

= Three Gorges Dam =

The Three Gorges Dam is a hydroelectric dam that spans the Yangtze River by the town of Sandouping, located in Yiling District, Yichang, Hubei province, China. The Three Gorges Dam is the world's largest power station in terms of installed capacity (22 @, @ 500 MW). In 2014 the dam generated 98 @. @ 8 TWh of electricity, setting a new world record by 0 @. @ 17 TWh previously held by the Itaipú Dam on the Brazil / Paraguay border in 2013 of 98 @. @ 63. But in 2015, the Itaipu power plant resumed the lead in annual worldwide production, producing 89 @. @ 5 TWh, while production of Three Gorges was 87 TWh.

Except for a ship lift, the dam project was completed and fully functional as of July 4, 2012, when the last of the main water turbines in the underground plant began production. The ship lift was complete in December 2015. Each main water turbine has a capacity of 700 MW. The dam body was completed in 2006. Coupling the dam's 32 main turbines with two smaller generators (50 MW each) to power the plant itself, the total electric generating capacity of the dam is 22 @, @ 500 MW.

As well as producing electricity, the dam is intended to increase the Yangtze River's shipping capacity and reduce the potential for floods downstream by providing flood storage space. The Chinese government regards the project as a historic engineering, social and economic success, with the design of state @-@ of @-@ the @-@ art large turbines, and a move toward limiting greenhouse gas emissions. However, the dam flooded archaeological and cultural sites and displaced some 1 @. @ 3 million people, and is causing significant ecological changes, including an increased risk of landslides. The dam has been a controversial topic both domestically and abroad.

= = History = =

A large dam across the Yangtze River was originally envisioned by Sun Yat @-@ sen in The International Development of China, in 1919. He stated that a dam capable of generating 30 million horsepower (22 GW) was possible downstream of the Three Gorges. In 1932, the Nationalist government, led by Chiang Kai @-@ shek, began preliminary work on plans in the Three Gorges. In 1939, Japanese military forces occupied Yichang and surveyed the area. A design, the Otani plan, was completed for the dam in anticipation of a Japanese victory over China.

In 1944, the United States Bureau of Reclamation chief design engineer, John L. Savage, surveyed the area and drew up a dam proposal for the ' Yangtze River Project '. Some 54 Chinese engineers went to the U.S. for training. The original plans called for the dam to employ a unique method for moving ships; the ships would move into locks located at the lower and upper ends of the dam and then cranes with cables would move the ships from one lock to the next. In the case of smaller water craft, groups of craft would be lifted together for efficiency. It is not known whether this solution was considered for its water @-@ saving performance or because the engineers thought the difference in height between the river above and below the dam too great for alternative methods. Some exploration, survey, economic study, and design work was done, but the government, in the midst of the Chinese Civil War, halted work in 1947.

After the 1949 Communist takeover, Mao Zedong supported the project, but began the Gezhouba Dam project nearby first, and economic problems including the Great Leap Forward and the Cultural Revolution slowed progress. After the 1954 Yangtze River Floods, in 1956, Mao Zedong authored " Swimming ", a poem about his fascination with a dam on the Yangtze River. In 1958, after the Hundred Flowers Campaign, some engineers who spoke out against the project were imprisoned.

During the 1980s, the idea of a dam reemerged. The National People's Congress approved the dam in 1992: out of 2 @, @ 633 delegates, 1 @, @ 767 voted in favour, 177 voted against, 664 abstained, and 25 members did not vote. Construction started on December 14, 1994. The dam was expected to be fully operational in 2009, but additional projects, such as the underground power plant with six additional generators, delayed full operation until May 2012. The ship lift was

completed in 2015 . The dam had raised the water level in the reservoir to 172 m (566 ft) above sea level by the end of 2008 and the designed maximum level of 175 m (574 ft) by October 2010 .

