

# How will hydropower crunch in Southwest China affect primary aluminum and alumina industries?

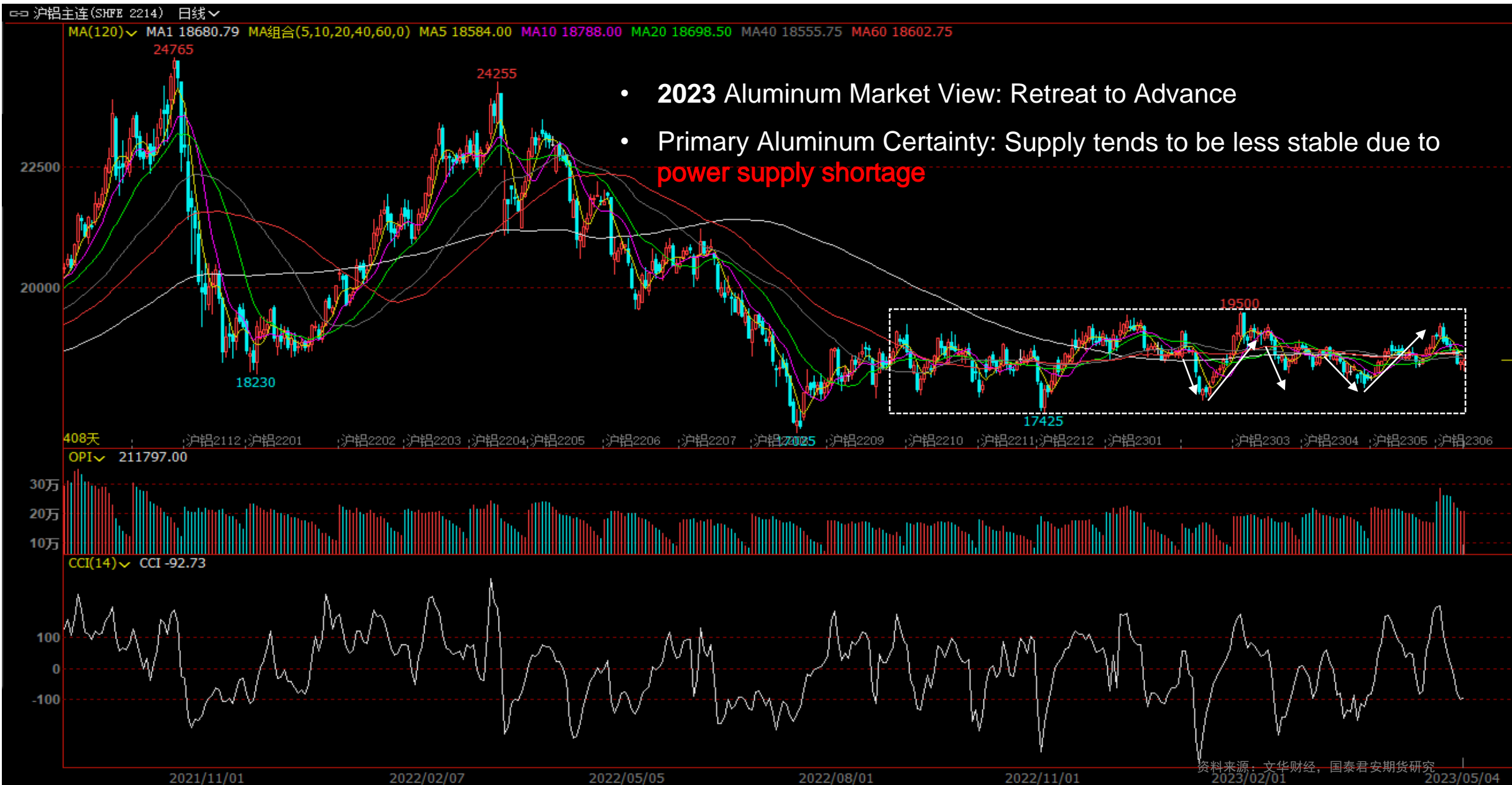
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# Shanghai Aluminum YTD Trend: Ups and downs. Collapsing cost? **Production cut and resumption in Southwest?** Uncertain consumption outlook?



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Yunnan water supply margin would improve slightly in the short term, but long-term concerns remain.

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When primary aluminum production in Southwest China reaches the bottleneck, the mode of "south-to-north shipment" of alumina is likely to become the norm.

The general trend of alumina cost pricing remains changed, but the use cost of primary aluminum smelter might be relatively raised

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Primary Aluminum: Capacity convergence; rise in hidden cost.

Alumina: "south-to-north shipment" likely to become the norm; general trend of alumina cost pricing remains changed, but the use cost of primary aluminum smelter might be relatively raised.

