



# Brief Introduction of Operating Management in Navigation Facilities

of CTG

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# Agenda

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Company overview

2

Brief Introduction of Three Gorges  
Project (TGP )

3

Ship lock of TGP

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Ship Lift of TGP

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Navigation Management

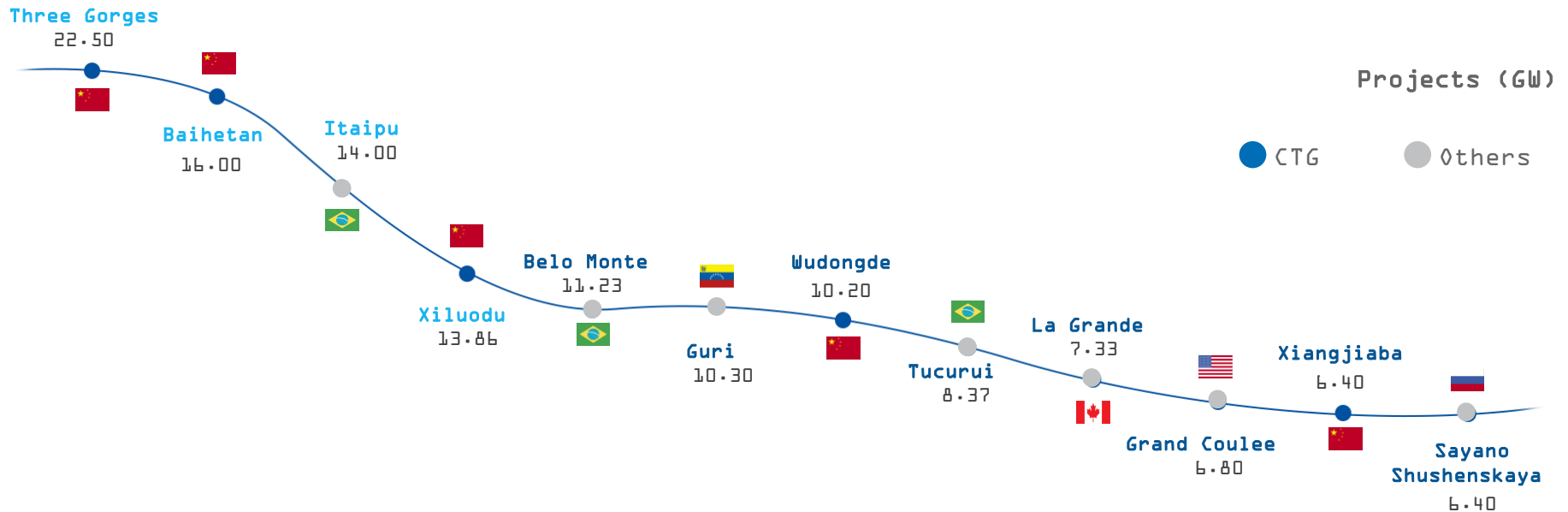
# Company overview

- **China Three Gorges Corporation** is the largest hydropower developer in the world, and the largest clean energy group in China. By the end of 2018, total installed capacity of CTG Corp reached 128GW, in which 92GW is in operation and 36GW is



