The Lower Yarlung Tsangpo Hydropower Project Is a Product of Extreme Nationalism (Part II)

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Published on January 27, 2025, by Radio France Internationale - China

The project's power generation is unlikely to surpass the Three Gorges Dam by more than threefold or exceed the proposed Grand Inga Dam.

In my previous article, I pointed out that the primary purpose of building the Lower Yarlung Tsangpo Hydropower Project is to surpass Africa's Grand Inga Dam and maintain China's position as the global leader in hydropower projects.

On December 25, 2024, Xinhua News Agency reported that "the Chinese government has recently approved the Lower Yarlung Tsangpo Hydropower Project," but the announcement contained no economic or technical details. Following this news, domestic and international media widely reported on the upcoming world's largest hydropower project, claiming that its installed capacity and average annual power generation would be more than three times that of the Three Gorges Dam, securing its place as the world's number one hydropower project.

This article analyzes the potential maximum installed capacity and annual power generation of the Lower Yarlung Tsangpo Hydropower Project based on the river's hydropower resources. The conclusion reached is that the project's average annual power generation will likely fall short of being more than three times that of the Three Gorges Dam and may also fail to surpass the planned Grand Inga Dam.

Tibetan Yarlung Tsangpo Grand Canyon. Image source: Internet.

1. A Globally Shocking Hydropower Project on the Lower Yarlung Tsangpo River Without Any Officially Disclosed Economic or Technical Data

On December 25, 2024, Xinhua News Agency released a report[1] stating that, "Recently, the Chinese government has approved the Lower Yarlung Tsangpo Hydropower Project." However, in this report, which spans over 400 words, there is not a single piece of economic or technical information. To provide readers with a full picture, the remaining content of the report is documented below:

> "The Lower Yarlung Tsangpo Hydropower Project will play an active role in accelerating the establishment of a new development framework and promoting high-quality development. It holds great significance in advancing the 'dual carbon' strategy and addressing global climate change.

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[1] "Lower Yarlung Tsangpo Hydropower Project Approved," December 25, 2024, Xinhua News Agency, http://www.news.cn/politics/20241225/b61f14cad5c046a0a209bf36fa99d69b/c.html

> The Lower Yarlung Tsangpo Hydropower Project is a green initiative driving low-carbon development. It harnesses the abundant hydropower resources of the Yarlung Tsangpo River, facilitating the development of nearby solar and wind energy resources to create an integrated water-wind-solar clean energy base. This represents a major step in China's transition to green and low-carbon energy.
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> The Lower Yarlung Tsangpo Hydropower Project is a livelihood project aimed at prosperity and stability in Tibet. Its construction will directly boost industries such as infrastructure development, logistics, and commercial services, generating new job opportunities. Once completed, the project will enhance the region's power, water, and transportation infrastructure, strengthening Tibet's integration with other regions and bringing a greater sense of fulfillment, happiness, and security to local communities.
>
> The Lower Yarlung Tsangpo Hydropower Project prioritizes ecological protection and safety. Through extensive geological surveys and technological advancements, a solid foundation has been established for its scientific, safe, and high-quality development. The project will also serve as a platform to improve local ecological monitoring systems, ensuring targeted development while maintaining broader environmental protection, thereby fostering harmonious coexistence between humans and nature."

The tone of this Xinhua report closely resembles Xi Jinping's style of speeches, full of grandiose rhetoric and newly created terms but devoid of substantive information—especially economic and technical details.

The report omits all essential economic and technical details of the Lower Yarlung Tsangpo Hydropower Project, including its official name, dam site location, height, type, reservoir capacity, water storage level, and overall project scale (installed capacity and annual power generation). It also lacks information on the project's water diversion and power generation methods, the extent of the reservoir's inundation, the number of displaced residents, total investment, funding sources, construction companies involved, start date, and expected construction timeline. Additionally, there is no disclosure of key assessment reports, such as the feasibility study and environmental impact assessment (EIA), nor any mention of

their authors or reviewers. In short, the report completely lacks the fundamental data that should be provided for any major hydropower project.

2. The Reality May Be Harsh

The Xinhua report has sparked numerous domestic and international discussions, some of which contain unverified data not confirmed by Chinese authorities:

- Dam site: Pai Town, Milin County, Nyingchi City, Tibet Autonomous Region
- Installed capacity: 60–70 GW, more than three times that of the Three Gorges Dam
- Annual power generation: 300 TWh, more than three times that of the Three Gorges Dam
- Investment cost: 1 trillion RMB
- Electricity supply: Capable of meeting the needs of 300 million people

While aspirations are often ambitious, reality tends to be far less promising. Given geographical constraints and other limiting factors, the claim that the Yarlung Tsangpo downstream hydropower project will generate 300 TWh annually—more than three times that of the Three Gorges Dam—is likely based on miscalculations that could ultimately disappoint many in China.

The discussion in this article will be broken down into four key questions:

1. Hydropower resources and the hydropower potential of the lower Yarlung Tsangpo River;
2. Regional distribution of the lower Yarlung Tsangpo's hydropower resources;
3. The dam site and the diversion-based power generation method;
4. Mean annual runoff, hydraulic head at the dam site, and the project's installed capacity and power generation potential.

3. Hydropower Resources and the Hydropower Potential of the Lower Yarlung Tsangpo River

Hydropower resources, previously referred to as hydraulic or hydroelectric resources, are further categorized into theoretical potential, technically exploitable potential, and economically exploitable potential.