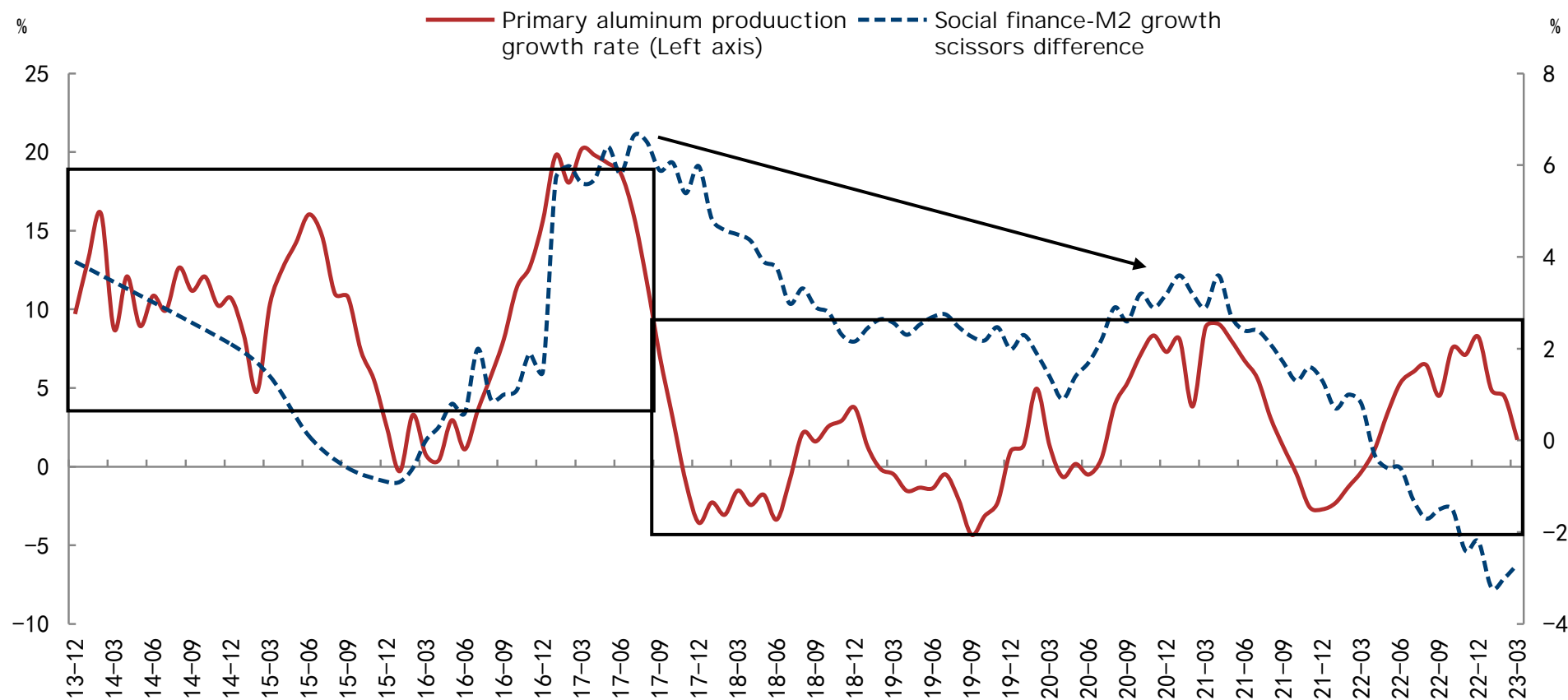
# 01

Primary Aluminum Certainty:  
Supply tends to be less stable

# Supply-side long-range outlook: Growth rate of primary aluminum production in China has obviously "stepped down"

- ◆ The growth rate of primary aluminum production in China fell visibly in mid-to-late 2017 due to supply-side policies and slowing growth of social finance. For the asset-heavy aluminum smelting industry, it is difficult to go against the trend in an environment where the credit expansion of the whole society tends to slow down.

China's primary aluminum production growth rate "stepped down" distinctly in mid-to-late 2017

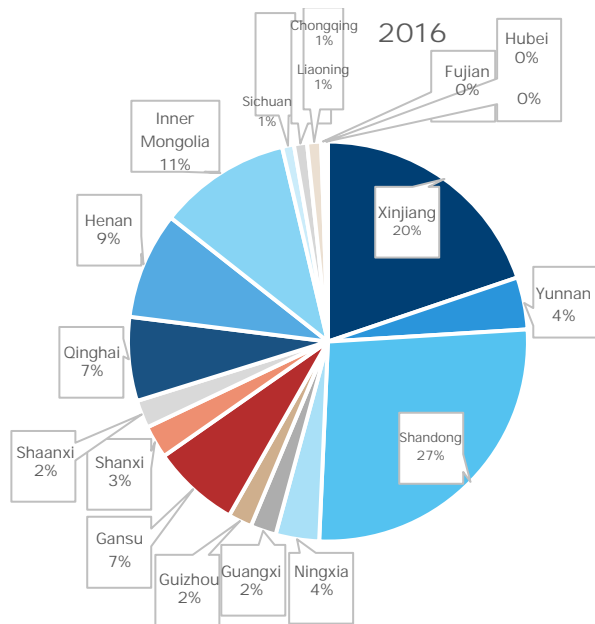


Source: Wind, Guotai Junan Futures

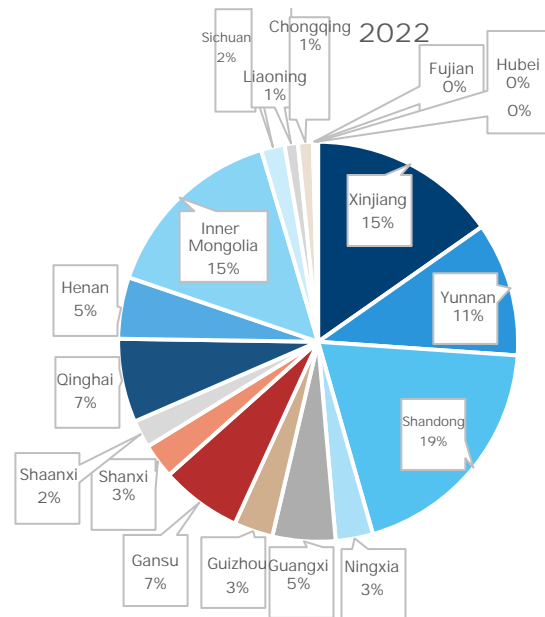
# The transfer of aluminum capacity to the southwest represented by Yunnan may be nearing an end

- ◆ From past experience, China's electrolytic aluminum industry will undergo a major capacity migration every five years or so. Energy consumption and power rationing may become important signposts for how the energy landscape will change over the next five years. Given the frequent supply disturbances of southwest hydropower over the past two years, the transfer of primary aluminum production capacity to southwest production areas represented by Yunnan may be nearing an end.
- ◆ In early 2023, China's primary aluminum production increased at a relatively high rate (YoY), which was largely due to the effect of the low base in the same period in 2022, not the release of new capacity projects. Judging from newly-released capacity this year, there is not much pressure for new capacity from the supply side.

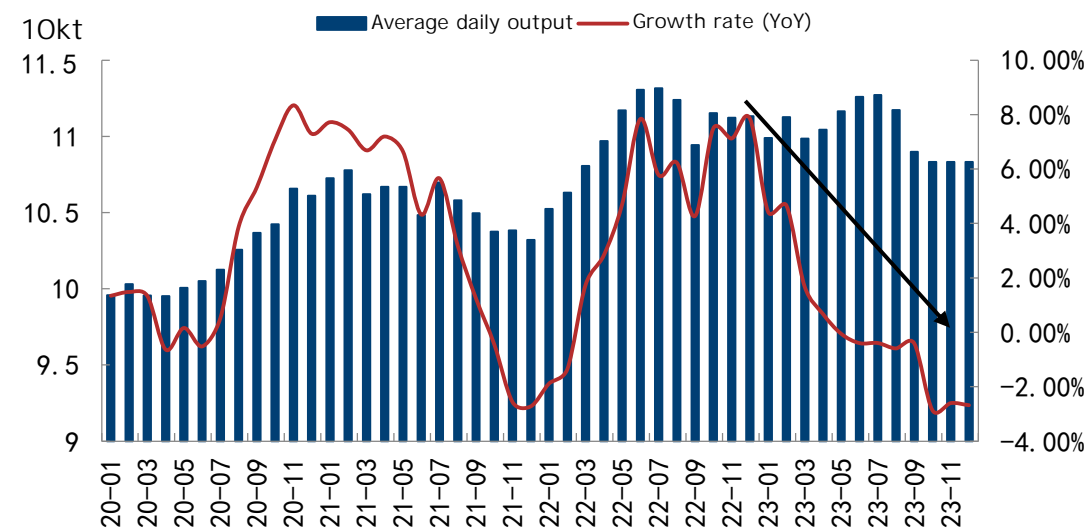
China's primary aluminum production by region in 2016



China's primary aluminum production by region in 2022



China's primary aluminum production growth rate prediction for 2023: From high to low

