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From Panel 4 The World Land-Bridge: It's Being Built! (continuation)

China: Great Infrastructure Projects at Home and Abroad

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China's economy has amazed the world in the last decade, and we can expect the enormous growth to continue, as I will explain in today's presentation. There is much to cover, but I will focus in on transport, water, and power infrastructure. For transport infrastructure, rail is by far the most important for China, and for power infrastructure, I'll concentrate on nuclear power, which will be key for continued economic growth.

This economic development is financed through China's banks, such as the Export-Import Bank of China that makes an enormous contribution. So you can just imagine why there is such a freak-out by the Anglo-American financial oligarchy, with China now expanding this role of finance in the establishment of the Asian Infrastructure Investment Bank. The AIIB is designed to expand infrastructure in the Asia Pacific region, so keep this in mind when we go through all of the projects that China has built already, even without this bank. And see that China's intention with the AIIB, and also the BRICS New Development Bank, is to expand this investment into infrastructure, to uplift the living standards of billions of people worldwide.

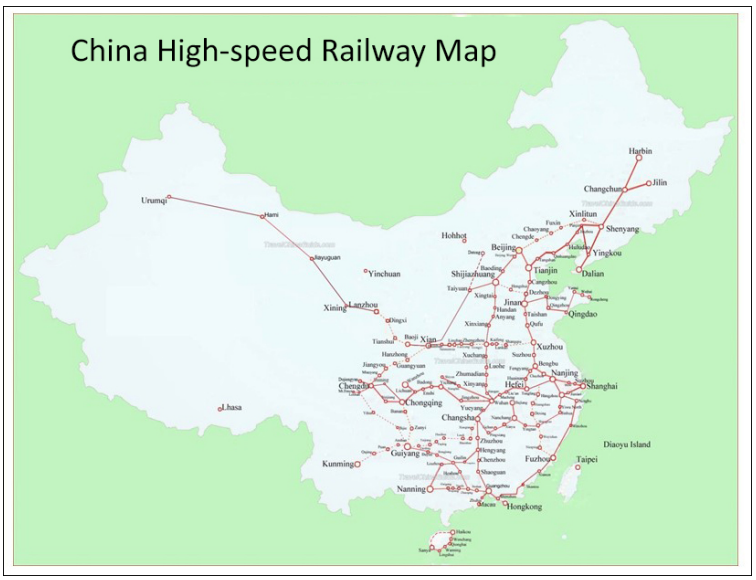
China has the world's only commercially operating maglev train, the Shanghai Maglev Train, which began commercial operation in 2004. It travels from the Podong International Airport to Shanghai—a distance of 30 km—and this journey takes just eight minutes. It has a maximum operating speed of 431 km/h but it has been tested at 501 km/h. Maglev has the advantage of a smoother ride and without any physical contact, the train hovers on a magnetic field. Electromagnets are also used to provide motion along the track in both acceleration and braking. Since there is no rolling resistance and physical contact, maglev transport is much quieter and allows for higher speeds.

China is building a maglev train in Beijing that is forecast to open in November or December this year. This maglev track, now under construction, is designed for minimising noise in an urban environment. It will stop at several Beijing city stations in close proximity, so maximum speeds won't be much more than 100 km/h.

A maglev train's speed in open air is limited by air resistance. Aeroplanes fly at greater speeds high up in the atmosphere where the air is thin, but air resistance at ground level is much greater. In addition, it would be unthinkable to break the sound barrier at ground level, with the noise of the sonic boom. The speed of sound in air is around 1,236 km/h. To address these problems, Chinese researchers have the world's most advanced program for vacuum maglev. A vacuum tube, where the air is pumped out, solves the problem of air resistance and the sonic boom. A team lead by Dr Deng Zigang at Southwest Jiaotong University in China has built a maglev train with the potential to reach 2,900 km/h. The vacuum tube diameter at the university test facility is too small to achieve such a speed, but if a long enough tube were constructed, this speed would be indeed be possible.