According to the 2000 edition of *World Rivers and Dams*, edited by Zhao Chunhou, Zhu Zhenhong, and Zhou Duanzhuang[2] the Yarlung Tsangpo River possesses abundant hydropower resources. The theoretical hydropower potential of the entire basin is 113.5 GW, with the mainstream accounting for 79.1 GW, approximately 70% of the total, while tributaries contribute 34.4 GW, making up 30%. The initially planned exploitable capacity of the entire basin is 47.4 GW, of which the mainstream accounts for 46.4 GW (95%), while tributaries contribute only 1 GW (5%). The book further states that the theoretical potential of the lower mainstream segment alone is 68.81 GW, representing 87.0% of the total theoretical capacity of the Yarlung Tsangpo's mainstem.

Author's Commentary:
The Yarlung Tsangpo's mainstream has a theoretical hydropower potential of 79.1 GW, with its lower segment alone contributing 68.81 GW. The planned exploitable capacity for the mainstream is 46.4 GW, which effectively sets an upper limit on the scale of the Lower Yarlung Tsangpo Hydropower Project.

On November 28, 2005, China's National Development and Reform Commission (NDRC) released the *National Hydropower Resource Reassessment Results*.[3] This reassessment reviewed 3,886 rivers on the Chinese mainland with a theoretical hydropower potential of 10 MW or more. The results indicate:

- Total national theoretical hydropower potential: 694.4 GW

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[2] Zhao Chunhou, Zhu Zhenhong, and Zhou Duanzhuang (Eds.), *World Rivers and Dams,* China Water & Power Press, Beijing, 2000.
[3] "National Hydropower Resource Survey Results Released," November 28, 2005, Source: National Development and Reform Commission, published on the Central People's Government website, https://www.gov.cn/ztzl/2005-11/28/content_110675.htm

- Technically exploitable installed capacity: 541.64 GW
- Economically exploitable installed capacity: 401.8 GW

Among China's river basins, the top three in terms of technically exploitable hydropower capacity were:

1. Yangtze River Basin: 256.27 GW (accounting for 47% of the national total).
2. Yarlung Tsangpo River Basin: 67.85 GW (13% of the national total).
3. Yellow River Basin: 37.34 GW (7% of the national total).

Author's Commentary:

The National Hydropower Resource Review *indicates that China's theoretical hydropower potential is 694.4 million kW, with a technically exploitable installed capacity of 541.64 million kW and an economically exploitable installed capacity of 401.8 million kW. This means that only 78% of the theoretical capacity is technically feasible, while the economically viable portion is even lower, at just 58%. The review also states that the technically exploitable capacity of the Yarlung Tsangpo River Basin is 67.85 million kW, which represents a significant increase compared to the World Rivers and Dams estimate of 47.4 million kW for potentially exploitable hydropower in the basin.*

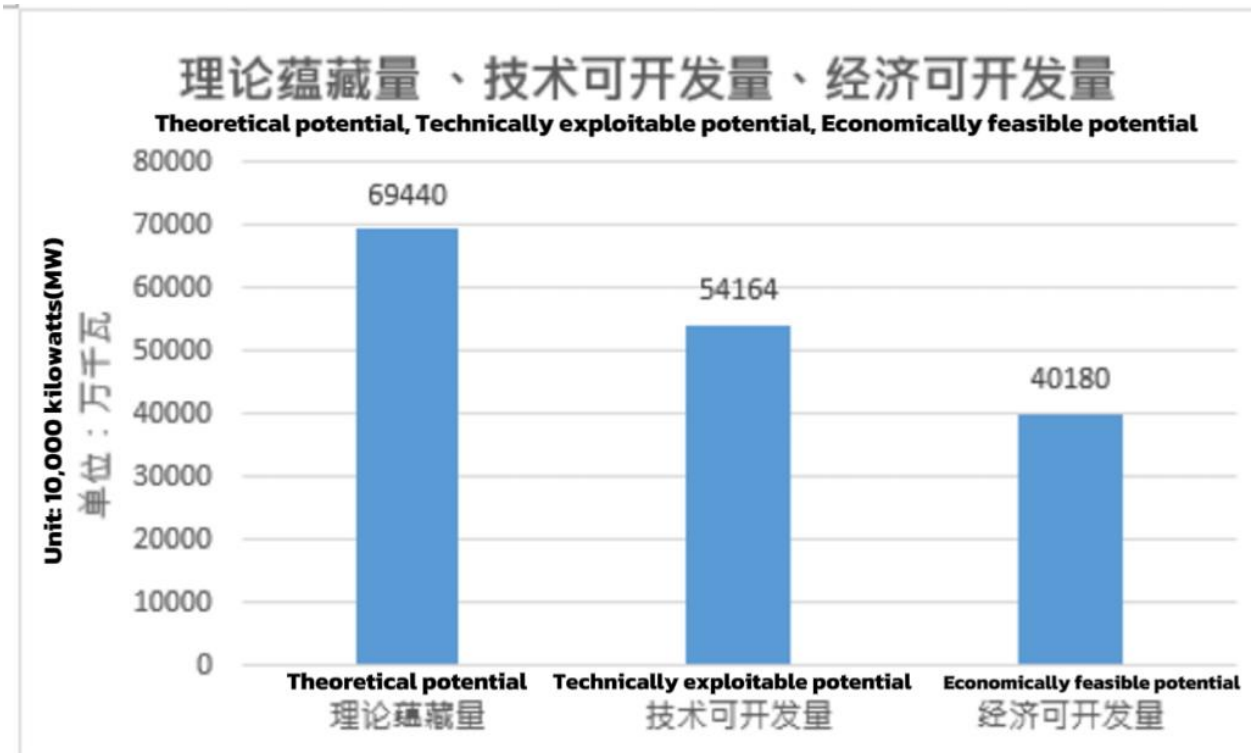

Figure 1

According to the *National Hydropower Resource Reassessment Results*, China's total theoretical hydropower potential is 694.4 GW (100%), with a technically exploitable installed capacity of 541.64 GW (78%) and an economically exploitable installed capacity of 401.8 GW (58%). Image source: Internet.

