

Context

Background

The Three Gorges Project (TGP) on the Yangtze River in Hubei province, China is the world's largest hydropower project. The idea for the TGP was first discussed in the 1920s by the Chinese Nationalist Party, but its construction did not start until 1994 due to the enormous scale of the project and surrounding controversy.



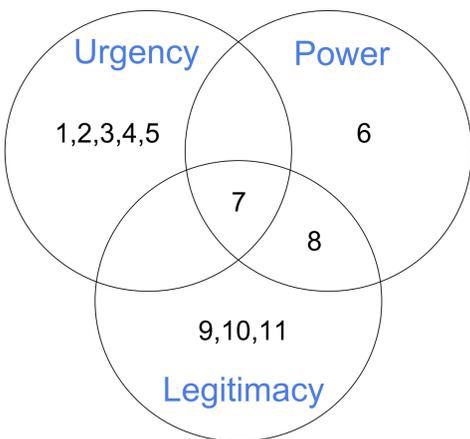
Controversy

The World Bank and other international organizations refused to fund the dam because of environmental, safety, and equity concerns. The dam has caused frequent landslides and severe downstream droughts. An estimated 1.4 million people were displaced due to the flooding to fill the reservoir. Due to corruption, there was an inequitable distribution of relocation spending.

Problem Statement

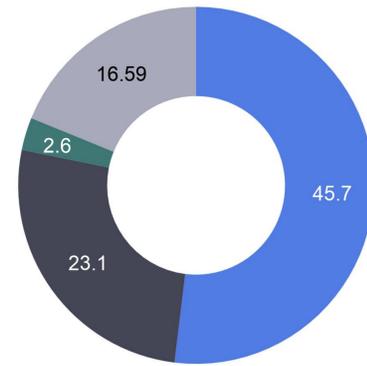
Did costs of the TGP outweigh benefits when considering environmental, social and economic factors? Is there a preferred alternative to the TGP?

Stakeholders



1. Construction workers
2. Fishermen
3. Downstream residents
4. General Chinese population
5. Displaced persons
6. Shipping industry
7. Three Gorges Corporation
8. Environmental, archaeological, and human rights groups
9. World Bank
10. Research institutions
11. Yangtze Valley Planning Office

Financial Analysis



(values in US\$ billions)

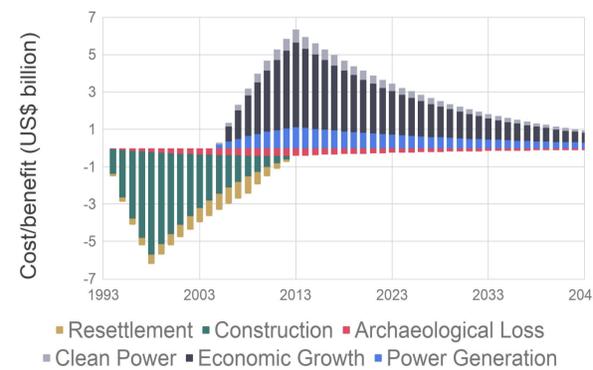
- TGP Construction Fund
- Power Revenue
- Domestic Loans
- International Export Credit and Loans

Construction Funding Sources

- Domestic sources comprised the majority of funding
- TGP Construction Fund was established by the Chinese government
- A levy on electricity use during project construction generated nearly 25% of the funding

TGP Cash Flow Diagram

- Construction costs ended when installation of turbines finished in 2013
- Construction accounts for \$50 billion in costs
- \$82 billion in economic growth (e.g. job creation) was generated



Solar Farm: A More Sustainable Alternative

- A solar farm would have a higher initial capital costs, but benefits would be felt sooner
- Solar farms would also incur much lower resettlement and archaeological costs

Uncertainties

Measurement uncertainty

Project lifespan

- Challenging to predict lifespan, as it is dependent on hydropower continuing to be economically favorable, the dam's resiliency, proper O&M, etc.

Valuation of social impact

- Valuation of displacement, archaeological sites, and environmental degradation is challenging to quantify, and most were excluded in TGP assessments

Future uncertainty

Energy demand

- Future Chinese energy demand may lead to higher or lower energy revenue than predicted

Displacement

- The extent of flooding was uncertain prior to construction, so displacement costs were unknown
- Informal settlements were difficult to account for in displacement analysis

Climate change

- Challenging to predict changes in climate, which alter river flow and benefits from energy generation

Conclusion

Accounting for social and environmental factors indicates that the benefits of the TGP still outweigh the costs. However, an equivalent solar farm would have lower social and environmental costs, and is a more economically favorable alternative.

Metric	TGP	Solar
NPV (US\$ bil)	60.48	219.26
BCR	1.83	7.41
IRR (%)	9	33
Breakeven yr	2020	1998

Sources

- <https://www.britannica.com/topic/Three-Gorges-Dam>
- <https://www.internationalrivers.org/campaigns/three-gorges-dam>
- <https://www.tandfonline.com/doi/pdf/10.3152/147154604781765888>
- <http://siteresources.worldbank.org/INTENERGY2/Resources/Tang.pdf>
- <http://publications.lib.chalmers.se/records/fulltext/218869/218869.pdf>

1920s

Chinese Nationalist Party leaders begin discussing the TGP

1953

Mao Zedong orders site feasibility studies

1992

National People's Congress ratifies decision to build dam

1994

Construction commences

2006

Construction completed

2012

All 32 turbine generator units operational