Most of China's high-speed trains use the steel-wheel-on-steel-rail-technology. Here we can see two high speed trains at a typical railway station in China. This is now everyday transport for millions of Chinese. Rail patronage in China has grown from 128 million trips in 2008 to 672 million trips in 2013, and over 2.9 billion passengers have taken a high speed train trip between April 2007 and 1 October 2014.

The Chinese CIT500, seen here, was tested at 605 km/h and is the world's fastest train. Maglev technology will allow greater speeds and, for any given speed, a much reduced noise level, but China has decided to rapidly lay out the known technology of steel-wheel-on-steel-rail at this time. Aside from the maglev, China's commercial high-speed trains travel at speeds of up to 350 km/h.

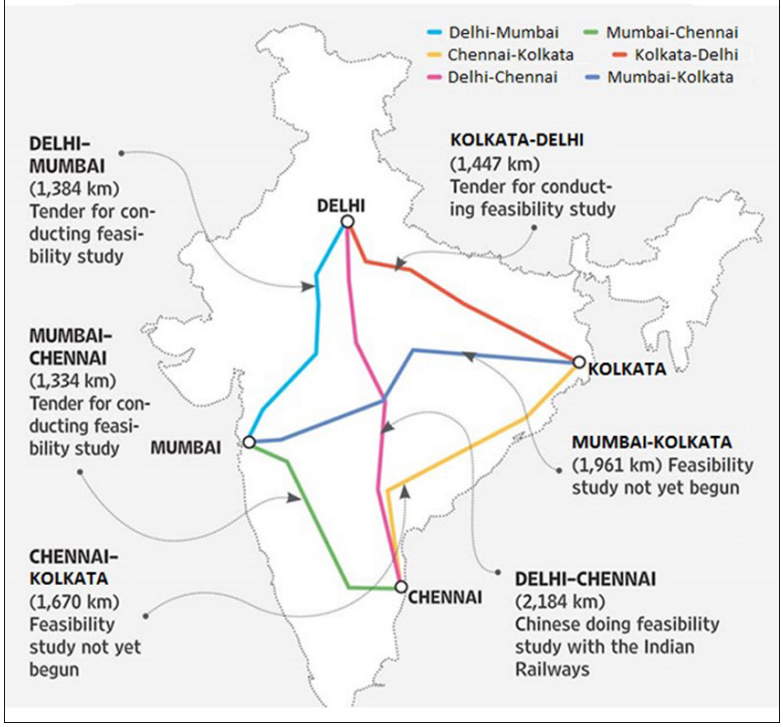


We see here the latest high-speed rail map, as updated in December of last year. The length of China's high-speed rail is more than 16,000 km—more than 60 per cent of the global total. By 2020, China is forecast to have 24,000 km of high-speed railways. And it certainly won't stop then. In this year alone, China plans to spend a further 800 billion yuan ($128 billion) on building railway tracks.

China is planning to build a 7,000 km high-speed rail link from Beijing to Moscow, at a cost of 1.5 trillion yuan ($242 billion). With a proposed maximum speed of 400 km/h, it would cut the Beijing-Moscow journey from five days to 33 hours. This massive project was announced in October 2014 and discussions are under way to confirm the exact route. Kazakhstan will likely welcome China's and Russia's option to build the railway through its territory. The other route option considered is to traverse through the Russian Altai Republic and just to the north of Kazakhstan. In any case, the railway will take 8-10 years to build.

China and India are negotiating a $33 billion high-speed rail scheme, the first major improvement in a rail system built by the British in the 19th century. The proposed Delhi-Chennai high-speed rail corridor will traverse close to 2,000 km, from the northern capital Delhi to the south-eastern city of Chennai. The project is part of Indian Prime Minister Narendra Modi's “diamond quadrilateral” project that aims to build a network of high-speed trains between cities, including Delhi-Mumbai, Mumbai-Chennai, Chennai-Kolkata, Kolkata-Delhi and Mumbai-Kolkata.