# Company overview

- 5 of 12 of the world's largest hydropower plants are owned by CTG



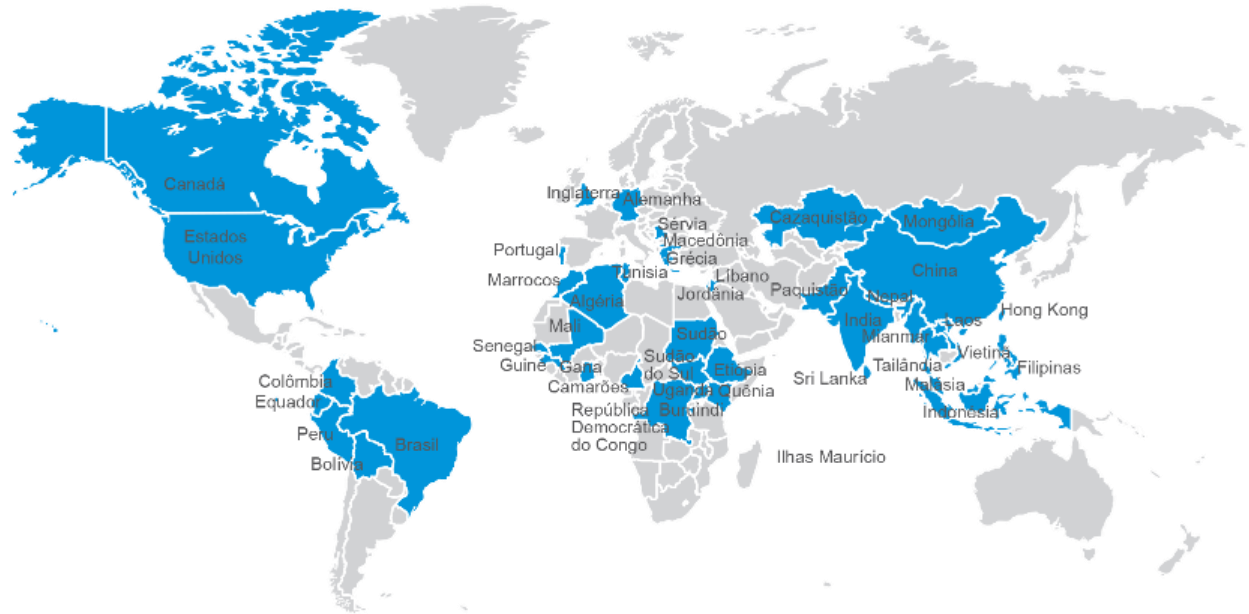


# Company overview

- International Business

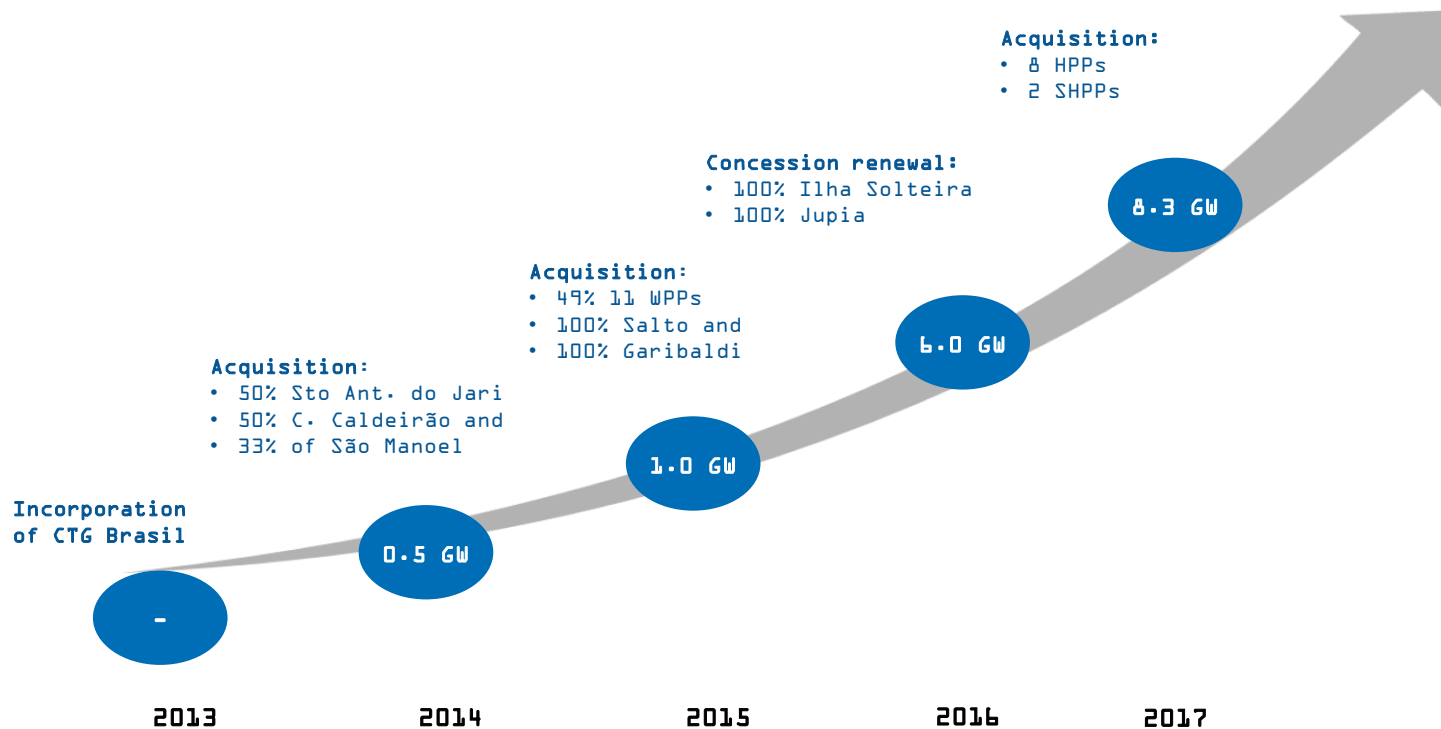


CTG has is present in more than 40 countries, 84 projects under construction and operation focused on three regions: Brazil (Latam America), Europe and South Asia