On August 14, 2010, the Tibet Autonomous Region Department of Natural Resources released *Water Resources in Tibet,*[4] stating that Tibet's theoretical hydropower potential is 201 million kW, accounting for 15.83% of China's total theoretical hydropower resources. The technically exploitable hydropower capacity in Tibet is 56.6 million kW, making up 17.1% of the nation's exploitable hydropower resources, ranking first nationwide.

The Yarlung Tsangpo River is the most hydropower-rich river in Tibet, with a theoretical potential of 113 million kW, representing 56.22% of the region's total theoretical hydropower reserves. Of this, 48.37 million kW is considered exploitable, accounting for over 80% of Tibet's total exploitable hydropower capacity. The report also highlights that the deep gorges along the Yarlung Tsangpo provide favorable conditions for dam construction and floodwater storage.

Author's Commentary

According to data from the Tibet Autonomous Region Department of Natural Resources, Tibet's theoretical hydropower potential is 201 GW, accounting for 15.83% of China's total. This suggests that China's national theoretical hydropower potential is approximately 1.27 TW, a significant increase compared to the 694.4 GWreported in the 2005 National Hydropower Resource Reassessment. However, the 2005 assessment only covered 3,886 major rivers and did not account for all water bodies, reflecting the inconsistencies in China's hydropower surveys, where each assessment differs in definitions and scope, making direct comparisons difficult.

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[4] "Tibet's Water Resources," August 14, 2010, published on the Tibet Autonomous Region Natural Resources Department website, http://zrzyt.xizang.gov.cn/dt/xzzrzygk/201907/t20190731_90650.html

The theoretical potential of the Yarlung Tsangpo River is 113 GW, which is essentially consistent with the 113.5 GW reported in World Rivers and Dams. Meanwhile, the technically exploitable hydropower capacity of the Yarlung Tsangpo River is 48.37 GW, which is significantly lower than the 67.85 GW reported in the 2005 reassessment, but very close to the 47.4 GW estimate in World Rivers and Dams.

By the time of the *13th Five-Year Plan*, China stopped distinguishing between technically and economically exploitable hydropower capacity. One possible reason for this shift is that China's installed hydropower capacity had already reached 352 GW, with an annual power generation of 1,232.9 TWh. This figure was not far from the 541.64 GW technically exploitable capacity and 2,474 TWh annual power generation reported in the 2005 National Hydropower Resource Reassessment, and even closer to the 401.8 GW economically exploitable capacity and 1,753.4 TWh annual power generation. As a result, China's future hydropower development potential has become increasingly limited.

Although China no longer differentiates theoretical, technically exploitable, and economically exploitable hydropower potential in official reports, technical and economic feasibility constraints still exist. Take the Yangtze River, for example: despite having remaining hydropower potential between Yichang and Shanghai, it lacks both technical and economic feasibility for development.

According to statistics cited by *The Paper*:[5]

China's hydropower potential exceeds 676 million kW, ranking first globally. Tibet's theoretical hydropower potential is estimated at over 200 million kW, accounting for 30% of the national total, making it the most hydropower-rich region among all provinces and autonomous regions. Tibet's hydropower resources are mainly concentrated along the mainstreams of the Yarlung Tsangpo River, Nu River, Lancang River, and Jinsha River.

Among them, the Yarlung Tsangpo River has the highest hydropower potential, with a theoretical capacity of nearly 80 million kW. The river's Great Bend region

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[5] "Lower Yarlung Tsangpo Hydropower Development Approved: Equivalent to Three Three Gorges Dams," November 28, 2020, The Paper, https://m.thepaper.cn/kuaibao_detail.jsp?contid=10182146&from=kuaibao

is described as the "world's most hydropower-rich area." Within a straight-line distance of 50 km, the river drops by 2,000 meters, creating an estimated 70 million kW of technically exploitable hydropower resources—equivalent to the capacity of more than three Three Gorges Dams (each with an installed capacity of 22.5 million kW).

Author's Commentary

The data cited by The Paper presents an inconsistency: it states that the Yarlung Tsangpo River's mainstream has a theoretical hydropower potential of nearly 80 million kW, while simultaneously claiming that the Great Bend region alone contains nearly 70 million kW of technically exploitable resources, equivalent to over three Three Gorges Dams. These figures contradict each other.

According to World Rivers and Dams, edited by Zhao Chunhou et al., the theoretical hydropower potential of the Yarlung Tsangpo mainstream is 79.116 million kW, which aligns with the "nearly 80 million kW" figure cited in The Paper. The hydropower potential is distributed among the river's sections as follows: the upper reaches contribute only 0.1%, the middle reaches 12.9%, and the lower reaches 87.0%. The lower mainstream of the Yarlung Tsangpo alone accounts for 68.807 million kW, which corresponds to the "nearly 70 million kW" cited in The Paper. However, this is still theoretical hydropower potential—not the technically or economically exploitable capacity.

Following the 13th Five-Year Plan, China's official reports now only disclose theoretical hydropower potential, without differentiating between theoretical, economically exploitable, or technically feasible capacity.

On November 26, 2020, Yan Zhiyong, former Chairman and Party Secretary of China Power Construction Group Co., Ltd., stated at the 40th anniversary of the China Society for Hydropower Engineering:[6]

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[6] "Breaking News: Lower Yarlung Tsangpo Hydropower Development Approved, Capacity Close to 60 GW, Equivalent to 'Three Three Gorges Dams,'" November 28, 2020, Source: *China Energy News,* published on *Sina*, https://finance.sina.cn/2020-11-28/detail-iiznctke3684513.d.html

“The lower Yarlung Tsangpo contains nearly 60 GW of exploitable hydropower, which could generate nearly 300 TWh of clean, renewable, zero-carbon electricity annually.”