Narendra Modi’s “diamond quadrilateral”

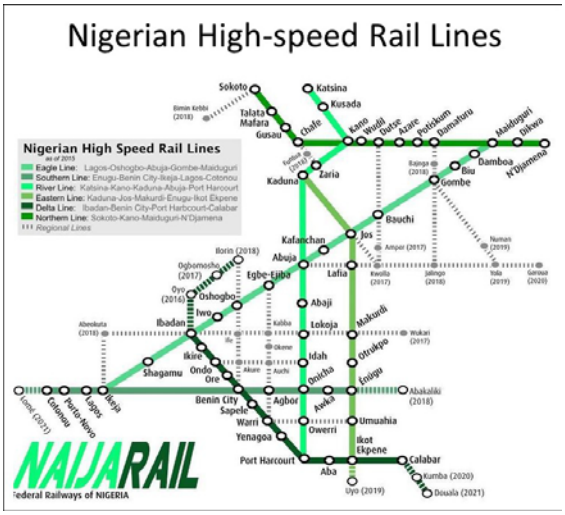


Mombasa-Nairobi Railway, Kenya

Mombasa-Nairobi Railway (extended)

China is building a Mombasa-Nairobi railway in Kenya that will be extended to five countries at a total cost of $13.8 billion. The first phase of the standard-gauge railway project will cover 609.3 km, from the port of Mombasa to Nairobi, and will cost $3.6 billion. Ninety per cent of the financing will come from the Export-Import Bank of China, while Kenya will cover the remaining 10 per cent. At least 30,000 Kenyans are expected to be employed by the project. And as seen here, construction is now under way.

Here’s the plan to extend the railway to five other countries: Uganda, Rwanda, Burundi, South Sudan and the Democratic Republic of the Congo. It covers a much greater distance than the initial Mombasa-Nairobi link.



Moving to the west of Africa, the construction of the 186.5 km Abuja-Kaduna railway line began in 2011 at the total cost of 850 million dollars, and was complete as of early this year. There are 37 overpass bridges and nine stations along the way. It was executed by the Chinese rail construction giant China Railway Construction Corporation (CRCC).

I now want to play a short one-minute video clip showing the excitement that such infrastructure generates.

Nigeria was obviously pleased with the Abuja-Kaduna railway. Now they've entered into a contract to build a nation-wide network of high-speed trains. Financing for Nigeria's massive new US$13 billion high-speed rail network is primarily in the form of a loan from China's Export Import Bank. The China Railway Construction Corporation is set to build the 3,218 km network, which will be a major boost to the economy, connecting Lagos, Kano, Kaduna, Warri, Bauchi, Abuja, and Port Harcourt. The system will be digitally operated, using fibre-optic cables, radio communication and wireless services—all the latest technology. The entire national network will take 25 years to build, but some of the lines will be completed much sooner.

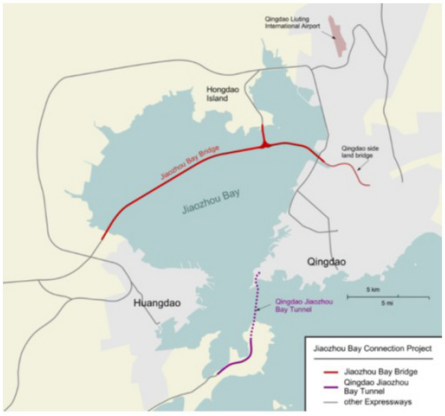
In Thailand, the government last year approved a $23 billion transport project that will see two high-speed railways link up directly with China by 2021. Thailand currently has only 250 km of dual-track railway.

China is looking to build a 3,000 km high-speed line from Kunming all the way down to Singapore, passing through Laos, Thailand and Malaysia—a project that would increase China's GDP and those of the involved nations by $375 billion, as a former Chinese railway chairman told the *China Daily*. Railway

construction in Thailand will begin in September or October at the latest, and will take around two-and-a-half years to complete, thanks to a $12 billion investment from China.