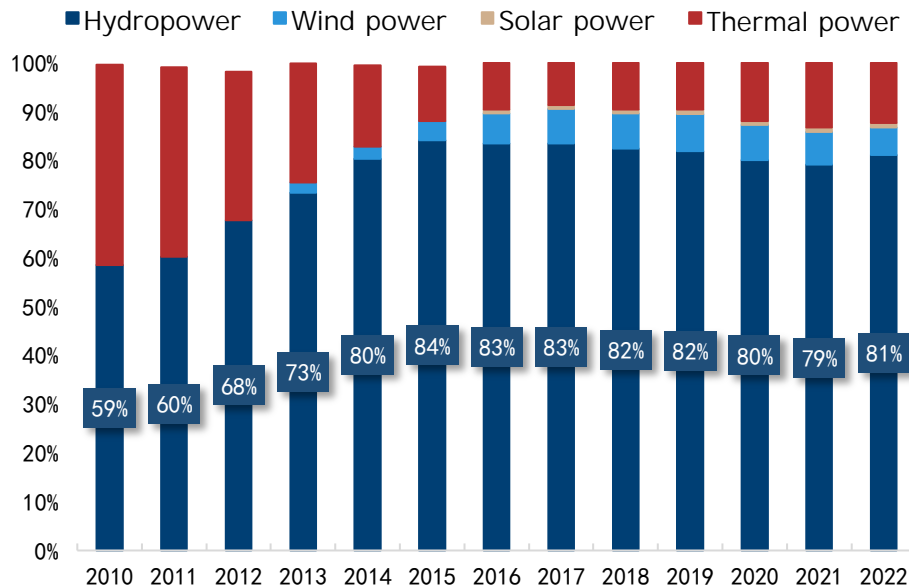


Source: Wind, Guotai Junan Futures

# Less Stable Aluminum Supply — 1. Power supply shortage

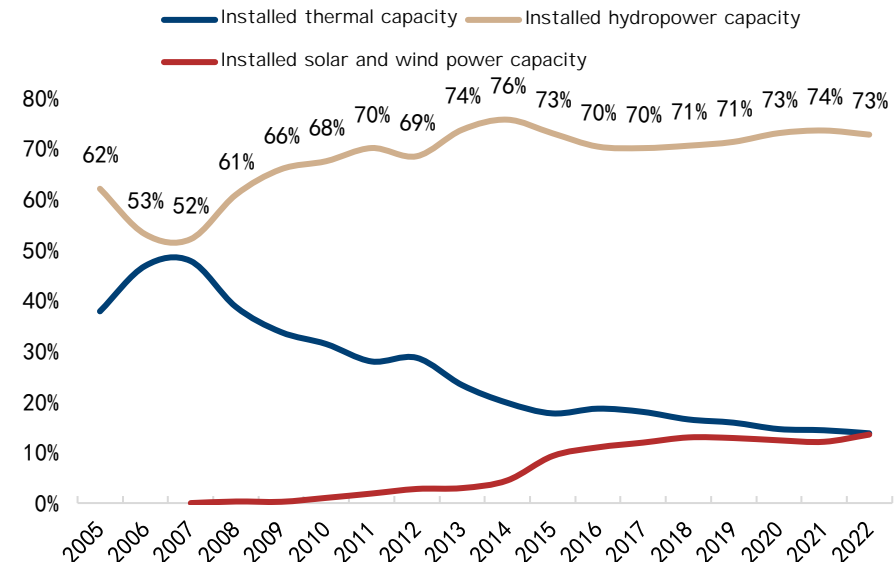
- ◆ Primary aluminum supply tends to be less stable due to production restriction directly caused by power rationing amid energy crunch.
- ◆ Especially for Yunnan, a key area that has formed a marginal increase in domestic primary aluminum supply in the past few years, the local water supply has encountered abnormal disturbances for two consecutive years, while at the same time, there is also a temporary shortage of power generated by other energy sources. Under such circumstances, the disadvantages of relying heavily on hydropower in Yunnan's power structure began to emerge. Due to the less stable power supply, primary aluminum producers in Yunnan cut production in 2021 and 2022.

Hydropower accounts for more than 80% of total power generation in Yunnan



Source: Yunnan Energy Bureau, Guotai Junan Futures

Higher share of wind and solar power installation expected in Yunnan for the next few years



Source: Kunming Power Trading Center, Guotai Junan Futures

# Less Stable Aluminum Supply — 1. Power supply shortage

From 2021 to 2022, large-scale hydropower stations in Wudongde and Baihetan were put into operation in Yunnan, but not much electricity was actually retained in the province.

10 billion KWH of electricity generated by Wudongde and Baihetan hydropower stations is retained for Yunnan during dry season (4 billion KWH from Baihetan station is for replacement)



Source: China Yangtze Power 2021 Value Booklet, Guotai Junan Futures

水电站名称	配套电网工程	电网工程建设进度	外接电网	电力外送区域	本地留存电量
白鹤滩水电站	白鹤滩水电站500千伏送出工程	2021年6月19日已带电投运	四川电网	江苏、浙江	丰水期电量均外送东部地区，枯水期云南留存40亿千瓦时
	白鹤滩-江苏±800千伏特高压直流	2022年5月5条线路成功投运	国家电网	江苏	
	白鹤滩-浙江±800千伏特高压直流	2022年6月2条线路成功投运	国家电网	浙江	
乌东德水电站	昆柳龙直流工程	2020年底全面投产	南方电网	广东、广西	丰水期电量均外送东部地区，枯水期云南留存60亿千瓦时

Source: Internet, Guotai Junan Futures

Among the key hydropower projects in Yunnan, Baihetan hydropower station was completed in late 2022, while Toba hydropower station is expected to become operational by the end of the 14th Five-Year Plan period (2021-2025)

项目名称	建设地点	项目建设内容及规模	建设年限	项目总投资	建设单位	项目进展	备注
金沙江白鹤滩水电站	四川省凉山州宁南县和云南省昭通市巧家县境内	装机1600万千瓦，云南侧800万千瓦	2017-2022年	2200亿元	三峡金沙川水电力开发有限公司	截至2022年9月22日，白鹤滩水电站已投产12台机组。预计2022年底全面完工。	白鹤滩水电站总装机容量1600万千瓦，共16台机组，单机容量100万千瓦。多年平均发电量624.43亿千瓦时
金沙江乌东德水电站	云南省禄劝县和四川省会东县交界	装机1020万千瓦，云南侧510万千瓦	2015-2021年	502亿元	三峡金沙川水电力开发有限公司	2021年6月16日所有机组全部投产发电	乌东德水电站共12台85万千瓦机组，多年平均发电量389.1亿千瓦时
金沙江旭龙水电站	云南省德钦县与四川省得荣县交界处	装机240万千瓦，云南侧120万千瓦	-	157亿元	国电金沙江旭龙水电开发有限公司	获发改委批复	2022年6月，国家发改委正式批复。旭龙水电站共4台60万千瓦发电机组，多年平均年发电量约105.14亿千瓦时
澜沧江托巴水电站	云南省迪庆州维西傈僳族自治县境内	装机140万千瓦	2019-2025年	232亿元	华能澜沧江公司	在建	2017年4月获批，核准工程总工期82个月，托巴水电站多年平均年发电量62.3亿千瓦时
澜沧江古水水电站	云南省迪庆州德钦县佛山乡境内	装机180万千瓦	-	179亿元	华能澜沧江公司	前期工作	公司2022年5月公告称，目前正深入开展可研阶段工作

Source: Yunnan Government, announcements of listed company, Guotai Junan Futures



# Less Stable Aluminum Supply — 1. Power supply shortage

- ◆ In the next 1-2 years, the power crunch in Yunnan may still be the headwind. The resumption of production of primary aluminum in Yunnan in 2023 is likely to fall short of expectations, or after the resumption of production during the wet season, production might decline again in the second half of the year when the dry season arrives, *which leads to the hidden cost of reducing and resuming production.*
- ◆ From the long-term outlook, we tend to believe that during the major transfer of China's primary aluminum production capacity every five years, the latest round of production capacity shift to the southwestern production areas represented by Yunnan may be nearing an end. We are already seeing a decline in the stability of primary aluminum supply, which may provide an opportunity for the aluminum market to bottom out after a short period of oversupply.