Author’s Commentary

Yan Zhiyong claims that the lower Yarlung Tsangpo has nearly 60 million kW of exploitable hydropower capacity, with an annual electricity generation of nearly 300 billion kWh. Meanwhile, The Paper cites data stating that the lower Yarlung Tsangpo contains nearly 70 million kW of technically exploitable hydropower resources, equivalent to more than three Three Gorges Dams (which has an installed capacity of 22.5 million kW). This forms the widely accepted description of the Lower Yarlung Tsangpo Hydropower Project: an installed capacity ranging from 60 to 70 million kW—more than three times that of the Three Gorges Dam—with an annual power output of 300 billion kWh, also more than three times that of Three Gorges. The Lower Yarlung Tsangpo Hydropower Project is thus considered the equivalent of “three-plus” Three Gorges Dams.

However, this widely circulated claim is based on the theoretical hydropower potential of the lower Yarlung Tsangpo—not on the technically exploitable or economically viable capacity. In real-world applications, the actual effective generating capacity of a hydropower station can never fully reach its theoretical hydropower potential, as this is only the maximum possible value in theory.

4. Distribution of Hydropower Resources in the Lower Yarlung Tsangpo

A major issue in the planning of the Lower Yarlung Tsangpo Hydropower Project is: How should the distribution of hydropower resources be calculated in this region? Specifically, how should the portion of hydropower resources located in the Chinese-administered area of southern Tibet—or what India calls Arunachal Pradesh—be accounted for?

Figure 2: The red-marked area represents the disputed region between China and India. This article focuses on the eastern section of this disputed area. (Image Source: Internet).

According to Chinese sources,[7] the Yarlung Tsangpo lies entirely within China, traversing the southern Tibetan Plateau. The river's mainstream stretches 2,070 km (some sources state 2,057.2 km). It is divided into three sections:

- The upper course runs from its source to Lizi, spanning 270 km (or 267.5 km in some records).
- The middle course extends from Lizi to Pai, covering 1,300 km (or 1,293.4 km).
- The lower course stretches from Pai to Pasighat, measuring 500 km (or 496.3 km).
  At Pasighat, where the river exits China, its average annual discharge is 165.4 billion cubic meters.

By contrast, Indian sources[8] claim that the Yarlung Tsangpo originates from Lake Manasarovar, flows approximately 1,600 km through Tibet, then bends southeastward near Namcha Barwa before entering India's Arunachal Pradesh at Gelling—where it is known as the Siang River. Within Arunachal Pradesh, it flows through three districts—Siang, Upper Siang, and East Siang—for nearly 300 km before entering Assam, where it becomes the Brahmaputra River.

[Ed. Part of the Yarlung Tsangpo River runs through an area that is disputed territory. The Chinese description of the location of the river differs from the Indian description of the location of the river because of the Sino-Indian border dispute. According to the Chinese, the Yarlung Tsangpo lies entirely within China because China claims most of the Indian state of Arunachal Pradesh, calling it "South Tibet" (Zang Nan in Chinese). In fact, this area is south of the McMahon Line and is currently claimed and controlled by India (see the map below). This region was recognized by Tibet as belonging to British India under the McMahon Line Agreement (part of the 1914 Simla Convention). Though China does not recognize the McMahon Line and claims that the area is a part of the Tibet

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[7] Zhao Chunhou, Zhu Zhenhong, and Zhou Duanzhuang (Eds.), *World Rivers and Dams,* China Water & Power Press, Beijing, 2000. *(Note: The data on the distribution of hydropower resources in the Yarlung Tsangpo in this book slightly differs from that in the article.)*

[8] Brahma Chellaney, *"China Quietly Building a Massive Dam on the Yarlung Tsangpo; India Considers Countermeasures,"* September 13, 2023, Source: *The Times of India* and *Nikkei Asia,* published on *Sanxia Tansuo*, http://www.sanxiatansuo.com/index.html?index=view&vid=10185

Autonomous Region, it does not, in fact, occupy it. India does. This is important, because China assumes in its calculations that it will be able to harness hydropower capacity in the part of the river that flows through India's state of Arunachal Pradesh. Without seizing Indian territory, this is impossible, leaving China's claims of the project's power capacity a gross exaggeration.]

Image source: The Borderlens, "US Resolution on 'Arunachal Pradesh'- A Challenge to China's Claim over 'South Tibet.'"

Author's Commentary:

When India calculates the length of the Yarlung Tsangpo within Arunachal Pradesh, it does not only account for the section from Gelling to Pasighat but also includes other river segments. This is why Indian sources report the Yarlung Tsangpo's length within Arunachal Pradesh as nearly 300 km. However, if one were to calculate only the segment from Gelling to Pasighat, the length would likely be just over 200 km.

According to Xilu Military, citing Indian media sources,[9] the Yarlung Tsangpo flows 1,625 km within Tibet. Based on its total length of 2,057 km, this means that over 400 km of the river lies within Indian-controlled territory. Xilu Military also notes that the section from Pai District (elevation: over 2,900 meters) to Beibeng in Motuo County (elevation: 680 meters) spans approximately 250 km.

