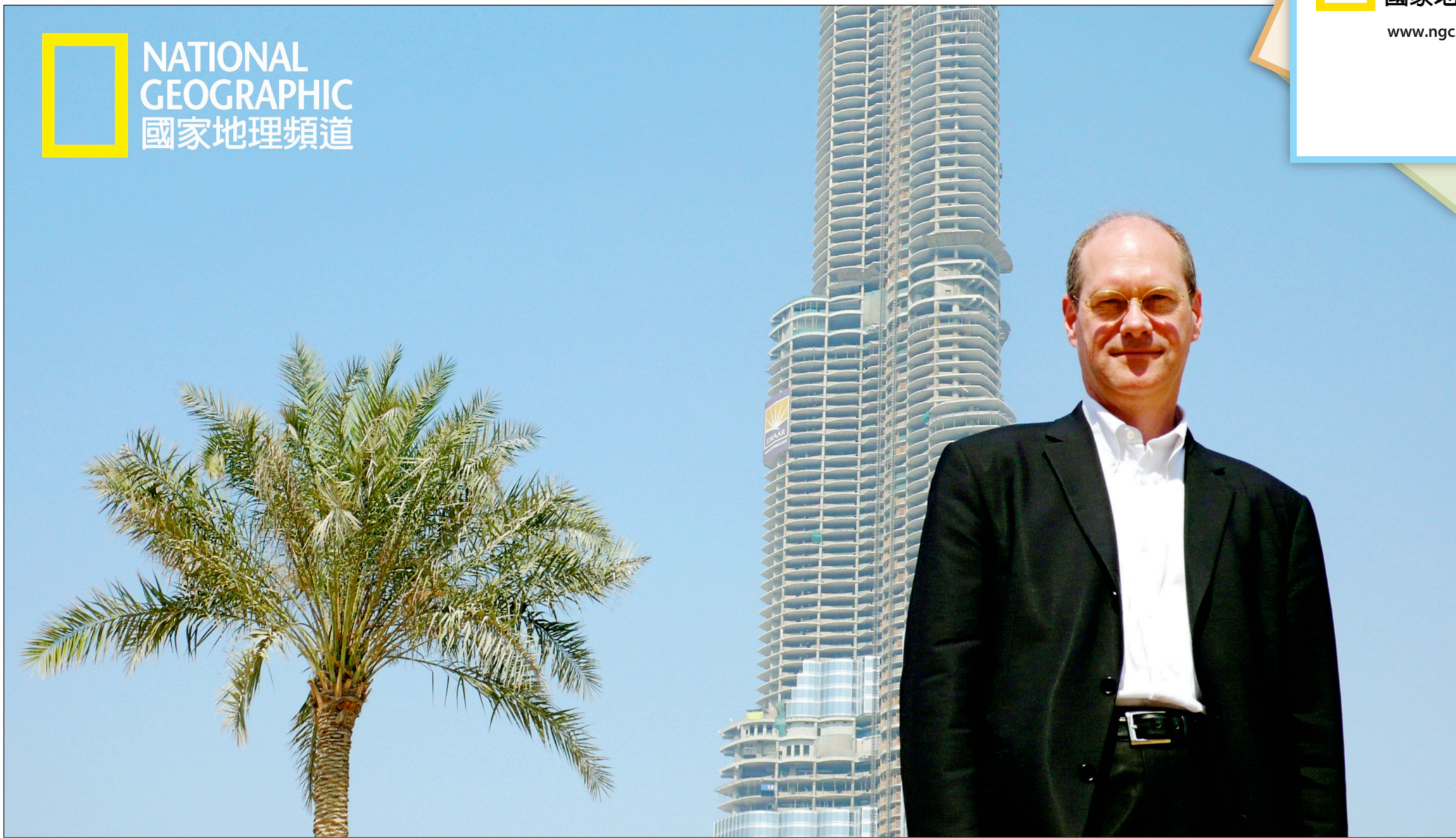




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Saturday, June 20 at 10:00pm 6月20日 週六 晚上10點 播出


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Top: Bill Baker, structural engineer, in front of Burj Dubai building.  
 上圖：結構工程師比爾·貝克在杜拜塔前留影。

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# Skyscrapers

## 杜拜塔

Dubai is the fastest growing city in the world. An army of cranes and laborers work around the clock, to turn the city into a place that the whole world will look up to. The **centerpiece** in the grand plan is the Burj Dubai. It is the ultimate leap in a series of historic engineering **breakthroughs**. To understand how the Burj Dubai can be this tall, we need to go back in time and look at how skyscrapers began.