# Company overview

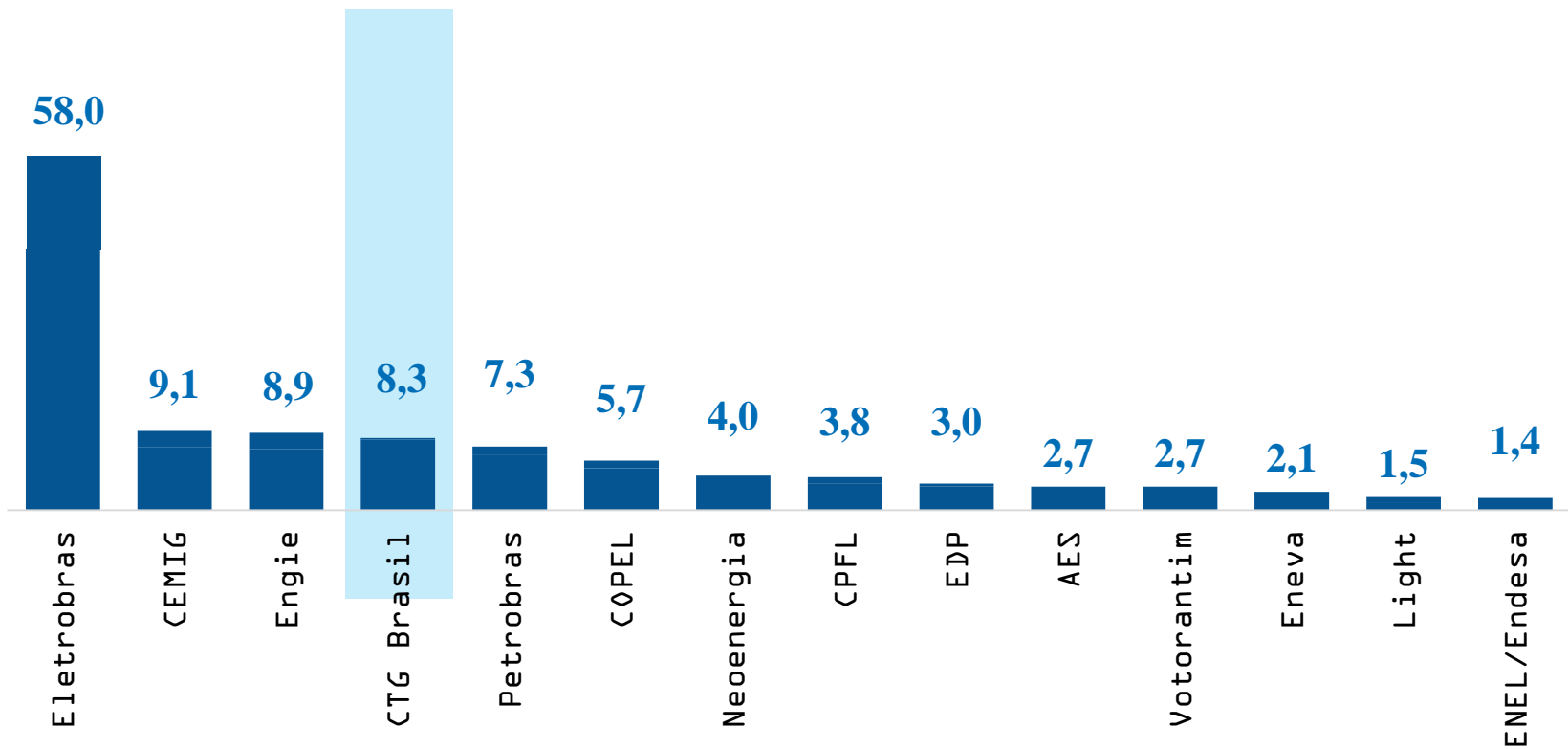
- CTG Brasil has a successful entry story through strategic alliance with EDP and acquisitions