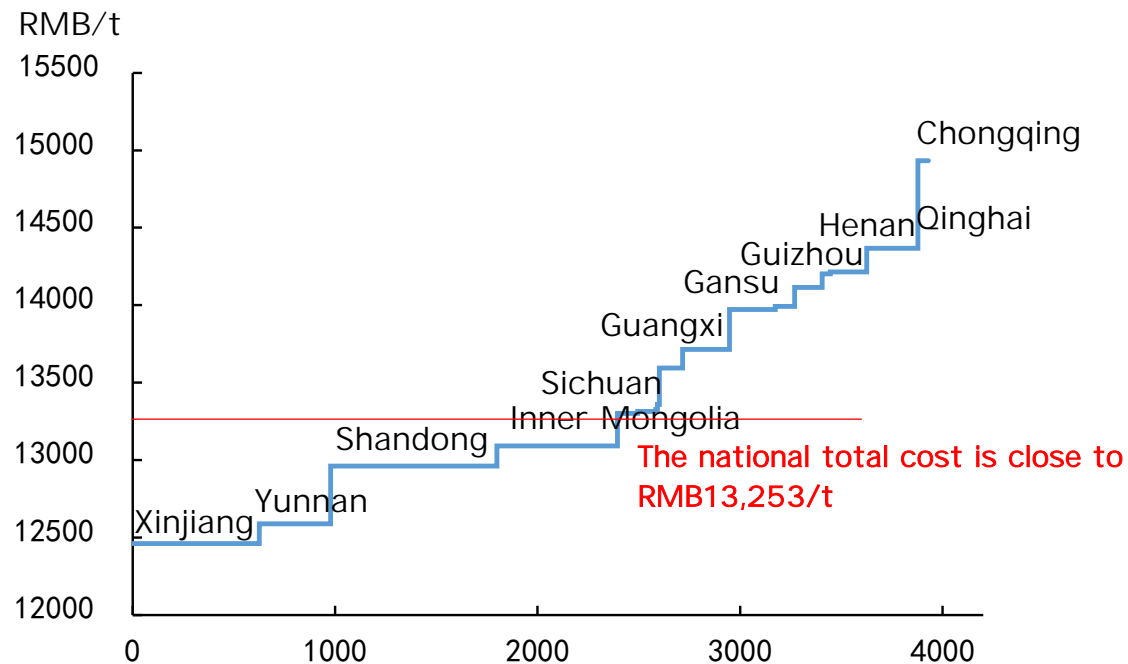
According to Yunnan power supply-demand balance chart, there are still concerns about power shortages in 2023

单位：亿千瓦时	2019	2020	2021	2022Q1	2022Q2	2022Q3	2022Q4	2022E	2023E
<b>全省总发电量</b>	3193	3674	3541	713	1006	1151	883	3753	4149
火电发电量	218	415	350	142	88	99	110	438	448
水电发电量	2685	2960	2913	476	857	1022	722	3077	3272
风电发电量	244	250	233	85	52	22	40	199	245
光伏发电量	45	50	45	10	9	9	12	40	184
<b>全省总用电量</b>	3289	3509	3618	726	856	1397	923	3902	4246
1. 云南省内用电量	1812	2025	2139	546	583	640	580	2349	2504
第一产业	8	9	23	6	6	6	7	25	30
第二产业	1307	1487	1534	382	419	475	415	1690	1798
a. 电解铝用电量	175	371	431	106	151	162	132	551	646
b. 硅行业相关用电量	90	150	67	23	29	40	33	125	152
c. 其他用电行业	1042	965	1036	252	239	273	250	1014	1000
第三产业	243	254	286	79	79	79	79	315	340
城乡居民生活用电	245	266	296	80	80	80	80	320	336
2. 西电东送用电量	1452	1458	1473	180	270	757	340	1547	1742
3. 送境外用电量	26	26	6	-	3	-	3	6	-
<b>供需平衡</b>	-97	166	-77	-13	150	-246	-40	-149	-97

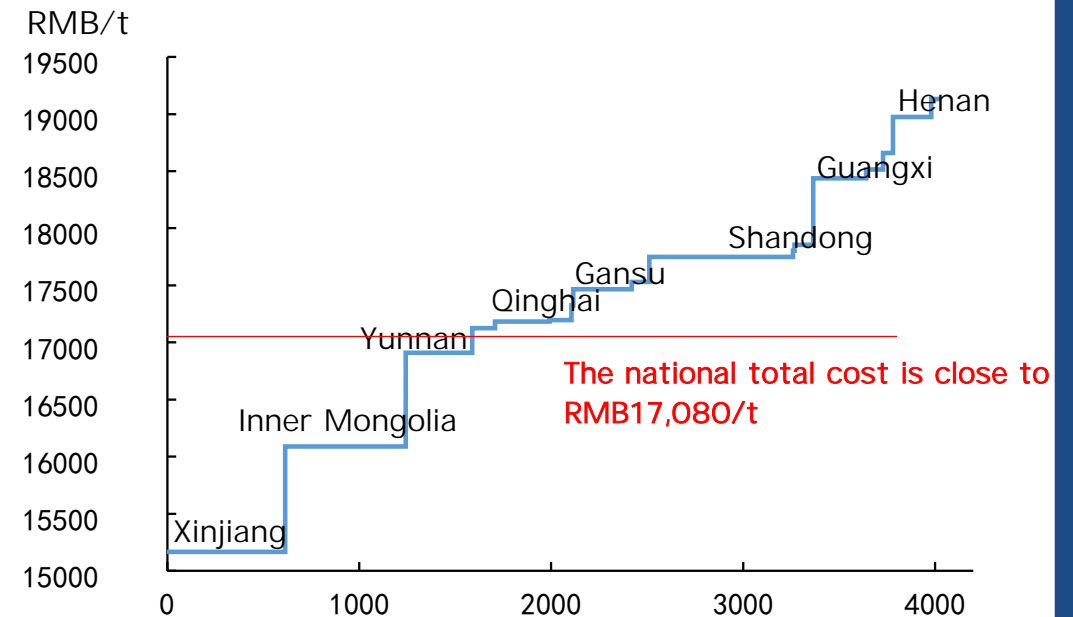
# Less Stable Aluminum Supply — 2. Firm power prices

- ◆ Primary aluminum supply tends to be less stable due to firm power prices.
- ◆ In the revolutionary wave of switching between old and new energy, primary aluminum, as a traditional industry with high power consumption and high carbon emission, has seen less stable supply since 2021, which is the core driving force that we believe that once aluminum price falls, it would have some support at the bottom, and could even bounce out of the bottom. At a time when macro cycles affect overall commodities, differentiated pricing on the supply side may bring some alpha benefits to aluminum varieties.