= = Composition and dimensions = =

Made of concrete and steel , the dam is 2 335 m (7 661 ft) long and the top of the dam is 185 metres (607 ft) above sea level . The project used 27 million cubic metres (35×10^6 cu yd) of concrete (mainly for the dam wall) , 463 000 tonnes of steel (enough to build 63 Eiffel Towers) and moved about 102 million cubic metres (134×10^6 cu yd) of earth . The concrete dam wall is 181 metres (594 ft) high above the rock basis .

When the water level is at its maximum of 175 metres (574 ft) above sea level , which is 110 metres (361 ft) higher than the river level downstream , the dam reservoir is on average about 660 kilometres (410 mi) in length and 12 kilometres (3 700 ft) in width . It contains 39 km³ (31 900 acre · ft) of water and has a total surface area of 1 045 square kilometres (403 sq mi) . On completion , the reservoir flooded a total area of 632 square kilometres (244 sq mi) of land , compared to the 1 350 square kilometres (520 sq mi) of reservoir created by the Itaipu Dam .

= = Economics = =

The government estimated that the Three Gorges Dam project would cost 180 billion yuan (US \$ 22.5 billion) . By the end of 2008 , spending had reached 148.365 billion yuan , among which 64.613 billion yuan was spent on construction , 68.557 billion yuan on relocating affected residents , and 15.195 billion yuan on financing . It is estimated that the construction cost will be recovered when the dam has generated 1 000 terawatt - hours (3 600 PJ) of electricity , yielding 250 billion yuan . Full cost recovery is expected to occur ten years after the dam starts full operation .

As of December 20 , 2013 , the full cost of the Three Gorges Dam project has been recovered .

Funding sources include the Three Gorges Dam Construction Fund , profits from the Gezhouba Dam , loans from the China Development Bank , loans from domestic and foreign commercial banks , corporate bonds , and revenue before and after the dam is fully operational . Additional charges were assessed as follows : Every province receiving power from the Three Gorges Dam has to pay ¥ 7.00 per MWh extra . Other provinces had to pay an additional charge of ¥ 4.00 per MWh . The Tibet Autonomous Region pays no surcharge .

= = Power generation and distribution = =

= = = Generating capacity = = =

Power generation is managed by China Yangtze Power , a listed subsidiary of China Three Gorges Corporation (CTGC) ? a Central Enterprise SOE administered by SASAC . The Three Gorges Dam is the world 's largest capacity hydroelectric power station with 34 generators : 32 main generators , each with a capacity of 700 MW , and two plant power generators , each with capacity of 50 MW , making a total capacity of 22 500 MW . Among those 32 main generators , 14 are installed in the north side of the dam , 12 in the south side , and the remaining six in the underground power plant in the mountain south of the dam . The expected annual electricity generation will be over 100 TWh .

= = = Generators = = =

The main generators weigh about 6 000 tonnes each and are designed to produce more than

700 MW of power . The designed head of the generator is 80 @. @ 6 meters (264 ft) . The flow rate varies between 600 ? 950 cubic metres per second (21 @, @ 000 ? 34 @, @ 000 cu ft / s) depending on the head available . The greater the head , the less water needed to reach full power . Three Gorges uses Francis turbines . Turbine diameter is 9 @. @ 7 / 10 @. @ 4 m (VGS design / Alstom 's design) and rotation speed is 75 revolutions per minute . Rated power is 778 MVA , with a maximum of 840 MVA and a power factor of 0 @. @ 9 . The generator produces electrical power at 20 kV . The outer diameter of the generator stator is 21 @. @ 4 / 20 @. @ 9 m . The inner diameter is 18 @. @ 5 / 18 @. @ 8 m . The stator , the biggest of its kind , is 3 @. @ 1 / 3 m in height . Bearing load is 5050 / 5500 tonnes . Average efficiency is over 94 % , and reaches 96 @. @ 5 % .