# Company overview

- CTG Brasil is the 2nd largest private Genco in Brazil

Ranking of installed capacity (GW)





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# Brief Introduction of TGP

- **Mission of TGP**

- TGP is the Crucial Project in Yangtze River regulation and development
- Comprehensive benefits of Flood control, Power generation, **Navigation**, Water regulation, Energy-saving and emission-reduction



- **4 Main Financing sources of TGP**

- Revenue from Gezhouba HPP
- TGP fund collected through end-consumer tariff
- Financing from Chinese development bank
- After start of operation, revenue of TGP also support the construction of the project.

# Brief Introduction of TGP

- River Basin Complexes Administration

Xiangjiaba Project  
6.4GW



Three Gorges Project  
22.5GW



Xiluodu Project  
13.86GW



Wudongde Project  
10.2GW



Baihetan Project  
1.6GW



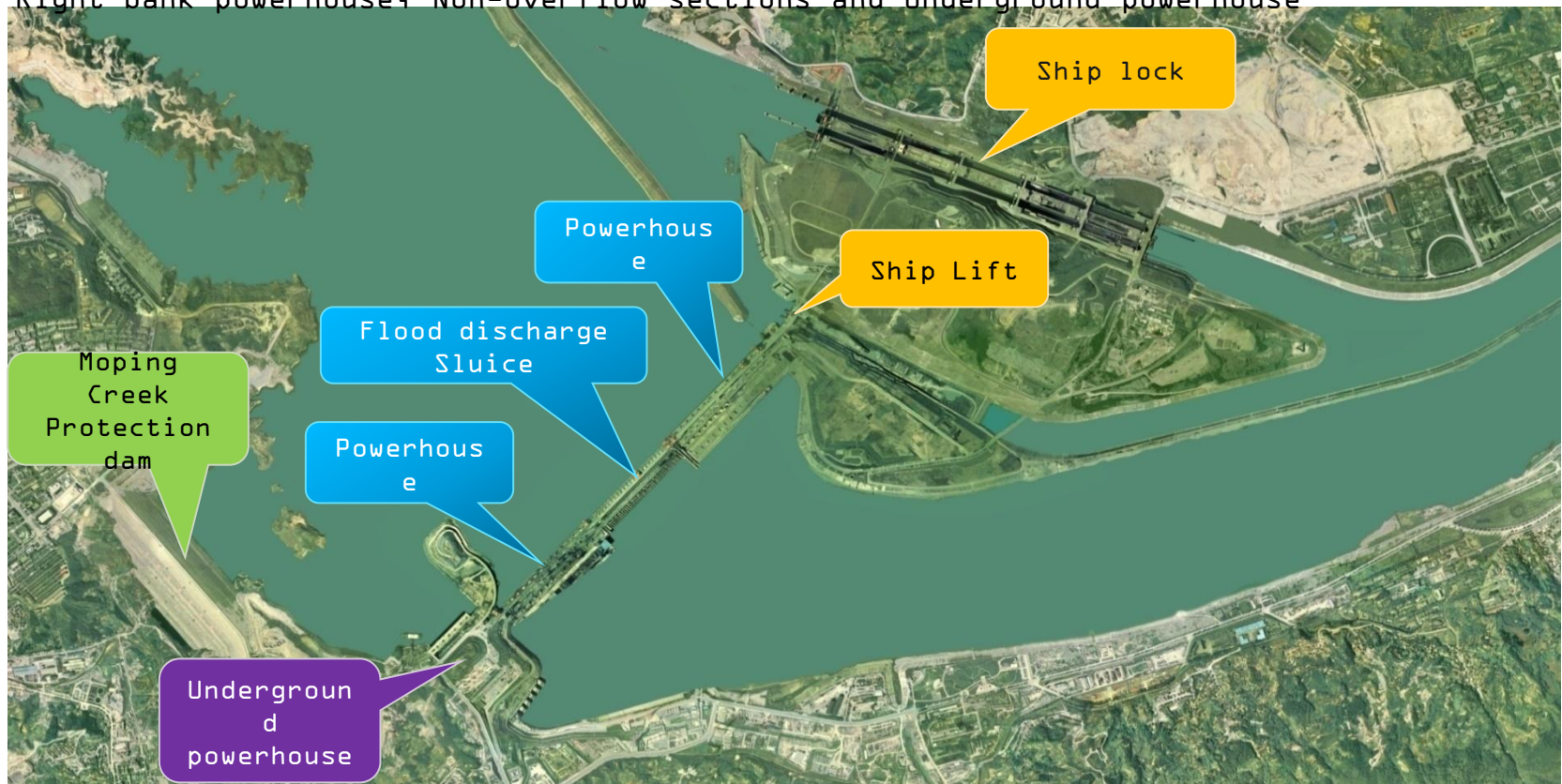
Gezhouba Project  
2.72GW



# Brief Introduction of TGP

- **Layout of TGP**

Three Gorges Project is located in Sandouping County, lower reach of Xilin Gorge of Yangtze river. From left bank to right bank: Ship lock, Ship lift, Non-overflow sections, Power supply station, Left bank powerhouse, Flood discharge sections, Right bank powerhouse, Non-overflow sections and Underground powerhouse





# Brief Introduction of TGP

- Rational to have Navigation Function

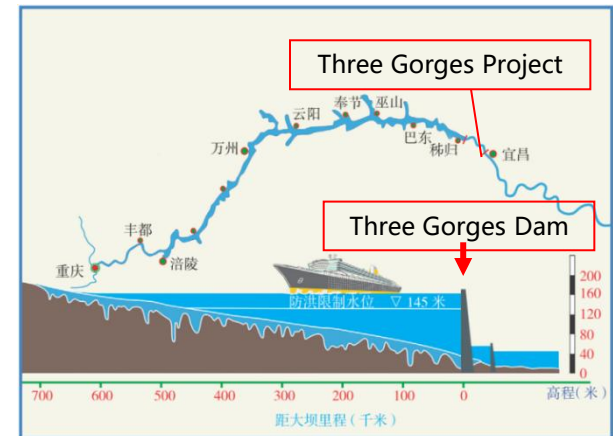