Aluminum smelter full cost curve in late Jan 2021



Aluminum smelter full cost curve in late Mar 2023

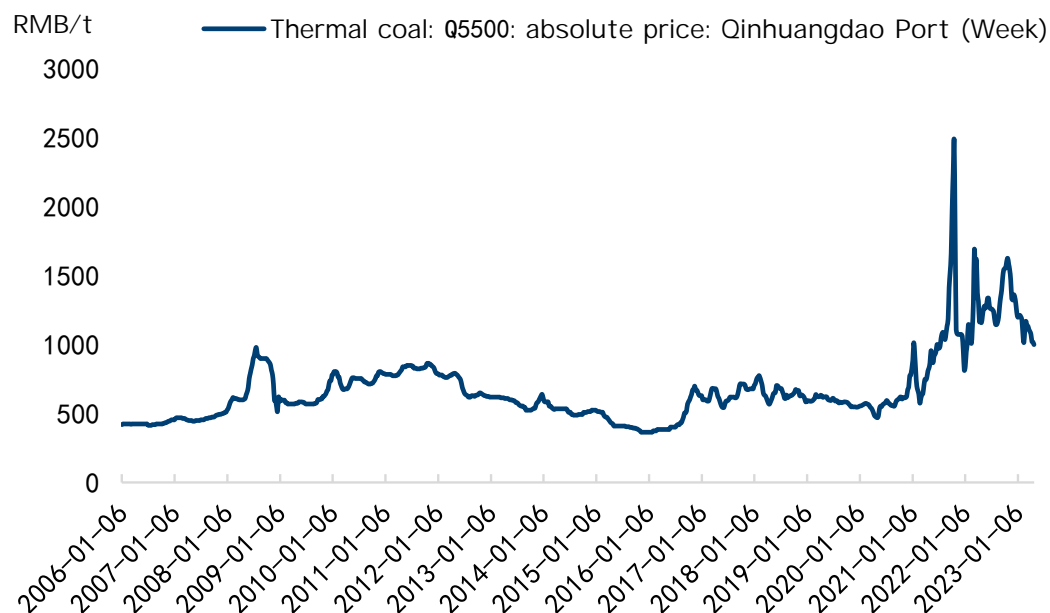


Source: Guotai Junan

# Less Stable Aluminum Supply — 2. Firm power prices

◆ Given the fact that the cost of electricity can basically account for more than 30% of the complete cost of primary aluminum smelting, the cost of electricity may be relatively stable in the medium and long term, supported by coal supply disruption, step tariff policy for electricity, primary aluminum being included in compliance cycle of China's carbon market, and others factors.

Mainstream coal prices in the domestic market still higher than those before 2021



China's power consumption per ton of aluminum already at world's top levels

Electricity Electrolysis 2021							
	Production 1000 tonnes	Energy Efficiency Kwh/tonne	Hydro	Coal	Oil	Natural Gas	Nuclear
Oceania	1888	16513	38%	58%	0%	1%	0%
South America	1163	16490	82%	0%	0%	16%	0%
Non Reporting	1878	15510	0%	100%	0%	0%	0%
GCC	5889	15190	0%	0%	0%	99%	0%
Europe(incl Russia)	7468	15146	93%	1%	0%	1%	3%
Asia(ex China)	4499	14669	6%	94%	0%	0%	0%
Africa	1590	14499	41%	59%	0%	0%	0%
China	38837	13511	16%	82%	0%	0%	0%
North America	3880	13089	95%	5%	0%	0%	0%
Global	67092	14114	31%	57%	0%	10%	1%
Global(ex China)	28255	14931					

Source: IAI, Guotai Junan

The background features a dark blue field with several light blue arrows pointing towards the right. A large, semi-transparent white number '02' is positioned on the left side of the image. A diagonal band of lighter blue and white shapes cuts across the scene from the top-left towards the bottom-right.

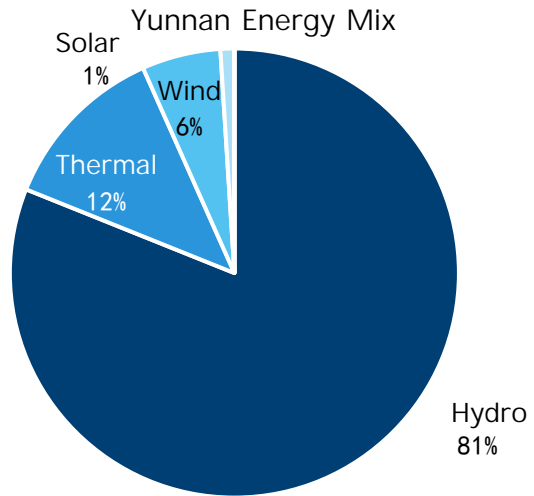
02

Southwest Hydropower  
Dynamic Tracking:  
Short-term water supply  
improves, long-term  
concerns remain

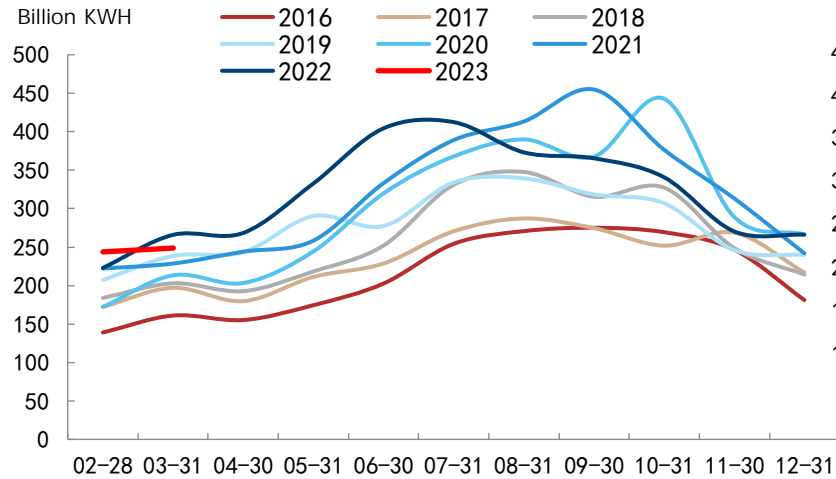
# Short-term view: Yunnan's water supply margin slightly improved, but the overall power generation capacity remains to be seen

- From the perspective of the overall situation in Southwest China, Yunnan and Sichuan both have a power generation structure of "hydropower as the mainstay and thermal power as the supplement". Therefore, the water supply conditions and the water level of hydropower stations would disturb the local power generation capacity.
- **Precipitation data indicated:** *Recently, the precipitation from the upper reaches of the Qinghai-Tibet Plateau has improved, corresponding to an increase in snowmelt.* In addition, the marginal improvement in precipitation in the Jinsha River, Lancang River, and Nujiang River basins in Yunnan has boosted the power generation of local hydropower stations. The precipitation in Minjiang and Tuojiang areas in Sichuan remains at high levels, and the local hydropower stations have sufficient power generation capacity, and their power generation capacity is normal.
- **Water line data indicated:**
  - 1) *The current water levels of Xiangjiaba and Xiluodu, the main hydropower stations on the Jinsha River in Yunnan, are at a relatively low level in the same period, and the corresponding water storage capacity is also at a low level. Their power generation capacity may not be as good as in the year ago period.*
  - 2) Current water levels of Nuozhadu and Xiaowan, the main hydropower stations on the Lancang River in Yunnan, are at the median level for the same period, and their power generation capacity may be similar to that of the same period in previous years.
  - 3) Water level of the Ertan Hydropower Station in Sichuan is higher than that of the same period in 2022, while the water level of Jinping Hydropower Station is lower than that of the same period of 2022. The overall power generation capacity during the wet season is guaranteed.
  - 4) *In the Yangtze River Basin, the Three Gorges Hydropower Station has more inflow than outflow, which increased the water storage capacity of the hydropower station, and the corresponding water level is close to returning to the same period in previous years, but it is significantly lower than the 2022 level.*
- Overall, the precipitation in the Qinghai-Tibet Plateau and the Lancang River Basin in Yunnan would improve slightly in the short term. However, since the water levels of Xiangjiaba and Xiluodu in Yunnan are lower than the same period in previous years, the overall hydropower generation in Yunnan may still be weaker than in previous years. In the future, it is necessary to **focus on the water inflow and storage in Yunnan.**