The generators are manufactured by two joint ventures . One of them includes Alstom , ABB Group , Kvaerner , and the Chinese company Haerbin Motor . The other includes Voith , General Electric , Siemens (abbreviated as VGS) , and the Chinese company Oriental Motor . The technology transfer agreement was signed together with the contract . Most of the generators are water @-@ cooled . Some newer ones are air @-@ cooled , which are simpler in design and manufacture and are easier to maintain .

= = = Generator installation progress = = =

The 14 north side main generators are in operation . The first (No. 2) started on July 10 , 2003 . The north side became completely operational September 7 , 2005 with the implementation of generator No. 9 . Full power (9 @, @ 800 MW) was only reached on October 18 , 2006 after the water level reached 156 m .

The 12 south side main generators are also in operation . No. 22 began operation on June 11 , 2007 and No. 15 started up on October 30 , 2008 . The sixth (No. 17) began operation on December 18 , 2007 , raising capacity to 14 @. @ 1 GW , finally surpassing Itaipu (14 @. @ 0 GW) , to become the world 's largest hydro power plant by capacity .

The 6 underground main generators are also in operation as of May 23 , 2012 , when the last main generator , No. 27 , finished its final test raising capacity to 22 @. @ 5 GW . After 9 years of construction , installation and testing , the power plant is now fully operational .

= = = Output milestones = = =

By August 16 , 2011 , the plant had generated 500 TWh of electricity . In July 2008 it generated 10 @. @ 3 TWh of electricity , its first month over 10 TWh . On June 30 , 2009 , after the river flow rate increased to over 24 @, @ 000 m³ , all 28 generators were switched on , producing only 16 @, @ 100 MW because the head available during flood season is insufficient . During an August 2009 flood , the plant first reached its maximum output for a short period .

During the November to May dry season , power output is limited by the river 's flow rate , as seen in the diagrams on the right . When there is enough flow , power output is limited by plant generating capacity . The maximum power @-@ output curves were calculated based on the average flow rate at the dam site , assuming the water level is 175 m and the plant gross efficiency is 90 @. @ 15 % . The actual power output in 2008 was obtained based on the monthly electricity sent to the grid .

The Three Gorges Dam reached its design @-@ maximum reservoir water level of 175 m (574 ft) for the first time on October 26 , 2010 , in which the intended annual power @-@ generation capacity of 84 @. @ 7 TWh was realized . In 2012 , the dam 's 32 generating units generated a record 98 @. @ 1 TWh of electricity , which accounts for 14 % of China 's total hydro generation .

= = = Distribution = = =

The State Grid Corporation and China Southern Power Grid paid a flat rate of ¥ 250 per MWh (US \$ 35 @. @ 7) until July 2 , 2008 . Since then , the price has varied by province , from ¥ 228 @. @ 7 ? 401 @. @ 8 per MWh . Higher @-@ paying customers receive priority , such as Shanghai . Nine provinces and two cities consume power from the dam .

Power distribution and transmission infrastructure cost about 34 @. @ 387 billion Yuan . Construction was completed in December 2007 , one year ahead of schedule .

Power is distributed over multiple 500 kilovolt (kV) transmission lines . Three Direct current (DC) lines to the East China Grid carry 7 @, @ 200 MW : Three Gorges ? Shanghai (3 @, @ 000 MW) , HVDC Three Gorges ? Changzhou (3 @, @ 000 MW) , and HVDC Gezhouba ? Shanghai (1 @, @ 200 MW) . The alternating current (AC) lines to the Central China Grid have a total capacity of 12 @, @ 000 MW . The DC transmission line HVDC Three Gorges ? Guangdong to the South China Grid has a capacity of 3 @, @ 000 MW .

The dam was expected to provide 10 % of China 's power . However , electricity demand has increased more quickly than previously projected . Even fully operational , on average , it supports only about 1 @. @ 7 % of electricity demand in China in the year of 2011 , when the Chinese electricity demand reached 4692 @. @ 8 TWh .