Yangtze river has always played an important role between southeast coast and southwest basin of China. As the economic belt, Yangtze river navigation contributes a lot to the local GDP. Therefore, the navigation function is considered as part of the project since the designing phase.

# Brief Introduction of TGP

- **Navigation benefits**

- Navigation condition of the 660km waterway from Chongqing to Yichang was greatly improved, and fleet of 10,000t can reach Chongqing directly
- Navigation condition of the middle and lower reaches of Yangzi River in dry-season was effectively improved
- Prompted standardization and large-sized development of ship types. Shipping efficiency was improved, and transportation cost was reduced

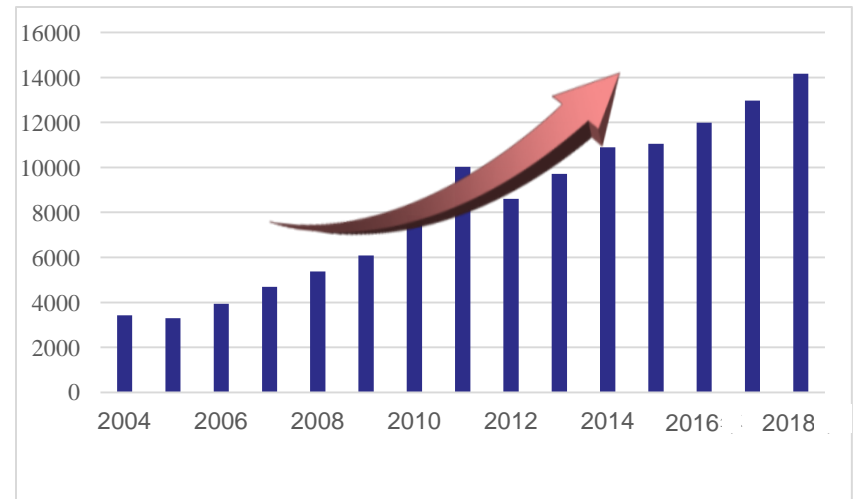


# Brief Introduction of TGP

- **Navigation benefits**

➤ The freight volume through the ship lock increased from less than 20 million tons in 2003 to 100 million tons in 2011, reached to the planned freight volume level of 2030, 19 years in advance

➤ The freight volume through the ship lock in 2018 was 142 million tons with an one-way freight volume of 81 million tons, which far exceeded the planned one-way freight volume of 50 million tons



Freight volume through the ship lock from 2004 to 2018



# Brief Introduction of TGP

- **Navigation benefits**

- The main products that are transported through Yangtze river navigation system are ore, coal, concrete, steel, containers, etc. Tourism boats are also passing through the ship locks.