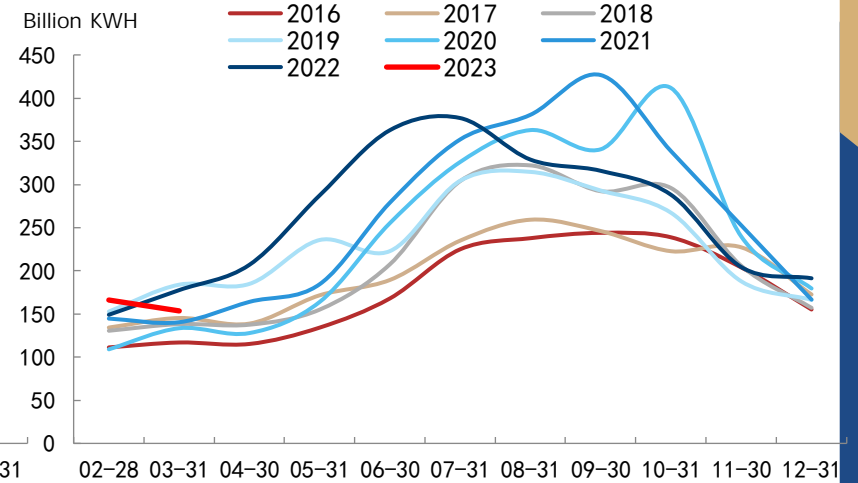
# Yunnan: Overall power generation in March was lower than the year ago period mainly due to hydropower shortage