I've mainly focused on rail infrastructure, but I just can't leave out the Jiaozhou Bay Bridge used by motor vehicles. It's an extraordinary piece of infrastructure. The length of the Jiaozhou Bay Bridge is 26.7 km, of which 25.9 km is over water. It's the longest bridge over water in the world. It is supported by 5,238 concrete piles. There are eight lanes, and it cost 14.8 billion yuan (or $2.3 billion). Construction started in May 2007; it took four years to build, and employed at least 10,000 people. It opened on 30 June 2011 for traffic. On the same day the Qingdao Jiaozhou Bay tunnel was opened as part of the entire Jiaozhou Bay Connection Project. The bridge shortens the route between the two centres by 30 km, cutting travel time from more than 40 minutes to about 20 minutes. The photo shows just a small section of the bridge, looking in an easterly direction. At the left of the photo is where the road goes to the north of the bay.

Jiaozhou Bay Connection Project



Water Management

Moving on to water infrastructure: China has more dams than the rest of the world combined.

The Three Gorges Dam Reservoir on the Yangtze River has a capacity of 39,300 GL. This dwarfs Australia's two biggest reservoirs, the connected Lake Gordon/Lake Pedder reservoirs with a combined capacity of 11,000 GL and Lake Argyle's capacity of 10,500 GL. So the Three Gorges Dam reservoir is nearly four times the size of Australia's biggest reservoir.

The Three Gorges Dam is the world's biggest power station, with a capacity of 22,500 MW. There are 32 turbines, each with a capacity of 700 MW. By comparison, Australia's biggest

Three Gorges Dam

Three Gorges Dam Generating Power

power station, Eraring Power Station in NSW, fuelled by black coal, has a capacity of 2,880 MW.

Another 100 dams are planned or under construction on the Yangtze and its tributaries. The Three Gorges Dam provides flood mitigation and allows water level control, which has assisted shipping.

South-to-North Water Diversion Project

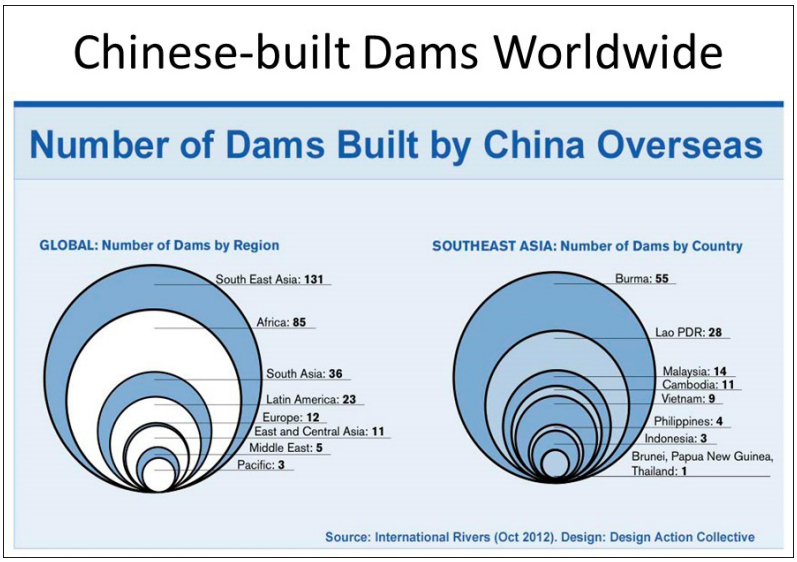
The South-to-North Water Diversion Project, upon completion, will be the greatest water project ever built. The north of China is dry and in need of water, which is plentiful in the south. There are three routes by which the water is transferred from the Yangtze River in the south to the Yellow River in the north. With an estimated total cost of 500 billion yuan ($AU 86 billion), the project is now well under way. Once completed, the project will channel a massive 44,800 GL of water annually from the Yangtze River to the drought-stricken north of China. As a comparison, the Snowy Mountains Scheme has historically transferred an average of 2,300 GL annually to the Murray and Murrumbidgee rivers.

Construction of the eastern and middle routes began in December 2002 and December 2003, respectively. The middle route was completed in December 2013. The eastern canal has been partially completed, while the western route remains in the planning stage.

Jinping-I Dam

The Jinping-I Dam, an arch dam, at 305 m is the tallest dam in the world. It impounds the Yalong River. China is now building an even taller dam on the Dadu River. The Shuangjiangkou Dam, when completed, will be 312 m tall. This is an embankment rock-fill dam, and is expected to open in 2018.