- The waterway transportation is much cheaper than railway (1/8

- The direct contribution of TGP to Chongqing city is 1.77%, the cost of highway and air transportation contribution reached 29.58% during the years of 2003-2010.

- The estimated economic benefit of Three Gorges navigation system from 2003 to 2013 is around BRL 4.78 bn. (BRL/CNY=1.8)



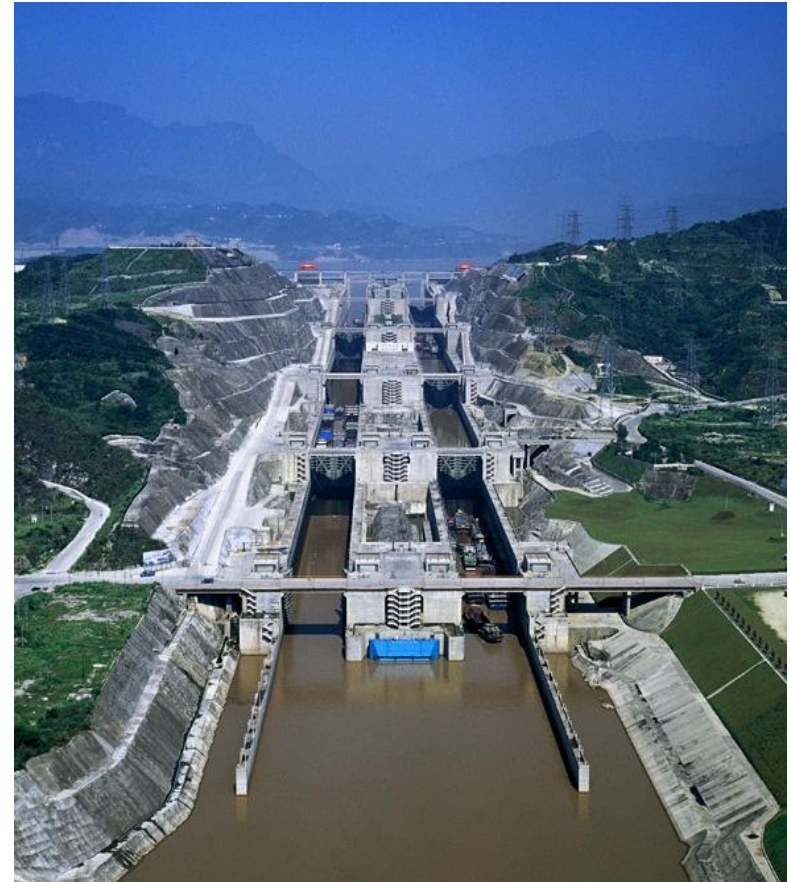
# Brief Introduction of TGP

- Achievements in navigation techniques

- The ship lock of TGP has been operating safely for 16 years, with 24 hours running a day under normal circumstances and an average annual navigation rate up to 94%

- The ship lift of TGP has been operating for more than two years, and the civil structures, equipments and facilities are all running normally

- Successful construction of the ship lock and the ship





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# Ship lock of TGP

- Characteristics of the ship lock in TGP

- Operating water head : 113m
- High navigation standard: in the discharge condition of  $56,700\text{m}^3/\text{s}$ , 10,000t fleet pass safely
- Difficulties: Deep excavation ( 170~200m), Short construction period





# Ship lock of TGP

- Overall layout

Of the 2 lines 5 stages, 6 lock heads and 5 lock chambers in each line. Main structure length 1,621m, Upstream approach channel length 2,113m, Downstream approach channel length 2,722m.