According to Fan Xiao's study *On the Infeasibility of Hydropower Development in the Yarlung Tsangpo Grand Canyon from a Geological Risk Perspective*,[10] the Lower Yarlung Tsangpo, from Pai Township in Milin County to Pasighat in Motuo County, covers a distance of 505 km. Meanwhile, *World Rivers and Dams*, edited by Zhao Chunhou, states that the length from Pai Township to Pasighat is 496.3 km. The discrepancy between these two figures is minimal, both being close to 500 km.

The following illustration represents a schematic map of the middle and lower Yarlung Tsangpo. The dotted line at the bottom denotes China's officially claimed border with India, while the upper dotted line represents the actual Line of Control (LAC) between China and India. The red rectangular marker indicates the location of the powerhouse for the Motuo Hydropower Project, positioned at the lowest section of the planned Lower Yarlung Tsangpo Hydropower Project. This suggests

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[9] "India Plans to Build Hydropower Stations in Southern Tibet," October 26, 2015, Source: *Xilu Military,* published on the *Guangdong Hydropower and Renewable Energy Engineering Society* website, https://gdshe.org/article/5480.html

[10] Fan Xiao, *"From a Geological Risk Perspective: Why Hydropower Development in the Yarlung Tsangpo Grand Canyon is Infeasible,"* October 18, 2022, published on *Sanxia Tansuo*, http://www.sanxiatansuo.com/index.html?index=view&vid=9482

that the Lower Yarlung Tsangpo Hydropower Project is very likely a continuation of the previously proposed Motuo Hydropower Project. Once the Yarlung Tsangpo enters Indian-controlled territory at Gelling, it meanders through Arunachal Pradesh before re-emerging at Pasighat and crossing the China-India border again.

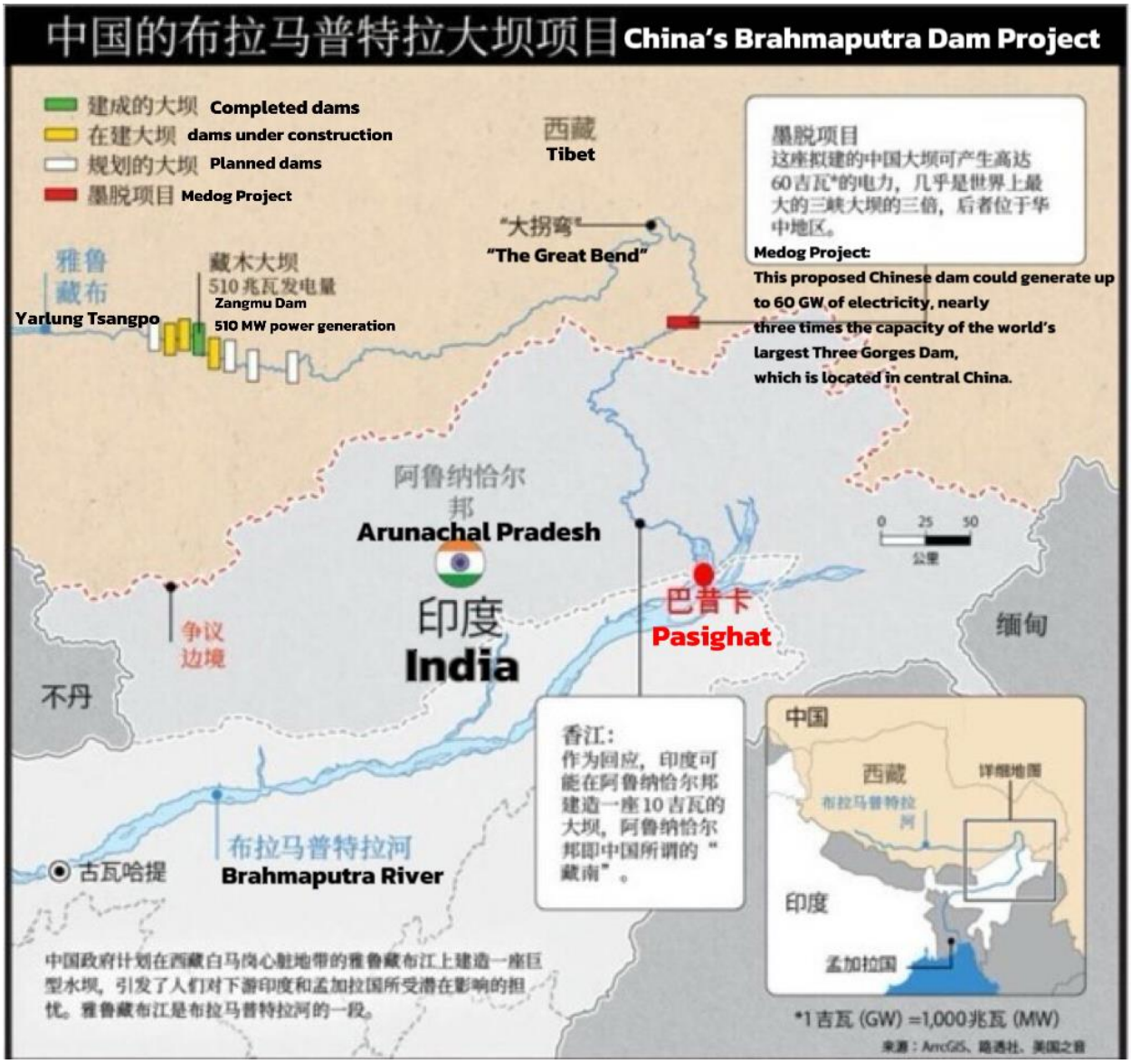

Figure 3: Schematic Map of the Middle and Lower Yarlung Tsangpo. Source: Screenshot from online sources; the location of Pasighat was added by the author.

[Ed. 1. Medog Project: This proposed Chinese dam could generate up to 60 GW of electricity, nearly three times the capacity of the world's largest Three Gorges Dam, which is located in central China.