Let’s move to Chinese dam-building worldwide. Chinese banks and companies are involved in some 330 dams in 74 different countries, particularly in Africa and Southeast Asia. The diagram here is a little old, from 2012, and a lot can happen in two and a half years, the way China is growing. But it illustrates the point of where



China is building dams by region and country. Incidentally, the source of the chart is International Rivers, an anti-dam environmentalist outfit based in Berkeley, California in the United States, which is run by Anglo-American interests. They are so hysterical over China's dam-building, that they have documented just about every dam China is building, which helped me with my research, so at least they've done something useful.

Now, let's look at a few specific dams that China is building overseas. The Kamchay hydropower dam in Kampot province opened in 2011 and was built with the help of finance from the Export-Import Bank of China. The 193 MW hydroelectric dam is the largest in Cambodia. Several other larger dams are proposed. Cambodia has an estimated 10,000 MW hydroelectric potential, and China is ready to help build these dams.

The Bukun Dam in Borneo, at 205 m high, is Asia's largest dam outside of China. It was opened in 2011. Eight Francis-type turbines provide a total of 2,400 MW of capacity. It was built with the help of China's state-owned Sinohydro and the Export-Import Bank of China.

Kamchay Dam, Cambodia

Bakun Dam, Malaysia

Merowe Dam, Sudan

The Merowe Dam construction started in 2004, and it opened and started generating electricity on 3 March 2009. The dam on the Nile River is 9 km in length and 67 m high. China National Water Resources and Hydropower Engineering Corporation and China International Water and Electric Corporation built the dam. The Export-Import Bank of China contributed EUR 240 million to finance the dam. The power station has a 1,250 MW capacity.

The Myitsone Dam, still to be completed, will be the fifteenth-largest hydroelectric power station in the world. The dam, planned to be 1,310 m long and 140 m high, will have a electricity generation capacity of 6,000 MW. As a comparison, Australia's Snowy Mountains Scheme's nine power stations have a combined capacity of 3,950 MW. Currently the project is suspended, due to a major campaign against the dam. Western environmentalist organisations have played a big role in an attempt to stop this dam.

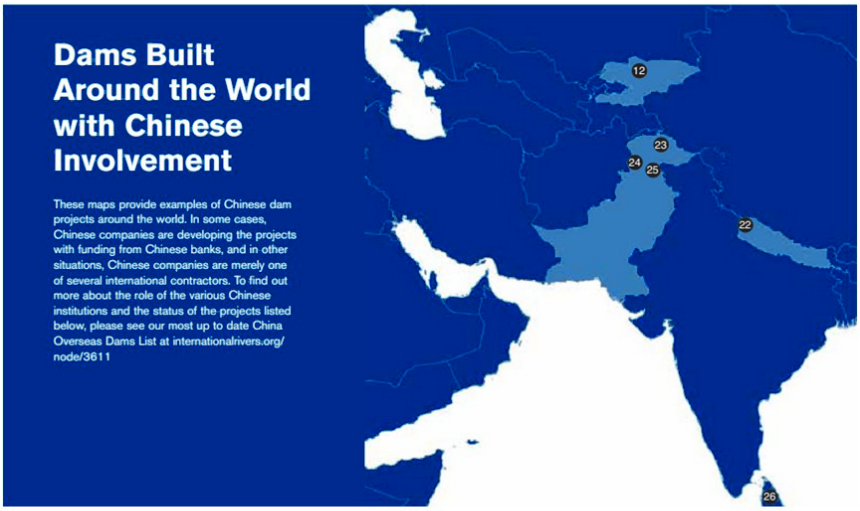
I can't go through all of the 330 dams that China is building around the world, but I've just put a list together of the 70 or so countries that China is working with to build dams.