= = Environmental impact = =

= = = Emissions = = =

According to the National Development and Reform Commission of China , 366 grams of coal would produce 1 kWh of electricity during 2006 . At full power , Three Gorges reduces coal consumption by 31 million tonnes per year , avoiding 100 million tonnes of greenhouse gas emissions , millions of tonnes of dust , one million tonnes of sulfur dioxide , 370 @, @ 000 tonnes of nitric oxide , 10 @, @ 000 tonnes of carbon monoxide , and a significant amount of mercury . Hydropower saves the energy needed to mine , wash , and transport the coal from northern China .

From 2003 to 2007 , power production equaled that of 84 million tonnes of standard coal , reducing carbon dioxide by 190 million tonnes , sulfur dioxide by 2 @. @ 29 million tonnes , and nitrogen oxides by 980 @, @ 000 tonnes .

The dam increased the Yangtze 's barge capacity sixfold , reducing carbon dioxide emission by 630 @, @ 000 tonnes . From 2004 to 2007 a total of 198 million tonnes of goods passed through the ship locks . Compared to using trucking , barges reduced carbon dioxide emission by ten million tonnes and lowered costs by 25 % .

= = = Erosion and sedimentation = = =

Two hazards are uniquely identified with the dam . One is that sedimentation projections are not agreed upon , and the other is that the dam sits on a seismic fault . At current levels , 80 % of the land in the area is experiencing erosion , depositing about 40 million tons of sediment into the Yangtze annually . Because the flow is slower above the dam , much of this sediment will now settle there instead of flowing downstream , and there will be less sediment downstream .

The absence of silt downstream has three effects :

Some hydrologists expect downstream riverbanks to become more vulnerable to flooding .

Shanghai , more than 1 @, @ 600 km (990 mi) away , rests on a massive sedimentary plain . The " arriving silt ? so long as it does arrive ? strengthens the bed on which Shanghai is built ... the less the tonnage of arriving sediment the more vulnerable is this biggest of Chinese cities to inundation ... "

Benthic sediment buildup causes biological damage and reduces aquatic biodiversity .

= = = Earthquakes and landslides = = =

Erosion in the reservoir , induced by rising water , causes frequent major landslides that have led to noticeable disturbance in the reservoir surface , including two incidents in May 2009 when somewhere between 20 @, @ 000 and 50 @, @ 000 cubic metres (26 @, @ 000 and 65 @, @ 000 cu yd) of material plunged into the flooded Wuxia Gorge of the Wu River . Also , in the first four

months of 2010 , there were 97 significant landslides .

= = = Waste management = = =

The dam catalyzed improved upstream wastewater treatment around Chongqing and its suburban areas . According to the Ministry of Environmental Protection , as of April 2007 more than 50 new plants could treat 1 @. @ 84 million tonnes per day , 65 % of the total need . About 32 landfills were added , which could handle 7 @, @ 664 @. @ 5 tonnes of solid waste every day . Over one billion tons of wastewater are released annually into the river , which was more likely to be swept away before the reservoir was created . This has left the water looking stagnant , polluted and murky .

= = = Forest cover = = =

In 1997 the Three Gorges area had 10 % forestation , down from 20 % in the 1950s .

Research by the United Nations Food and Agriculture Organization research suggested that the Asia @- @ Pacific region would , overall , gain about 6 @, @ 000 km² (2 @, @ 300 sq mi) of forest by 2008 . That is quite a turnaround from the 13 @, @ 000 km² (5 @, @ 000 sq mi) net loss of forest each year in the 1990s . The main reason is China 's huge reforestation effort . This accelerated after the 1998 Yangtze River floods convinced the government that it must restore tree cover , especially in the Yangtze 's basin upstream of the Three Gorges Dam .