2. In response, India may build a 10 GW dam in Arunachal Pradesh, which China refers to as "Southern Tibet."]

The lower section of the Yarlung Tsangpo spans approximately 500 km. Of this, the stretch from Pai Township to Beibeng is about 280 km. In 2006, the Director of the Yangtze River Water Resources Commission visited Beibeng Township in Motuo County and proposed that the final powerhouse of the hydropower project be constructed there. Some reports suggest that it may be built in Xirang Village instead, though the two locations are close to each other, and the difference in distance is negligible. The remaining 200 km of the river is under India's actual control, within Arunachal Pradesh. Moreover, the volume of water in the lower Yarlung Tsangpo increases progressively downstream.

The water level at Beibeng in Motuo County is approximately 680 meters above sea level, while at Pasighat, it is around 115 meters.[11] If the final turbines were to be installed at Beibeng, over 500 meters of water level drop would remain untapped.

In calculations of the hydropower potential for the lower Yarlung Tsangpo, whether the figure cited is 6,880.7 MW or nearly 7,000 MW, these estimates include the section from Pai Township in Milin County to Pasighat. However, at least 200 km of the river and over 500 meters of elevation drop lie within Indian-controlled territory and cannot be utilized.

Given this geopolitical reality, the overall scale of the Lower Yarlung Tsangpo Hydropower Project—particularly its projected annual power generation of over three times the Three Gorges Dam—may struggle to surpass the Grand Inga Dam in Africa.

5. Dam Site and Diversion-Based Power Generation

[11] "China Showcases Its Infrastructure Prowess! The Yarlung Tsangpo Hydropower Project May Exceed ¥1 Trillion in Total Investment," May 9, 2023, *Seetao*, https://www.seetao.com/details/213519.html

Chinese geologist Fan Xiao once detailed a possible design plan for the "Motuo Hydropower Station" in a dedicated article:[12]

"The proposed design involves constructing a high dam near Pai Township in Milin County to intercept the Yarlung Tsangpo. Three enormous tunnels, each with a diameter of 13 meters and a length of 34 kilometers, would be drilled through the Himalayas, diverting the river's flow away from the Great Bend of the Yarlung Tsangpo. Instead of following its natural course, the water would pass through these tunnels, utilizing a drop of 2,400 meters to generate electricity. At the downstream exit of the tunnels, on the right bank of the Yarlung Tsangpo in Motuo County, six cascading hydropower stations would be constructed. Once completed, the Motuo Hydropower Station's total installed capacity would reach 43.8 GW (with some sources suggesting 60 GW), making it the largest ultra-large-scale hydropower station in the world."

Upon completion, the river water would no longer follow its natural course through the Great Bend. Instead, it would be diverted through the massive tunnels, leveraging the 2,400-meter elevation drop created by this artificial shortcut to maximize power generation.

[Ed. This article does not use the schematic diagram included in Fan Xiao's article. Instead, it presents an alternative diagram, primarily because this illustration provides a clearer depiction of the Yarlung Tsangpo's natural course through the Great Bend.]

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[12] Fan Xiao, *"From a Geological Risk Perspective: Why Hydropower Development in the Yarlung Tsangpo Grand Canyon is Infeasible,"* October 18, 2022, published on *Sanxia Tansuo*, http://www.sanxiatansuo.com/index.html?index=view&vid=9482