Myitsone Dam, Burma

Countries with Chinese-built Dam Projects

Albania	Fiji	Mali	South Sudan
Algeria	Gabon	Mauritius	Sri Lanka
Angola	Georgia	Mongolia	Sudan
Argentina	Ghana	Montenegro	Tajikistan
Belarus	Guinea	Morocco	Tanzania
Belize	Guyana	Mozambique	Thailand
Bosnia and Herzegovina	Honduras	Nepal	Tunisia
Botswana	Indonesia	Niger	Uganda
Brunei	Iran	Nigeria	Ukraine
Burma	Ivory Coast	Pakistan	Uzbekistan
Cambodia	Kazakhstan	Papua New Guinea	Venezuela
Cameroon	Kenya	Peru	Vietnam
Central African Republic	Kyrgyzstan	Philippines	Zambia
Colombia	Lao	Republic of Congo	Zimbabwe
Congo, Democratic Republic of	Lao PDR	Romania	
Costa Rica	Macedonia	Russia	
Ecuador	Madagascar	Senegal	
Equatorial Guinea	Malawi	Serbia	
Ethiopia	Malaysia	Sierra Leone	

Chinese-built Dams in Central Asia



Source: *The New Great Walls: A guide to China's overseas dam Industry*
Published in November 2012 by International Rivers

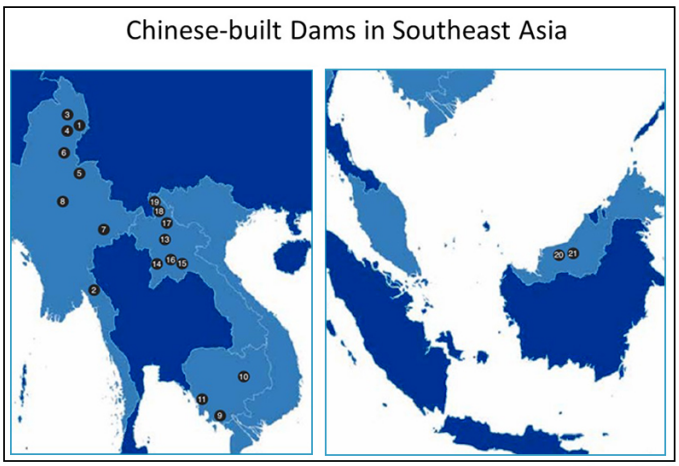
International Rivers has mapped several large dams that China is building worldwide, so I'll briefly go through some maps. Once again, these maps are a little old, but the 2012 data gives a good global picture.

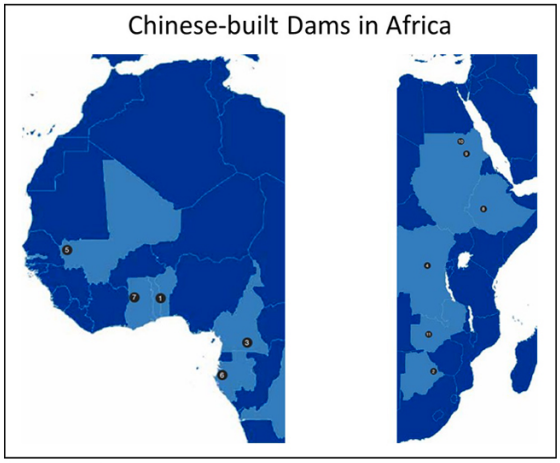
We can see several dams here in the Mekong River Basin.

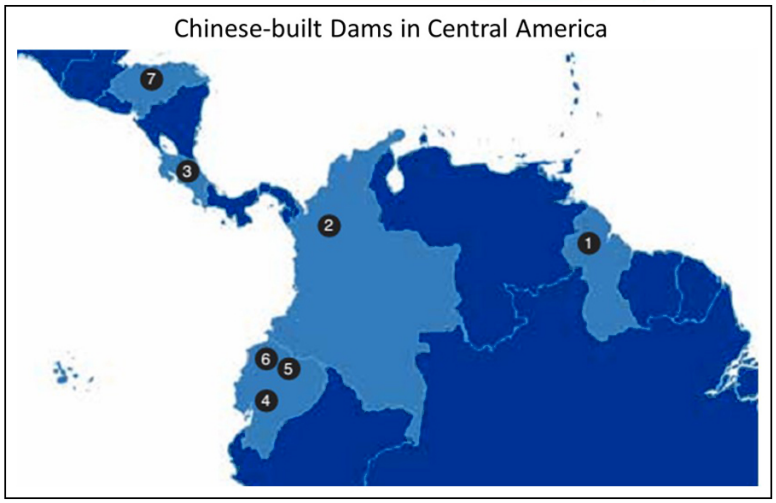
Africa is split here, but you get the picture.