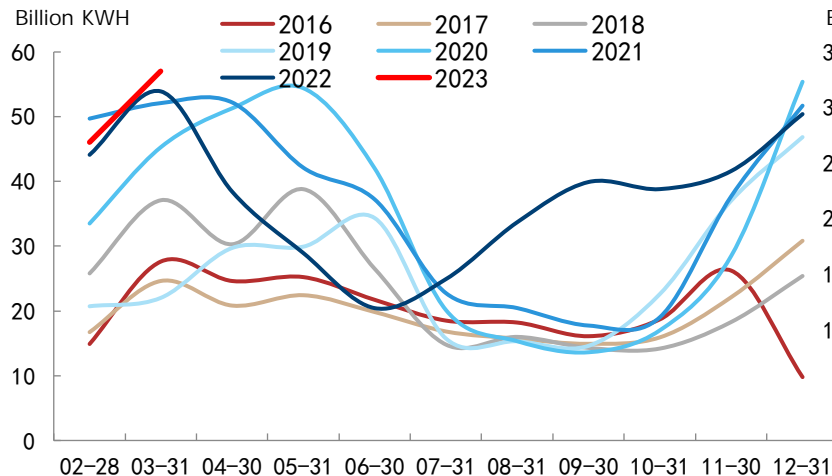
Total Power Generation in Yunnan



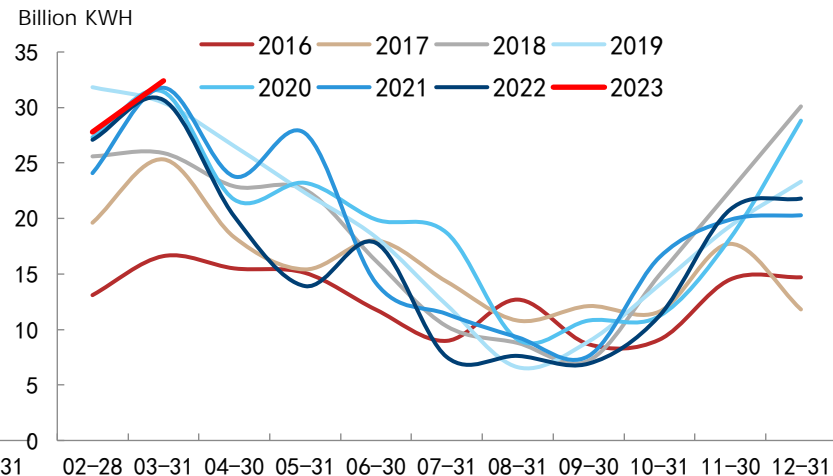
Yunnan:Production:Hydropower:Month



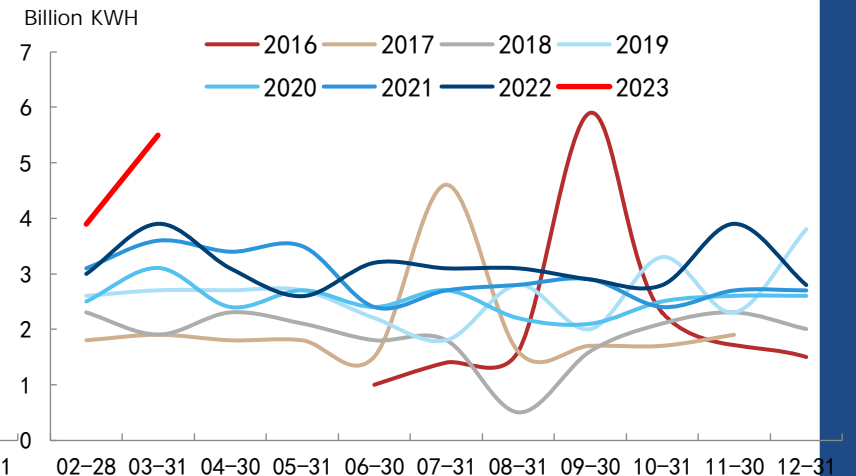
Yunnan:Production:Thermal Power:Month



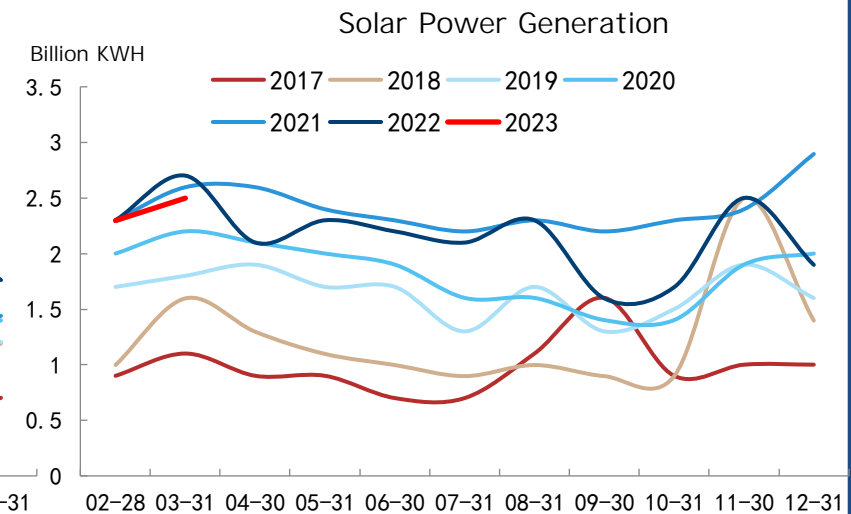
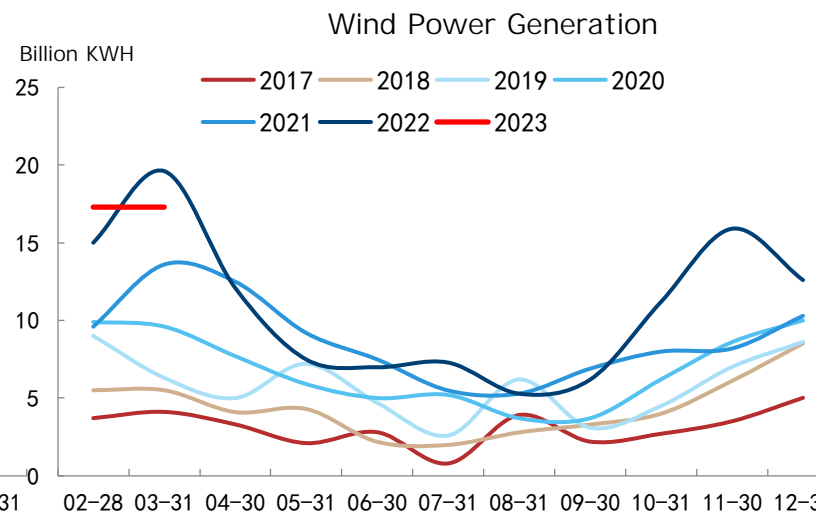
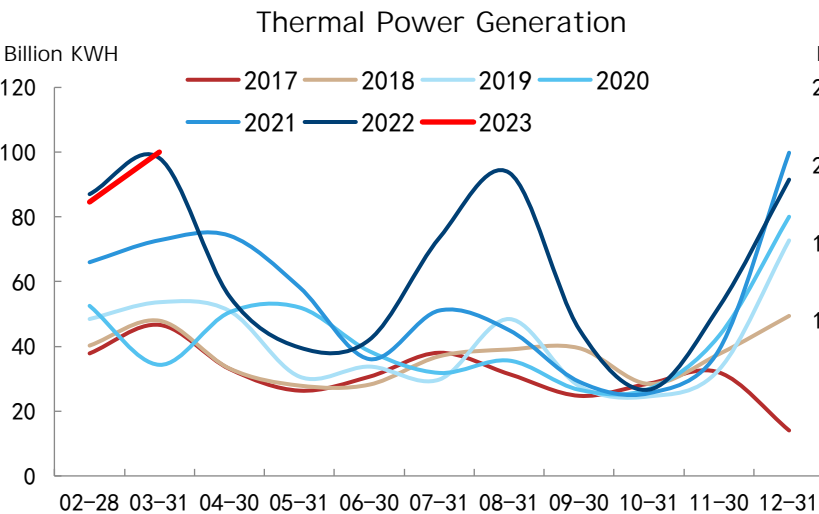
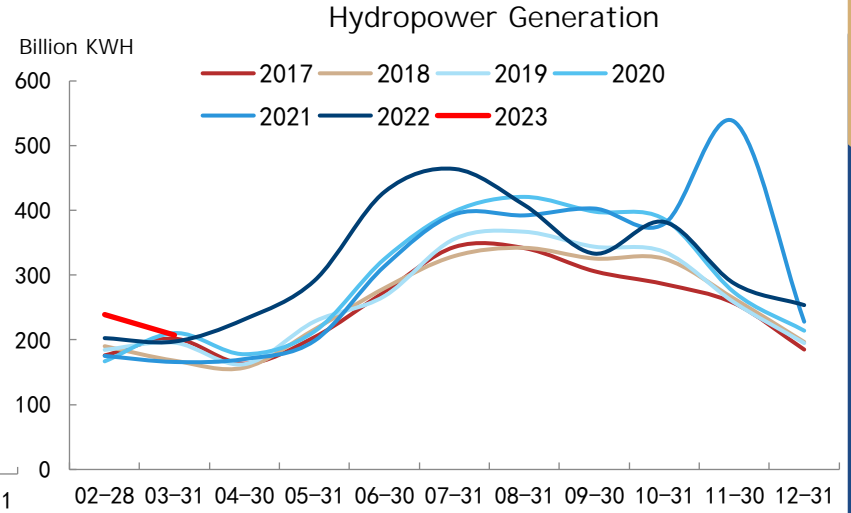
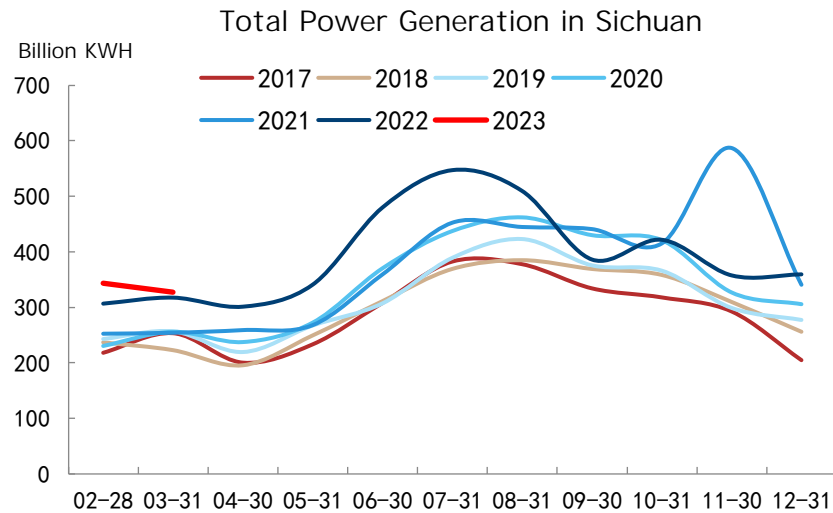
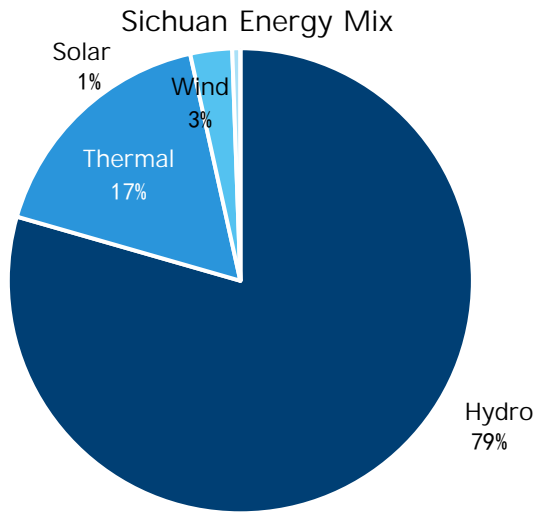
Yunnan:Production:Wind Power:Month