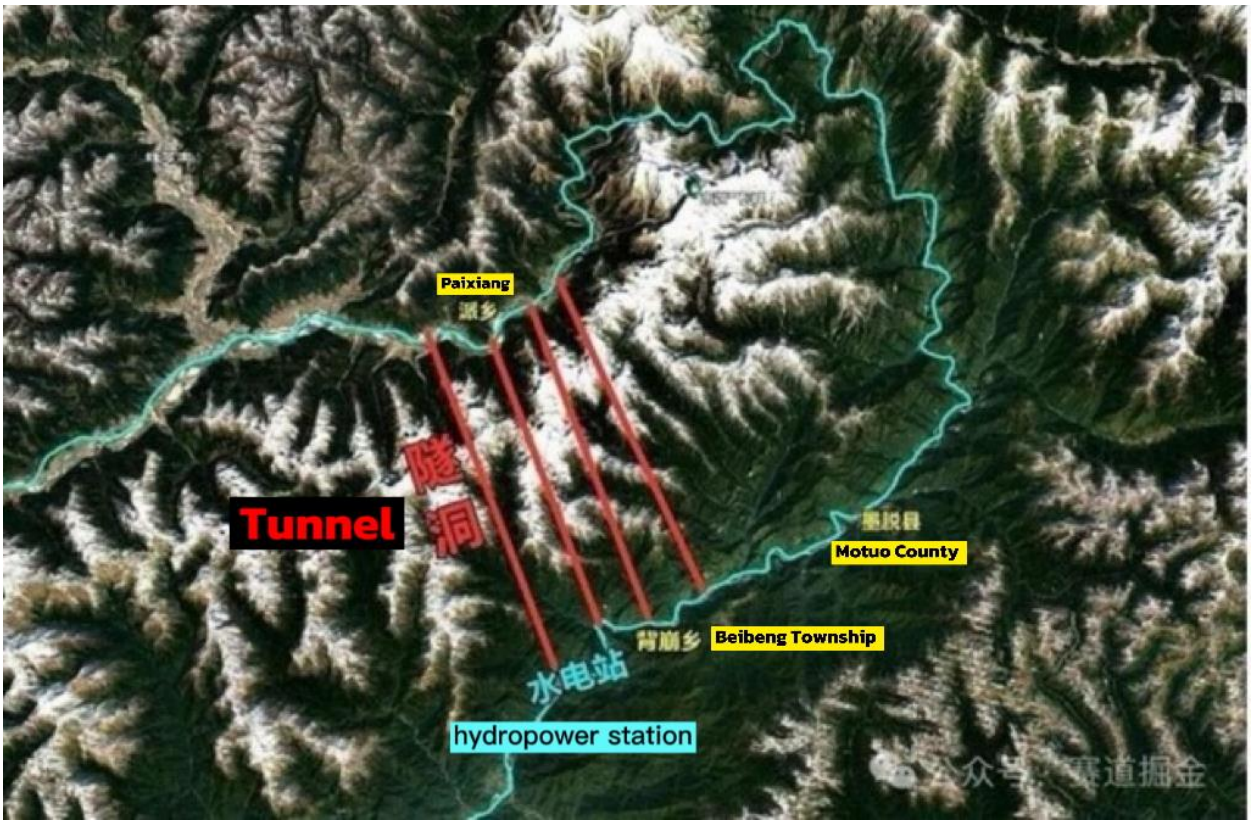

Figure 4: Possible Design Plan for the "Motuo Hydropower Station". The design may involve either three or four tunnels, but this distinction does not fundamentally impact the discussion in this article. Image Source: Internet.

The critical question: how much water will be diverted into the tunnels instead of flowing through the natural river course?

Will 100% of the Yarlung Tsangpo's water be diverted through the tunnels for power generation? Or will it be 75%? 50%? 25%?

If 100% of the river's flow is diverted into the tunnels, what will happen to the natural river course through the Great Bend, leading to Beibeng Township in Motuo? Will it dry up entirely? What will happen to the ecological environment of the Great Bend region? What about the ecosystem of the Yarlung Tsangpo Grand Canyon Nature Reserve?

If only 50% of the river's flow is diverted into the tunnels for power generation, while the other 50% continues through the natural course of the Great Bend and into Beibeng, the most immediate consequence would be that the overall scale of the Lower Yarlung Tsangpo Hydropower Project would be cut in half. In this

scenario, the project would no longer be able to fulfill its role as the "super-successor" to the Three Gorges Dam, nor would it surpass Africa's Grand Inga Hydropower Project. Consequently, China would inevitably lose its claim to the crown jewel of global hydropower engineering.

Furthermore, even if only 50% of the river's flow is diverted, there remains an unanswered question: Would this be enough to sustain the ecological integrity of the Great Bend region?

6. Average Annual Runoff, Head, Installed Capacity, and Power Generation at the Dam Site

The Yarlung Tsangpo's multi-year average runoff is 165.4 billion cubic meters, measured at Pasighat. However, the runoff at the planned dam site for the Lower Yarlung Tsangpo Hydropower Project is significantly lower, at less than 40% of this amount. If the dam site is located at Pai Township, the Nuxia Hydrological Station, which is the oldest station along the Yarlung Tsangpo's main course, has recorded a multi-year average runoff of 60.1 billion cubic meters.

According to a February 21, 2019, article published by NetEase, titled "The Motuo Hydropower Station on the Yarlung Tsangpo,"[13] the planned hydropower station spans the 260-kilometer Great Bend Gorge Section from Pai Village (District) in Milin County to Xirang Village in Motuo County. This river section has a total elevation drop of 2,350 meters, with a multi-year average flow rate of 60 billion cubic meters at Pai Township. The river bend has a straight-line distance of 35 kilometers, making it possible to construct massive water diversion tunnels. Along the Xirangqu Valley, six large hydropower stations could be arranged, each utilizing a 400-meter head. The total installed capacity would be 60,000 MW (60 GW).

[13] "What Difficulties Has the Motuo Hydropower Project on the Yarlung Tsangpo Encountered? Why Hasn't It Started Yet?" February 21, 2019, *NetEase*, https://www.163.com/dy/article/E8HMBITJ0517M80I.html

The author adopts this dataset as many reports cite these figures, but the original source is difficult to trace. Notably, the Tibetan Central Administration also uses these figures in its article, "The Atomic Bomb on the Roof of the World."[14]

The China Dam Association and the China Institute of Water Resources and Hydropower Research have published an article explaining "How Was the Installed Capacity and Power Generation of the Three Gorges Dam Calculated?"[15] Readers may refer to this article to understand the methodology, which can then be applied to estimate the potential capacity of the Lower Yarlung Tsangpo Hydropower Project.

The article explains that hydropower generation works by utilizing the head (H) to drive turbines, converting water energy into mechanical energy. If Q (flow rate in cubic meters per second) is known, the installed capacity (N) in kilowatts (kW) can be estimated using the following formula:

$N(kW)=8\times Q(\text{flow rate, } m^3/s)\times H(\text{head, m})N(kW)=8\times Q(\text{flow rate, } m^3/s)\times H(\text{head, m})$

This formula originates from the physical principle that 1 joule of energy corresponds to 1 newton of force applied over a distance of 1 meter. The gravitational force of 1 cubic meter of water is 9.8 kilonewtons. As it drops by 1 meter, it performs 9.8 kilojoules of work, which equates to a power output of 9.8 kW. Given an efficiency factor (η) of 0.8 to 0.82, the actual power output per cubic meter per second per meter of head is approximately 8 kW.