Scale: 280×34×5.0

# Ship lock of TGP

- **Measures of potential tapping**

- **Raise standards of the ship lock navigation standard**

The maximum draft standard for ships increased from 3.2m to 4.3m

- **Determine the towing standard of ships for different types of ships, different host powers, and different discharge flow levels**

- **Optimize ship lock operation and gate dispatching process**





# Ship lock of TGP

- **Measures of potential tapping**

- **Shorten the ship's crossing time**

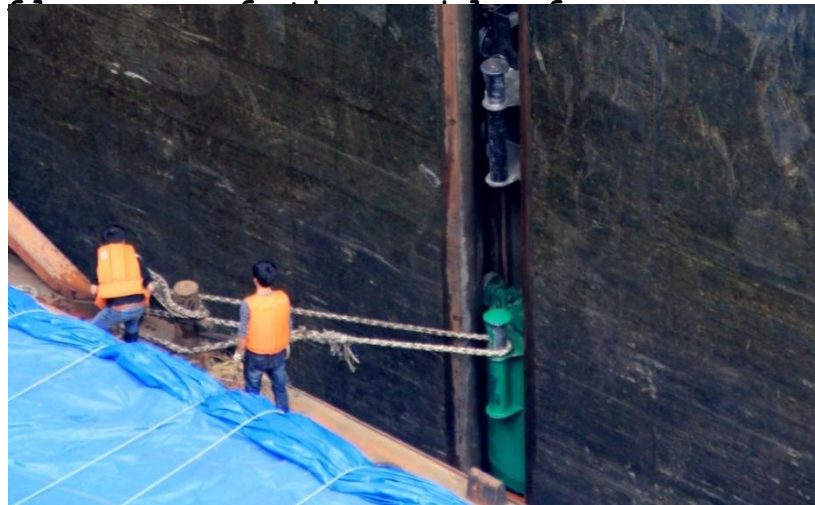
- Optimize equipment operating parameters

- Study the precise docking of ships and reduce the impact of human factors

- **Transform equipment to accommodate large ships**

- Develop a new floating bollard

- Review the infrastructure



# Ship lock of TGP

- **Overhaul**

- **Rotation maintenance**

Purchasing spare parts and replacing them in turn



- **Planned overhaul**

In the first stage (2012, 2013), inspection and repair of hydraulic defects

In the second stage (2015, 2017, 2018), repair of miter gate. For example, replace the seal of top and bottom hinges of miter gates

In the third stage (2018, 2020), repair of suspender of conveyance water lock



# Ship lock of TGP

- Overhaul

- Planned overhaul

	2012	2013	2015	2017	2018
overhaul period (days)	20	20	20	40	33
water filling and emptying system (m <sup>2</sup> )	496.8	596.6	193.06	192.24	112.92
No. of miter gate repaired	2	2	6	8	4
No. of repaired suspender of conveyance water lock	—	—	—	4	8



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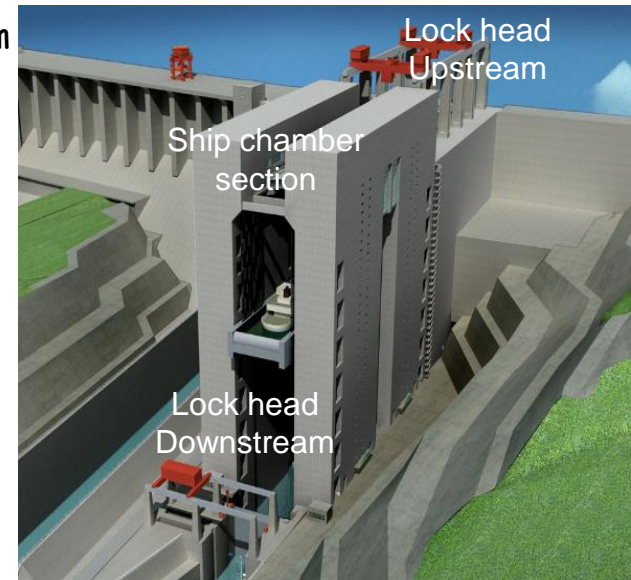
# Ship lift of TGP

➤ The TGP ship lift is one of the permanent navigation facilities, working with double-line 5-step ship lock, playing the role of fast passage for passenger ships and special vessels. It has ship tonnage of 3,000 tons, the max. lifting height of 113 m. The fluctuation of water level upstream is 30 m and fluctuation downstream is 11.8 m. The variability of water level downstream

➤ Ship lift consists of upstream approach waterway, the upper lock head, the ship container section, the lower lock head and downstream approach waterway