杜拜是全球發展最快的城市，大批起重機和勞工日夜無休，把這個城市變成全球仰望之所在。這個偉大計劃最重要的部分，正是杜拜塔，它是一系列劃時代工程學突破杜拜塔的最後一躍，要瞭解杜拜塔為何高聳參天，我們得回到過去看摩天樓怎麼蓋起來的。

The first big **obstacle** to skyscrapers is the stair. People weren't willing to walk up lots of flights of stairs. The elevator completely **transforms** the urban landscape. And it all starts on a busy street corner in downtown New York. This corner was the site of the Equitable Life Assurance company's headquarters, a building of extraordinary significance because it was the first office building with an elevator, and without an elevator the skyscraper would be impossible.

摩天樓的首要障礙是樓梯，人們不願意爬太多層樓梯。電梯徹底改變了都市景觀。一切就從紐約商業區一個忙碌的街角開始，這個角落是公平保險公司總部的所在地，這棟大樓的重要性非同小可，因為這是第一棟電梯辦公大樓，沒有電梯就不可能蓋摩天樓。

Obviously stone is not skyscraper material. Steel is much stronger than stone so this **skeleton** can be thin and light yet it can support the weight of the whole structure. Steel construction truly moves the skyscraper on — this is a new breed of building. Once the steel skeleton frame is perfected, you could **hypothetically** build to any height. The skeleton of the Burj Dubai combines the best of steel and stone. It uses over thirty thousand tons of steel but in a very clever way. The steel is embedded in artificial stone and concrete. This reinforced concrete backbone would be clad in a high-tech curtain wall of glass and steel. The wall

latches onto the Burj Dubai in units of up to two storeys tall. The panels themselves are rigid but the joints between them are flexible.

石材顯然不適合蓋摩天樓。鋼材比石塊堅固得多，骨架即使又輕又薄也能支撐整個結構的重量。鋼結構確實帶動摩天樓的發展——這是一種新型態的大廈，一旦鋼骨架臻於完美，理論上要蓋多高的大樓都可以。杜拜塔的骨架結合最好的鋼材和石材，動用3萬多噸的鋼材，但工法非常巧妙地把鋼材鑲嵌在人造石材和混凝土裡。鋼筋混凝土的骨幹將覆蓋上玻璃與鋼的高科技幕牆，牆壁以兩層樓為單元附著在杜拜塔上，玻璃鑲板本身具備剛性，但鑲板間的接縫則保有韌性。

If an occupant moves a heavy piece of furniture towards the edge of the skyscraper, the floor will bend and force down the exterior wall. But the flexible joint in between the wall panels absorbs the movement so the wall as a whole is not damaged. The joints also allow each wall section to expand and contract as the desert sun passes around the skyscraper, heating it up. But the most potent force it must withstand is the desert wind.

要是住戶把一件厚重家具搬到摩天樓邊緣，地板會彎曲，把外牆往下壓，但牆壁鑲板間的柔性接縫會吸納鑲板的移動，因此牆壁整體上不會受損。每塊鑲板拜這些接縫所賜，可隨沙漠烈日照耀摩天樓提高大樓溫度而伸縮，但摩天樓必須克服的自然力仍以沙漠強風為首。

The Burj Dubai has an early warning system that guards it round the clock. If fire activates a smoke detector, a heat sensor or a water sprinkler, a network of high powered fans kick in. The fans force clean cool air through fire resistant ducts into the building. The fresh air pushes the smoke out of the stairwell and keeps the evacuation routes clear.

杜拜塔有預警系統二十四小時守護大樓，一旦火災啟動了濃煙偵測器、熱感應器或灑水裝置，高性能風扇體系就會打開，風扇把乾淨涼爽的新鮮空氣從防火的輸送管灌進大樓，新鮮空氣把濃煙推出樓梯井，保持疏散路線的暢通。

Standing on the shoulders of historic engineering marvels, the Burj Dubai really is the ultimate skyscraper.

站在劃時代工程學奇蹟的肩膀上，杜拜塔不愧為終極摩天樓。



CGI — Woman looking up at Burj Dubai.  
 電腦合成影像——女子抬頭仰望杜拜塔。

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- 1. **centerpiece** /'sentəˌpiːs/ n. 最重要的項目 (zui4 zhong4 yao4 de5 xiang4 mu4), 中心之物 (zhong1 xin1 zhi1 wu4)
- 2. **breakthrough** /'brekˌθruː/ n. 突破性進展 (tu2 po4 xing4 jin4 zhan3)
- 3. **obstacle** /'ɒbstəkl/ n. 障礙 (zhang4 ai4)
- 4. **transform** /træns'fɔːm/ v. 改變 (gai3 bian4)
- 5. **skeleton** /'skelətn/ n. 骨架 (gu3 jia4)
- 6. **hypothetically** /,haɪpə'θetɪklɪ/ adv. 假設地 (jia3 she4 de5)

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