= = = Wildlife = = =

Concerns about the potential wildlife impact of the Dam predate the National People 's Congress 's approval in 1992 . This region has long been known for its rich biodiversity . It is home to 6 @, @ 388 species of plants , which belong to 238 families and 1508 genera . Of these plant species , 57 percent are endangered . These rare species are also used as ingredients in traditional Chinese medicines . Already , the percentage of forested area in the region surrounding the Three Gorges Dam has dropped from twenty percent in 1950 to less than ten percent as of 2002 , negatively affecting all plant species in this locality . The region also provides habitats to hundreds of freshwater and terrestrial animal species . Freshwater fish are especially affected by dams due to changes in the water temperature and flow regime . Many other fish are hurt in the turbine blades of the hydroelectric plants as well . This is particularly detrimental to the ecosystem of the region because the Yangtze River basin is home to 361 different fish species and accounts for twenty @- @ seven percent of all endangered freshwater fish species in China . Other aquatic species have been endangered by the dam , particularly the baiji , or Chinese river dolphin , now extinct . In fact , Government Chinese scholars even claim that the Three Gorges Dam directly caused the extinction of the baiji .

Of the 3 @, @ 000 to 4 @, @ 000 remaining critically endangered Siberian crane , a large number currently spend the winter in wetlands that will be destroyed by the Three Gorges Dam . The dam contributed to the functional extinction of the baiji Yangtze river dolphin . Though it was close to this level even at the start of construction , the dam further decreased its habitat and increased ship travel , which are among the factors causing what will be its ultimate demise . In addition , populations of the Yangtze sturgeon are guaranteed to be " negatively affected " by the dam .

= = Floods , agriculture , industry = =

An important function of the dam is to control flooding , which is a major problem for the seasonal river of the Yangtze . Millions of people live downstream of the dam , with many large , important cities like Wuhan , Nanjing , and Shanghai situated adjacent to the river . Plenty of farm land and China 's most important industrial area are built beside the river .

The reservoir 's flood storage capacity is 22 cubic kilometres (18 @, @ 000 @, @ 000 acre · ft) . This capacity will reduce the frequency of major downstream flooding from once every ten years to

once every 100 years . The dam is expected to minimize the effect of even a " super " flood . In 1954 the river flooded 193 @, @ 000 km² (74 @, @ 518 sq mi) , killing 33 @, @ 169 people and forcing 18 @, @ 884 @, @ 000 people to move . The flood covered Wuhan , a city of eight million people , for over three months , and the Jingguang Railway was out of service for more than 100 days . The 1954 flood carried 50 cubic kilometres (12 cu mi) of water . The dam could only divert the water above Chenglingji , leaving 30 to 40 km³ (7 @. @ 2 to 9 @. @ 6 cu mi) to be diverted . Also the dam cannot protect against some of the large tributaries downstream , including the Xiang , Zishui , Yuanshui , Lishui , Hanshui , and the Gan .

In 1998 a flood in the same area caused billions of dollars in damage ; 2 @, @ 039 km² (787 sq mi) of farm land were flooded . The flood affected more than 2 @. @ 3 million people , killing 1 @, @ 526 . In early August 2009 , the largest flood in five years passed through the dam site . The dam limited the water flow to less than 40 @, @ 000 cubic metres (52 @, @ 000 cu yd) per second , raising the upstream water level from 145 @. @ 13 metres on August 1 , 2009 , to 152 @. @ 88 on August 8 , 2009 . 4 @. @ 27 cubic kilometres of flood water were captured and the river flow was cut by as much as 15 @, @ 000 cubic metres per second .

The dam discharges its reservoir during the dry season between December and March every year . This increases the flow rate of the river downstream , and provides fresh water for agricultural and industrial usage . It also improves shipping conditions . The water level upstream drops from 175 m to 145 m , preparing for the rainy season . The water also powers the Gezhouba Dam downstream .

Since the filling of the reservoir in 2003 , the Three Gorges Dam has supplied an extra 11 cubic kilometres of fresh water to downstream cities and farms during the dry season .