Scale: : 120 × 18 × 3.5m

total weight : 15,500t





# Ship lift of TGP

- construction and operation



Tower column of ship  
container





# Ship lift of TGP

- construction and operation



Pre-assembly of ship  
container  
(in segments) in the factory



Site assembly of  
ship container

# Ship lift of TGP

- construction and operation



Container of ship lift after completion

Ship lift after completion



# Ship lift of TGP

- construction and operation



Leaving the container  
for downstream channel

Leaving the container  
for  
upstream channel



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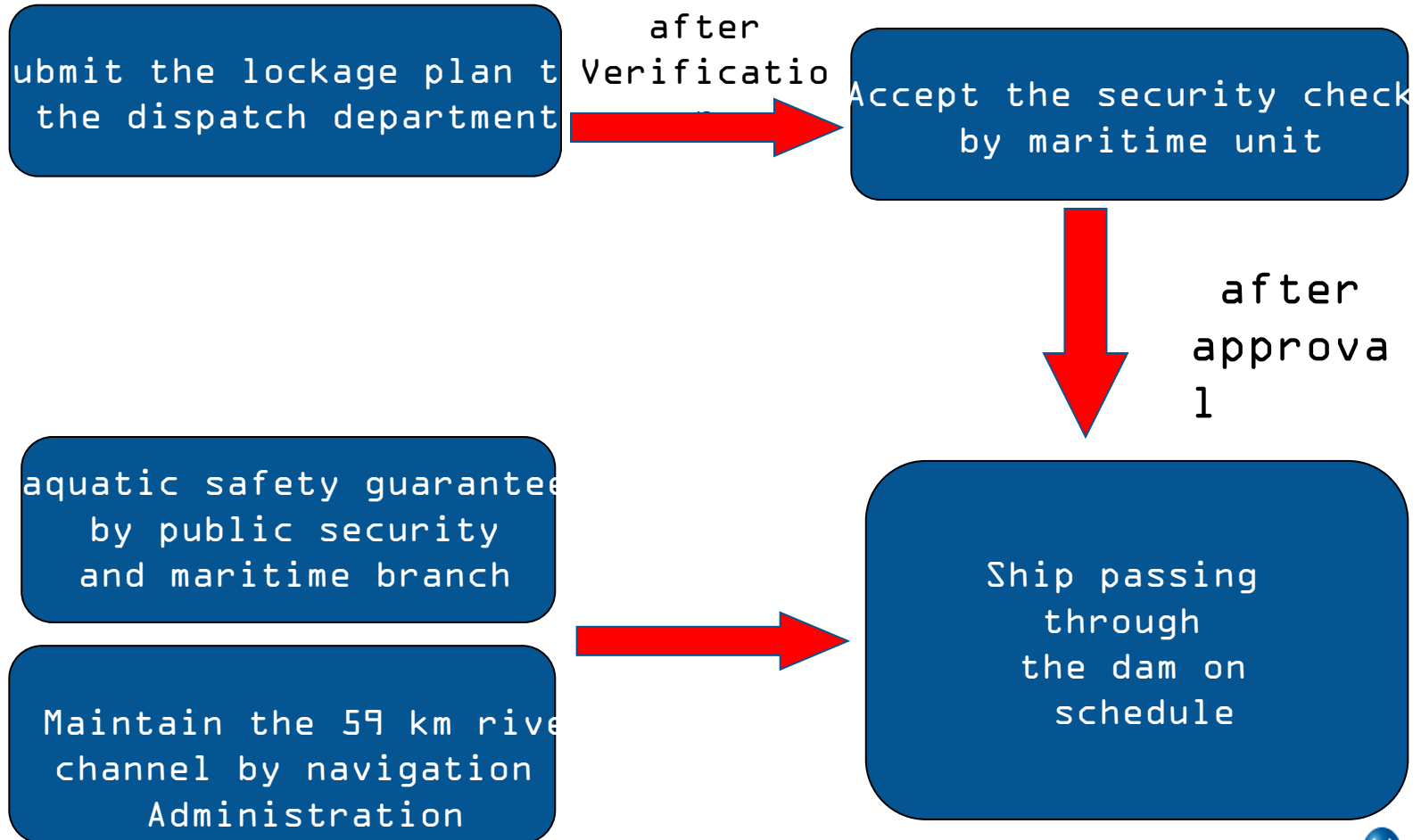
Ship Lift of TGP

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Navigation Management

# Navigation Management

- Flow chart of ship passing through the dam





# Navigation Management

- **The innovative modern dispatching and command system**  
Dealing with lockage application based on the dispatch regulation, work out and adjust the lockage plans  
According to the distance between the ship and the dam, remote declaration
- **Law enforcement by maritime unit**  
In charge of navigation order in the area under administration and surveillance on /under water engineering





Obrigado!

Thanks!

谢谢!