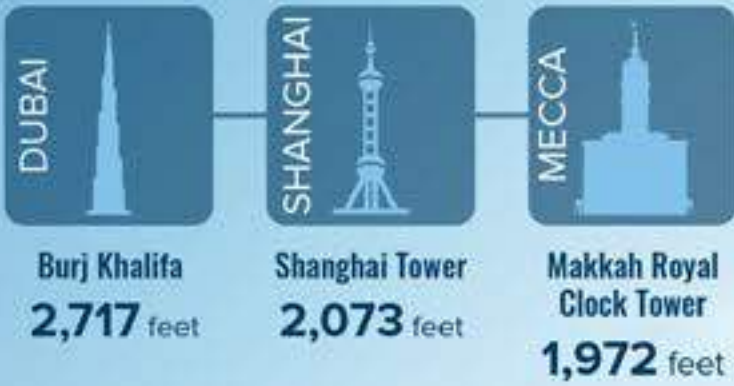


# The Future of Skyscrapers

## Stats about skyscrapers

The three tallest buildings in the world are:



The number of buildings over **200 meters (656 feet)** has tripled since the year 2000. More than 180 buildings over 250 meters (820 feet) are currently under construction.



Skyscraper construction and design needs to evolve, however, the design hasn't changed much over the last 100 years. Steel ropes used for elevators can only hold so much weight, and as skyscrapers grow taller, elevators will need to evolve. Furthermore, skyscraper construction isn't green. Concrete and steel are big components.

## Environmental impacts



of man-made CO<sub>2</sub> emissions worldwide come from the production and transportation of cement (which is in concrete). Another 5 percent of worldwide CO<sub>2</sub> emissions come from steel production.



For every ton of steel produced, 2 tons of CO<sub>2</sub> are emitted which equals approximately **3 billion tons of CO<sub>2</sub> each year**



The carbon embodied in building materials will make up **45%** of a typical modern office block's carbon footprint.



A single elevator with conventional steel rope carrying **24 passengers** consumes **130,000** kilowatt hours of energy per year and weighs up to **27,000 kilograms** (almost 60,000 pounds). And that elevator rope is subjected to severe strains. In fact on windy days building sway can put a steel-cabled elevator out of service.



**Traditional elevators are not efficient:** In 2010 alone, New York City office workers spent a cumulative **16.6 years** waiting for elevators.

## The future

Companies are using glass more often to design the shape of skyscrapers. Also, some construction companies are working to build sustainable, and green-friendly wooden skyscrapers using CLT, (cross-laminated timber).

### Wood vs Steel



In order to solve elevator problems, some companies are working on ropeless elevators that can move vertically and horizontally (by using magnets and linear motor technology)



Ropeless elevators require smaller shafts than conventional elevators and can increase a building's usable area by up to 25% (consumer elevators can take up to 40 percent of a building's useable space depending on the building height)



Ropeless elevators are made from lightweight carbon composite materials for cabins and doors, weighing a mere 50 kg instead of 300 kg in standard elevators. The result is an overall 50 percent weight reduction as compared to standard technologies (and therefore less energy to move these elevators around.)



Ropeless elevators can potentially increase the shaft transport capacity by up to 50% (fitting twice as many people) which would also reduce the carbon footprint of each elevator by half

### Replacing steel with wood

Only 5% of the skyscrapers finished last year were built using steel as the main component. majority of 2014 completions used cross-laminated timber construction (CLT) as the primary structural system – 52 out of 97 buildings (54 percent), as compared to 24 out of 71 (34 percent) in 2013.

CLT is several layers of timber board glued together at 90 degrees to form large structural sheets up to 40cm thick. The cross-lamination provides the material's dimensional stability and strength.

Substituting a cubic metre (35.3 cu ft.) of wood for other construction materials (concrete, blocks or bricks) results in an average saving of 0.7 to 1.1 tons of CO<sub>2</sub>.

A hybrid system of timber with concrete beams and core (shafts in the center with stairs and elevators) would reduce the building material carbon footprint by 60 – 75 percent, as compared, as compared to a concrete-only structure.

Wood can "store" CO<sub>2</sub>: Baobab (is a proposed wooden skyscraper for Paris that would) would store an estimated 3,700 metric tons of carbon dioxide. That's equivalent to keeping 2,207 cars off the road for a year or operating a home for 982 years.

Wood is a good thermal insulator. It is 400 times better at resisting thermal conductivity than steel, and 10 times better than concrete or bricks. This means less wood needs to be used (which equals thinner walls and more useable space) than with other building materials

### SOURCES:

<http://skyscrapercenter.com/buildings>  
<http://www.thyssenkrupp-elevator.com/>  
<http://skyscrapercenter.com/year-in-review2014>  
<http://news.mit.edu/2013/steel-without-greenhouse-gas-emissions-0508>  
<http://www.cnn.com/2015/06/12/europe/worlds-tallest-wooden-skyscraper-paris/>  
<http://theconversation.com/the-skyscrapers-of-the-future-will-be-made-of-wood-42132>  
<http://www.theatlantic.com/technology/archive/2015/05/the-skyscraper-of-the-future/387118/>  
<http://www.cbc.ca/news/business/skyscraper-construction-total-hits-record-in-2014-1.2899340>  
<http://www.canadawood.ca/downloads/pdf/technical-literature/building-with-wood-English.pdf>  
<http://www.theguardian.com/artanddesign/2015/jul/07/tree-houses-are-wooden-skyscrapers-the-future-of-tall-buildings>  
[https://static.dezeen.com/uploads/2015/01/The-Council-on-Tall-Buildings-and-Urban-Habitat\\_Year-in-Review\\_2014\\_dezeen\\_2\\_1000.jpg](https://static.dezeen.com/uploads/2015/01/The-Council-on-Tall-Buildings-and-Urban-Habitat_Year-in-Review_2014_dezeen_2_1000.jpg)

**NJIT**  
New Jersey Institute of Technology

[graduatedegrees.online.njit.edu](http://graduatedegrees.online.njit.edu)