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[14] "The Atomic Bomb on the Roof of the World," published on *Tibetan Central Administration,* https://xizang-zhiye.org/%E4%B8%96%E7%95%8C%E5%B1%8B%E8%84%8A%E4%B8%8A%E7%9A%84%E5%8E%9F%E5%AD%90%E5%BC%B9/

[15] "How Were the Installed Capacity and Power Output of the Three Gorges Dam Calculated?" October 25, 2011, published on the websites of *China Dam Association* and *China Institute of Water Resources and Hydropower Research*, http://www.iwhr.com/zgskywwnew/ztbd/jjsx/zsd/webinfo/2011/10/1319163809341532.htm

For reference, the Three Gorges Dam has a measured average multi-year flow rate of 14,800 m³/s at the Yichang Hydrological Station. With a maximum head of 113 meters, its potential installed capacity is:

8×14,800×113≈13.38 GW(13.38millionkW)8×14,800×113≈13.38 GW(13.38millionkW)

Since seasonal flow variations require peaking capacity, the initial design of the Three Gorges Dam included 26 turbines of 700 MW each, totaling 18.2 GW. Later, six additional turbines were installed in an underground powerhouse, bringing the total installed capacity to 22.5 GW, with an additional 100 MW auxiliary station, resulting in a final capacity of 22.5 GW.

However, the practical annual power generation of the Three Gorges Dam is only 882.41 billion kWh, which is 75% of its theoretical maximum of 1,172.088 billion kWh:

13.38 GW×24 hours/day×365 days=1,172.088 billion kWh13.38 GW×24 hours/day×365 days=1,172.088 billion kWh

For the Lower Yarlung Tsangpo Hydropower Project, using a multi-year average flow rate of 60 billion cubic meters at Pai Township, the converted flow rate (Q) in cubic meters per second is:

60 billion m³31,536,000 seconds/year≈1,903 m³/s31,536,000 seconds/year60 billion m³≈1,903 m³/s

Applying the same calculation formula with a head of 2,350 meters:

8×1,903×2,350=35.7764 GW (35.78millionkW)8×1,903×2,350=35.7764 GW(35.78millionkW)

If the turbines operate at full capacity year-round, the maximum theoretical annual power generation is:

35.78 GW×24 hours/day×365 days≈3,134 billion kWh35.78 GW×24 hours/day×365 days≈3,134 billion kWh

Applying the same 75% efficiency factor as the Three Gorges Dam, the realistic annual power generation would be:

3,134 billion kWh×0.75≈2,350.5 billion kWh3,134 billion kWh×0.75≈2,350.5 billi on kWh

This result demonstrates that the Lower Yarlung Tsangpo Hydropower Project's realistic annual generation is 2,350.5 billion kWh—far from three times the output of the Three Gorges Dam, and certainly not 3,000 billion kWh, meaning it will not surpass Africa's Grand Inga Hydropower Project.

As for the installed capacity, the Three Gorges Dam's final capacity (22.5 GW) is approximately 1.68 times its potential installed capacity (13.38 GW). If this same factor (1.68x) is applied, the Lower Yarlung Tsangpo Hydropower Project could reach:

35.78 GW×1.68≈60.1 GW
(60.1millionkW)35.78 GW×1.68≈60.1 GW(60.1millionkW)

This result aligns with the widely reported 60 GW figure but falls short of the 70 GW claim. However, increasing the scale factor to 1.96x would allow the installed capacity to reach 70 GW, though this would not improve the annual power output.

One critical caveat: all these calculations assume that every cubic meter of the Yarlung Tsangpo's 60 billion cubic meters of water is diverted into the tunnels for hydropower generation—leaving no water in the natural river course downstream.

If 50% of the river's water is retained in the natural channel instead of being diverted into the tunnels, the total annual power generation would be cut in half.

Conclusion

The Lower Yarlung Tsangpo Hydropower Project has been incorporated into China's 14th Five-Year Plan, yet the Chinese government has not disclosed even the most basic data about the project.

On October 18, 2022, Engineer Fan Xiao published an article titled "From a Geological Risk Perspective: Why Hydropower Development in the Yarlung Tsangpo Grand Canyon is Infeasible." This article has since been censored. Along with it, several of Fan Xiao's other articles have also been removed, including:

- "The Four Major Hazards of the Tiger Leaping Gorge Hydropower Project on the Jinsha River"

- “A Discussion on the 6.8-Magnitude Luding Earthquake and Seismic Activity in the Sichuan-Yunnan Fault Zone”
- “China’s Rivers Are Over-Dammed: Excessive Hydropower Development Has Led to Large-Scale Wasted Water Resources”
- “Did the Zipingpu Reservoir Really Trigger the Wenchuan Earthquake? —A Literature Review on the Relationship Between Zipingpu Reservoir and the Wenchuan Earthquake”

Reflecting on this wave of censorship, Fan Xiao lamented:

“The correct approach should be to discuss, and debate based on scientific data and facts—this is what truly benefits the country and its people. If all you do is censor speech and silence voices, it not only violates the Constitution but also reveals fear and insecurity. What is there to fear? If your actions are legitimate and justified, you would not be afraid of criticism or opposition. Even the Three Gorges Project allowed NPC representatives to cast dissenting votes.”

These deleted articles had remained available for years, yet their sudden removal is clearly linked to the recent push for certain hydropower projects. The information revealed in these articles directly exposed uncomfortable truths that some authorities would rather keep hidden, truths they are unable to refute.

Among the hydropower projects Fan Xiao referred to is the Lower Yarlung Tsangpo Hydropower Project. His argument stands firm:

“The correct approach is to base discussions and debates on scientific data and factual evidence.”

However, without even the most fundamental data on the Lower Yarlung Tsangpo Hydropower Project, how can a discussion even take place?

This article, relying on macro-level data analysis, has arrived at the following conclusion:

The Lower Yarlung Tsangpo Hydropower Project is unlikely to generate an average annual power output more than three times that of the Three Gorges Dam. It is also unlikely to surpass the planned Grand Inga Hydropower Project in Africa.

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