And here we have a number of dams in Central and South America.

And even a couple in Eastern Europe.

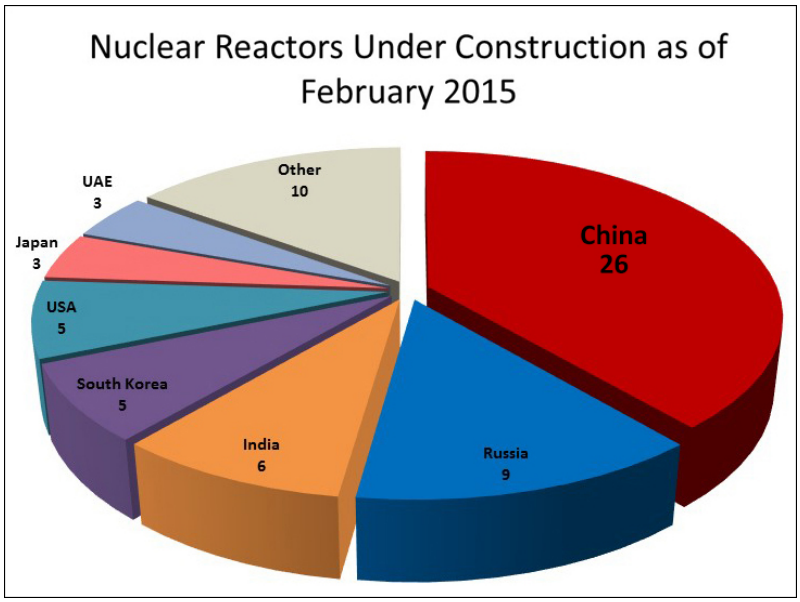




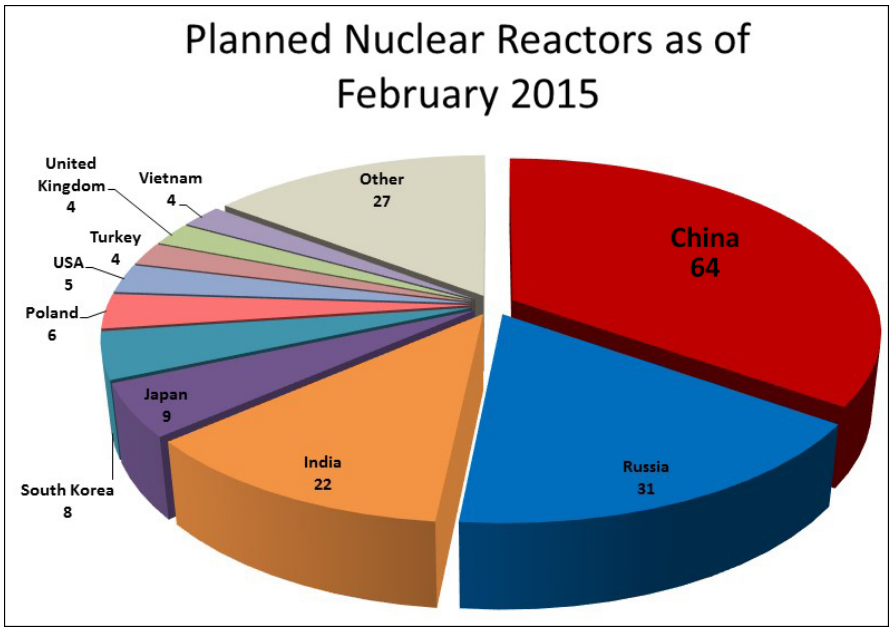


Going Nuclear

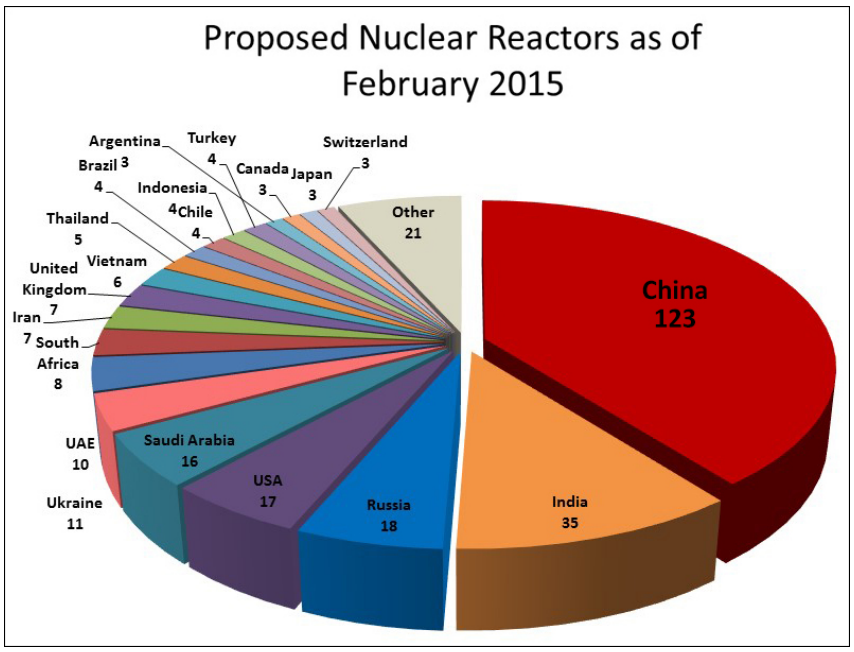
Currently China has 24 nuclear power reactors in operation. The average reactor construction time in 1992-2012 was 5.8 years; the minimum time was 4.3 years. Construction times are becoming shorter—the CPR-1000 takes just 52 months to build and smaller modular reactors take 36-40 months to build. At the current pace of development, China will be the world number one in nuclear power generation in a decade. It will leapfrog and then *double* U.S. nuclear capacity in the following few years, as I'll show in the next two slides.



Here we see a chart of planned reactors. I got this data from the World Nuclear Association, which defines planned as "Approvals, funding or major commitment in place, mostly expected in operation within 8-10 years." Once again, China is way out in front. The reactors in operation in the world—99 of them—but, as we see here, they only have five planned reactors vs. China's 64.



[The third pie chart shows] proposed reactors, defined as "Specific program or site proposals, expected operation mostly within 15 years."



Argentina

