site construction workers and system installers in the building sector for high-energy performance in EU countries (BUILD UP, 2017). Cities must also be aware that energy efficiency measures might increase the level of rents, and thus lead to unintended social impacts.

Policy/legislation

City administrations must approach policymaking for the energy efficient buildings sector with the intention to nudge all actors towards more energy efficient building construction – implementing with the principles of the New Urban Agenda. This approach must involve all actors, both public and private, and entail a structured policymaking intervention in the social/cultural understanding of energy efficient buildings. The policymaking framework must also incorporate a redesign the traditional approaches to building construction, and change how the practices of constructing buildings are interlocked. Below are a few examples of further policy intervention tools that cities should implement to bring about this shift:

Mandatory codes and standards are effective policy tools that cities/countries need to implement in order to achieve significant reductions in energy consumptions of buildings, by setting minimum energy performance standards (MEPS) with a gradual move towards strengthening it over time. Some of the examples are Energy Performance of Buildings Directive (EPBD) on the EU level, Energy saving ordinance (EnEV) in Germany and the Energy Conservation on Building Code (ECBC) in India. Mandatory stan-

dards are specifically important in situations where the tenant rather than the owner of a building profits from increasing the building's energy efficiency (split incentives, landlord tenant problem).

Voluntary certification and labelling programmes provide an opportunity for the innovative sector to design beyond the codes and can transform the market towards higher building energy efficiency in a city. Some examples are the Energy Performance Certificate (EPC) in Europe, the Passive House (PH) standard in Germany and the Energy Star in the USA.

In order to foster acceptance and increase demand for energy efficient buildings, municipal administrations can initiate demonstration projects (e.g. with government owned buildings) and pilot projects (e.g. the 'Efficiency House Plus' supported by Federal Government of Germany - BMVBS). Technical trainings to stakeholders along with competition and award programme also provides for stakeholders engagement.

The most important barriers that hinder the take-up of energy efficient buildings are affordability, split incentives, impacts on rents, a lack of political and financial support, public awareness, and trained building professionals. Potential measures to tackle financial barriers comprise of grants, rebates, funding programmes, bonds, loans and tax incentives. One example is low interest loan (for energy efficient new buildings and renovating existing buildings) in Germany, through the government's development bank, KfW (Kreditanstalt für Wiederaufbau), and is considered to be one of the most successful incentive schemes in Europe. The KfW programme finances homes that consumes less energy than the energy efficient building ordinance demands , i.e. less energy consumption than ENEV in Germany (KFW, 2017). In France, tax credits are given for the installation of efficient equipment in the buildings.

Institutions

Depending on the political institutional design, the lead authority to initiate policy framework design would be the department responsible for public and private building, usually the department of housing on the national level and the responsible authority on the provincial and/or municipal level. Local governments agencies such as planning authorities that support public procurement policies and demonstration

projects. Chamber of Architects associations that act as multipliers and awareness developers. Subordinate authorities such as government offices for building and regional planning can also facilitate dialogue among the manifold stakeholders and contribute to aligning their interests. Funding support is needed from financial institutions – international (for demonstration, research and development, capacity building), national banks (for upfront cost and financial incentives).

Transferability

Good practice examples of energy efficient buildings are highly replicable to other cities and countries, but need to consider regional climate conditions, building traditions, and the availability of technologies and materials. The promotion of energy efficient buildings depends on the existing regulatory framework, urban planning specifications, and the pay-off structures for builders, architects, building companies and residents.

Case study: Passive House standard buildings in Brussels, Belgium

Context

Brussels-Capital region, a region of Belgium with 19 municipalities including the City of Brussels, with 1.19 million inhabitants. Most of the city's buildings were built prior to 1970 contributing to Brussels having one of the most energy inefficient building stock in Europe in the early 2000s (Antonelli, 2016). In 2004, the government identified buildings as a priority sector for reducing energy consumption. Stakeholders were involved in the process of implementation of Passive House (PH) standard and financial incentives (energy bonuses) were provided (energycities n.d.). In 2009, the regional authorities in Brussels formally committed to the PH standard in the construction of all new public buildings. In 2011, the government of Brussels-Capital Region adopted the new energy target regulation for all new construction (residential and non-residential), taking effect from 2015 onwards, along with major retrofits (PassREg, 2015).

In action

Since 2015, all new buildings and renovation of existing buildings in Brussels need to comply with the PH standard. This new law was provisioned for a 3-year period of 'soft landing' that allows for the gradual accumulation of best practices and experiences. In order to support the growth of PH standard buildings and to promote the 'energy transition', Brussels provided a number of incentive schemes (e.g. BatEx fund for exemplary buildings) and capacity building/training programs (PassREg, 2015).
Other financial incentives include grants (in order to tackle upfront costs) and 'green' credits (for the most vulnerable social groups). When the federal government abolished the tax breaks for efficient in 2012 (which were introduced in 2009), the Brussels regional government decided to double local subsidies to keep the interest of investors, reaffirm its commitment to energy efficiency in buildings (PassREg, 2015).

Results

With the political will and determination for energy efficient buildings successfully combined with a multitude of financial incentives (PassREg, 2015), Brussels has already more than 1 million sq. m of PH standard building (data as of 2014) and the number is growing (vs. zero in 2007). The increase in energy efficient building construction had also increased businesses and jobs involved in the 'sustainable construction' activity (PassREg, 2015). The cost surveys on the Batex-funded PH buildings showed that they are cost-effective and the total cost is not much higher than conventional one (Antonelli, 2016).

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