During the 2010 South China floods , in July , inflows at the Three Gorges Dam reached a peak of 70 @, @ 000 m³ / s (2 @, @ 500 @, @ 000 cu ft / s) , exceeding the peak during the 1998 Yangtze River Floods . The dam 's reservoir rose nearly 3 m (9 @. @ 8 ft) in 24 hours and reduced the outflow to 40 @, @ 000 m³ / s (1 @, @ 400 @, @ 000 cu ft / s) in discharges downstream , effectively alleviating serious impacts on the middle and lower river .

= = Navigating the dam = =

= = = Locks = = =

The installation of ship locks is intended to increase river shipping from ten million to 100 million tonnes annually , as a result transportation costs will be cut between 30 and 37 % . Shipping will become safer , since the gorges are notoriously dangerous to navigate . Ships with much deeper draft will be able to navigate 2 @, @ 400 kilometres (1 @, @ 500 mi) upstream from Shanghai all the way to Chongqing . It is expected that shipping to Chongqing will increase fivefold .

There are two series of ship locks installed near the dam (30 ° 50 ' 12 " N 111 ° 1 ' 10 " E) . Each of them is made up of five stages , with transit time at around four hours . Maximum vessel size is 10 @, @ 000 tons . The locks are 280 m long , 35 m wide , and 5 m deep (918 × 114 × 16 @. @ 4 ft) . That is 30 m longer than those on the St Lawrence Seaway , but half as deep . Before the dam was constructed , the maximum freight capacity at the Three Gorges site was 18 @. @ 0 million tonnes per year . From 2004 to 2007 , a total of 198 million tonnes of freight passed through the locks . The freight capacity of the river increased six times and the cost of shipping was reduced by 25 % . The total capacity of the ship locks is expected to reach 100 million tonnes per year .

These locks are staircase locks , whereby inner lock gate pairs serve as both the upper gate and lower gate . The gates are the vulnerable hinged type , which , if damaged , could temporarily render the entire flight unusable . As there are separate sets of locks for upstream and downstream traffic , this system is more water efficient than bi @-@ directional staircase locks .

= = = Ship lift = = =

In addition to the canal locks , there is a ship lift , a kind of elevator for vessels . The ship lift can lift

ships of up to 3 @, @ 000 tons . The vertical distance traveled is 113 metres , and the size of the ship lift 's basin is 120 × 18 × 3 @. @ 5 metres . The ship lift takes 30 to 40 minutes to transit , as opposed to the three to four hours for stepping through the locks . One complicating factor is that the water level can vary dramatically . The ship lift must work even if water levels vary by 12 meters (39 ft) on the lower side , and 30 metres on the upper side .

The ship lift 's design uses a helical gear system , to climb or descend a toothed rack .

The ship lift was not yet complete when the rest of the project was officially opened on May 20 , 2006 . In November 2007 it was reported in the local media that construction of the ship lift started in October 2007 .

In February 2012 Xinhua reported that the four towers that are to support the ship lift had almost been completed .

The report said the towers had reached 189 metres of the anticipated 195 metres , the towers would be completed by June 2012 and the entire shiplift in 2015 .

As of May 2014 , the ship lift was expected to be completed by July 2015 . It was tested in December 2015 and announced complete in January 2016 . Lahmeyer , the German firm that designed the ship lift , said it will take a vessel less than an hour to transit the lift . An article in Steel Construction says the actual time of the lift will be 21 minutes . It says that the expected dimensions of the 3 @, @ 000 tonnes (3 @, @ 000 @, @ 000 kg) passenger vessels the ship lift 's basin was designed to carry will be 84 @. @ 5 metres (277 ft) X 17 @. @ 2 metres (56 ft) X 2 @. @ 65 metres (8 @. @ 7 ft) .