Argentine President Cristina Fernandez de Kirchner, on her three-day state visit to China in February this year, signed 15 agreements with Chinese President Xi Jinping, including an agreement to build two new nuclear power stations in Argentina. Fernandez de Kirchner said on her Twitter that the fourth Nuclear Plant and fifth Nuclear Plant require investment of $5.8 billion and $7 billion respectively. Argentina already has three nuclear power stations that use German and Canadian technology.

Pakistan

Karachi Nuclear Power Complex was officially initiated in November 2013 and is China's largest energy investment in Pakistan. China is involved in at least six nuclear power projects in Pakistan and is likely to export more to the country. Initially China declared it was building two reactors for Pakistan.

The Director General of the Nuclear Safety Institute of the Russian Academy of Sciences, Bulat Nigmatullin, forecast that China will be winning half of all contracts to construct nuclear power plants abroad in 10 years. On 6 February 2015, Wang Xiaotao, vice minister of China's National Development and Reform Commission, said that China is currently holding talks with a number of countries on constructing nuclear reactors on their territories. He argued that China is ready to enter the global market, adding that Chinese facilities comply with all international standards. The signing of the relevant contracts will take three or four years. Expect to see this take place in the developing markets of the Middle East, India, Latin America and Asia.

I hope I've given you all a better sense of the enormous shift that China has made and the exciting development potential for the future.