

IN PERSPECTIVE

FALL 2024

EXPONENTIAL GROWTH

Humans are so smart that we have learned to evade nature's population controls. The resulting population explosion has been facilitated by the development of the built environment. It ensures comfort and security in any climate.

The growth and maintenance of the built environment brings with it increasing service and replacement requirements. It is a building activity in a perpetual growth mode.

The resulting building cycle, fueled with the entry of new structures, consumes some 40% of the world's manufactured energy and has a very large environmental



impact. Understanding its drivers and its operation will help address its now evident adverse effects.

To this end, Aida Farokhyar, an architectural designer, has designed and constructed a display for the Canadian Museum of Architecture explaining this interesting phenomenon.

- Peter Brueckner

THE BUILDING CYCLE

Our built environment includes all buildings and infrastructure from cottages to skyscrapers and bridges to airports. Millions of structures are built every year. However, the average lifespan of buildings is about 60 years after which nearly all are replaced. The construction of new buildings, their use, demolition and replacement constitute the building cycle. The activity is almost certainly changing our environment and is not under anyone's control. We examine it here as comprised of four phases.



Model of the building cycle; its start is denoted by a cement factory (left). The end of life phase is shown in greater detail (right).

Most buildings begin their actual life with the manufacture of building materials. The one that is currently used in largest quantity is concrete. Its essential ingredient is cement. Cement is manufactured in most countries in factories such as the one modeled in the display. The process requires high heat, consuming an astounding one twenty fifth of the world's energy. The manufacture of steel is also energy intensive while wood products are less so.

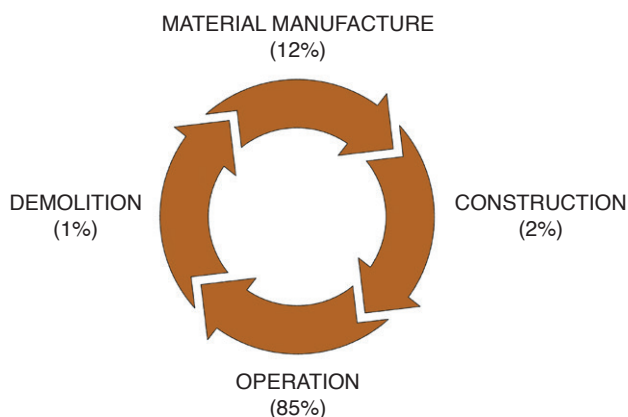
Altogether the extraction of resources and the manufacture and transport of building materials represents 12% of building cycle energy, produces a proportionate amount of pollution and leaves significant scars on the landscape.

Construction accounts for another 2% of building cycle energy. However, this figure does not include human labour, which is substantial. A large amount of waste results from unused offcuts and packaging material.

The largest component of building cycle energy, at 85%, is the operation of buildings. It includes energy required for heating, cooling, hot water and lighting. It results in enormous greenhouse gas emissions. Energy efficiency is an important factor. However, at this time, efficiency gains are more than offset by increased construction.

Though demolition is the least energy consumptive phase at 1%, it generates large amounts of waste and, sometimes toxic, materials. Refurbishing old buildings is an alternative.

But it's not all so simple. Myriad factors link the building cycle to other activities. Some are well defined such as building codes and construction practices, while the effect of others such as housing policies and social norms is much more difficult to trace.



The building cycle in four phases. Energy consumed in each phase is shown as a percentage.

Our everyday awareness tends to be focused on our immediate and apparently benign surroundings. We are inured to the environmental impact of our individual home

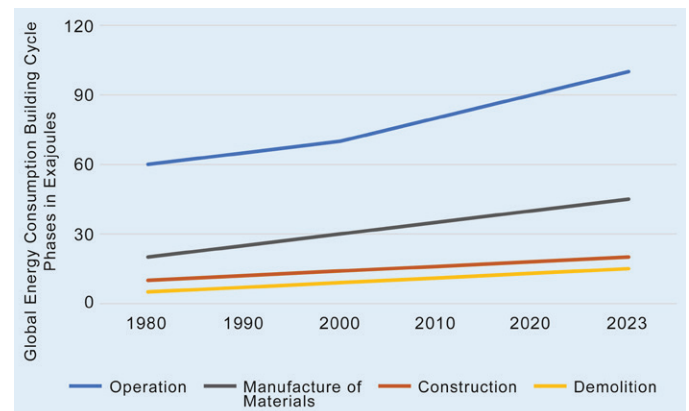
and workplace. But multiplied by billions, the effect is massive.

As the building cycle is a major and increasing source of pollution it presents a particularly important challenge in the response to global warming. Since most building cycle energy is used for building operations, this phase might be given the highest priority. Even so, our way of life is entrenched in the built environment so making substantive change will be difficult as it will likely call for altered lifestyles and contentious choices. Long term and broadly based official programs will need to be implemented.



Aida Farokhyar.

A lack of accurate data is another impediment to progress. While there is significant variability in results, as shown even in this article, all studies reveal a relentless increase in energy consumption and hence, pollution.



Global energy consumption in building cycle phases. Note the increasing and accelerating trend for building operations.

This is a global problem that involves everyone. But perhaps the most important role ought to be played by architects. Innovations in building design, space allocation, construction technology and related areas are keys to progress. Providing leadership in public education and bringing about change in popular attitudes ought to spearhead reform, leading to a new paradigm.

- Aida Farokhyar

References

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