= = = Portage railways = = =

Plans also exist for the construction of short portage railways bypassing the dam area altogether . Two short rail lines , one on each side of the river , are to be constructed . The 88 kilometer long northern portage railway (?????) will run from the Taipingxi port facility (????) on the northern side of the Yangtze , just upstream from the dam , via Yichang East Railway Station to the Baiyang Tianjiahe port facility in Baiyang Town (???) , below Yichang . The 95 kilometer long southern portage railway (?????) will run from Maoping (upstream of the dam) via Yichang South Railway Station to Zhicheng (on the Jiaozuo ? Liuzhou Railway) .

In late 2012 , preliminary work started along both future railway routes .

= = Relocation of residents = =

As of June 2008 , China relocated 1 @. @ 24 million residents (ending with Gaoyang in Hubei Province) as 13 cities , 140 towns and 1350 villages either flooded or were partially flooded by the reservoir [A _ 2 @- @ M : CR3 @- @ 1HP : S @- @ 15] , about 1 @. @ 5 % of the province 's 60 @. @ 3 million and Chongqing Municipality 's 31 @. @ 44 million population . About 140 @, @ 000 residents were relocated to other provinces .

Relocation was completed on July 22 , 2008 . Some 2007 reports claimed that Chongqing Municipality will encourage an additional four million people to move away from the dam to the main urban area of Chongqing by 2020 . However , the municipal government explained that the relocation is due to urbanization , rather than the dam , and people involved included other areas of the municipality .

Allegedly , funds for relocating 13 @, @ 000 farmers around Gaoyang disappeared after being sent to the local government , leaving residents without compensation .

= = Other effects = =

= = = Culture and aesthetics = = =

The 600 km (370 mi) long reservoir flooded some 1 @, @ 300 archaeological sites and altered the

appearance of the Three Gorges as the water level rose over 300 ft (91 m) . Cultural and historical relics are being moved to higher ground as they are discovered , but the flooding inevitably covered undiscovered relics . Some sites could not be moved because of their location , size , or design . For example , the hanging coffins site high in the Shen Nong Gorge is part of the cliffs .

= = = National security = = =

The United States Department of Defense reported that in Taiwan , " proponents of strikes against the mainland apparently hope that merely presenting credible threats to China 's urban population or high @-@ value targets , such as the Three Gorges Dam , will deter Chinese military coercion . "

The notion that the military in Taiwan would seek to destroy the dam provoked an angry response from the mainland Chinese media . People 's Liberation Army General Liu Yuan was quoted in the China Youth Daily saying that the People 's Republic of China would be " seriously on guard against threats from Taiwan independence terrorists . "

The three gorge dam is a steel @-@ concrete gravity dam . The water is held back by the innate mass of the individual dam sections . As a result , damage to an individual section should not affect other parts of the dam . Due to the sheer size of the dam , it is expected to withstand tactical nuclear strikes .

= = = Structural integrity = = =

Days after the first filling of the reservoir , around 80 hairline cracks were observed in the dam 's structure . The submerged spillway gates of the dam might pose a risk of cavitation , similar to that which severely damaged the poorly designed and cavitating spillways of the Glen Canyon Dam in the US state of Arizona , which was unable to properly withstand the Colorado river floods of 1983 . However 163 @, @ 000 concrete units of the Three Gorges dam all passed quality testing and the deformation was within design limits . An experts group gave the project overall a good quality rating .

= = Upstream dams = =

In order to maximize the utility of the Three Gorges Dam and cut down on sedimentation from the Jinsha River , the upper course of the Yangtze River , authorities plan to build a series of dams on the Jinsha , including Wudongde Dam , Baihetan Dam , along with the now completed Xiluodu and Xiangjiaba dams . The total capacity of those four dams is 38 @, @ 500 MW , almost double the capacity of the Three Gorges . Baihetan is preparing for construction and Wudongde is seeking government approval . Another eight dams are in the midstream of the Jinsha and eight more upstream of it .