Yunnan:Production:Solar Power:Month



# Sichuan: Overall power generation in March was lower than the prior month mainly due to hydropower shortage

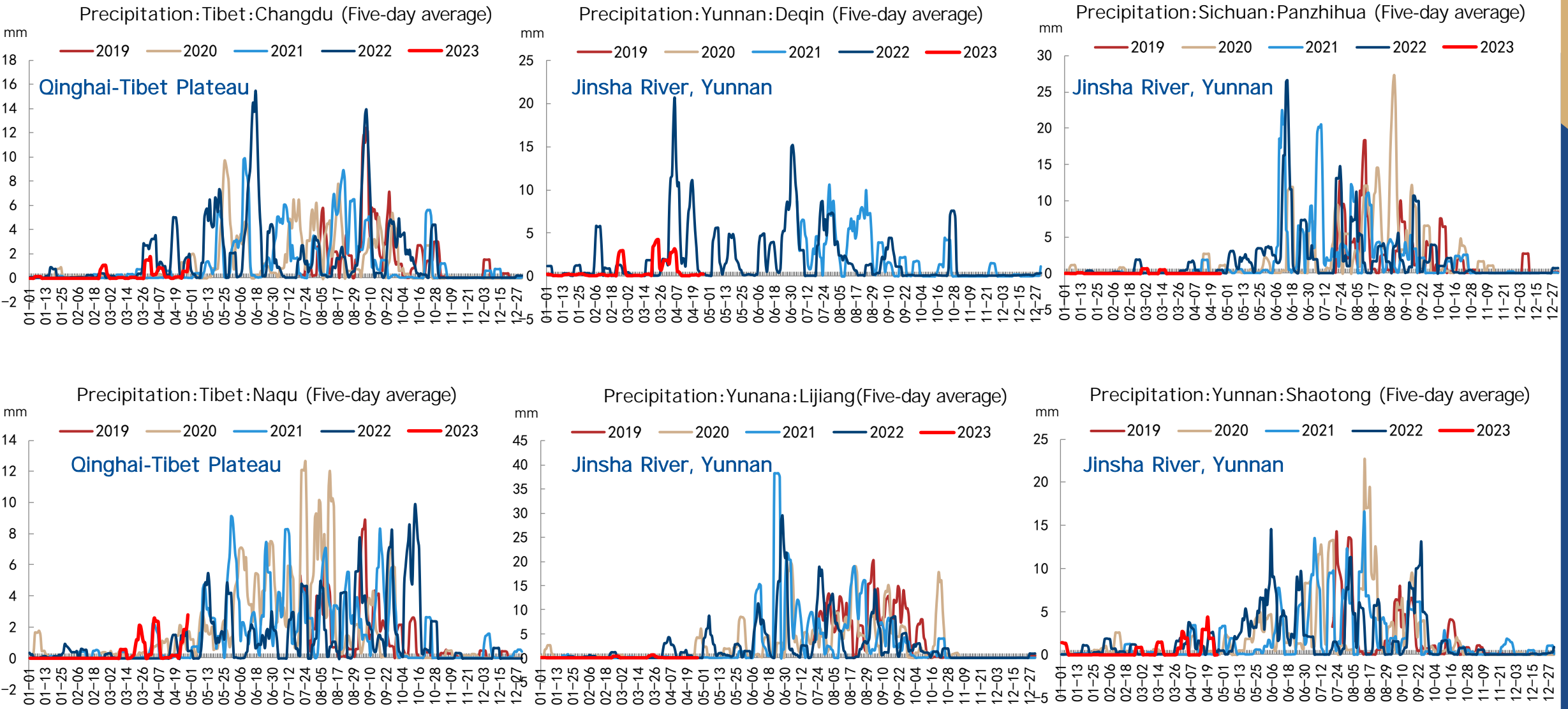


# Precipitation observation: Tracking of daily precipitation in major river basins in Southwest China

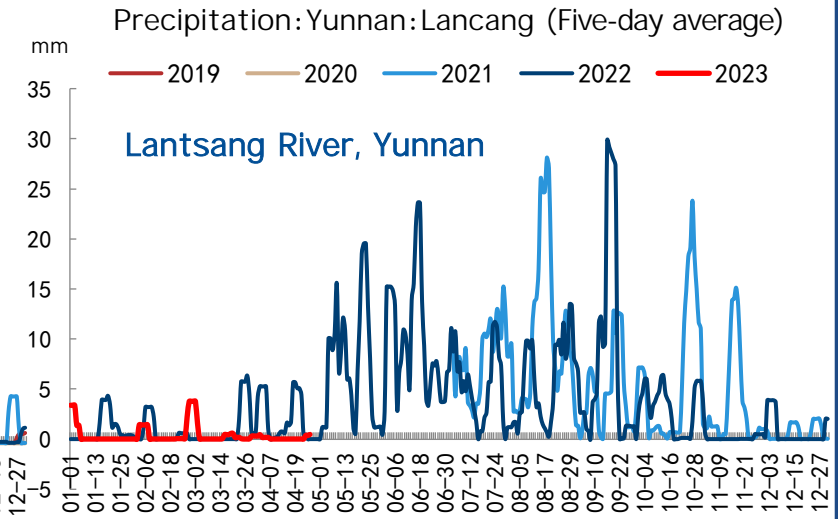
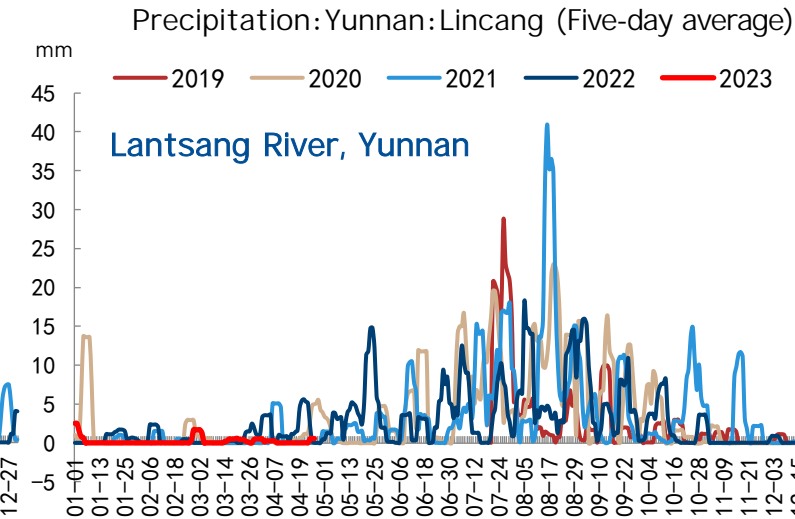
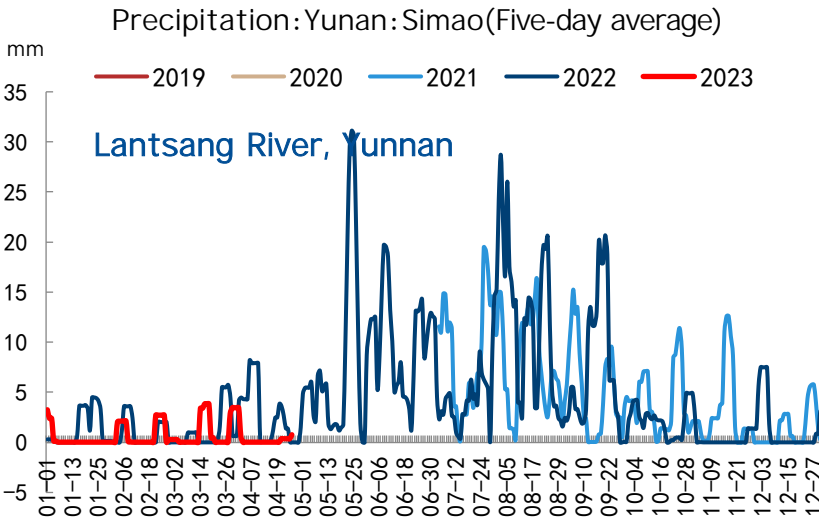
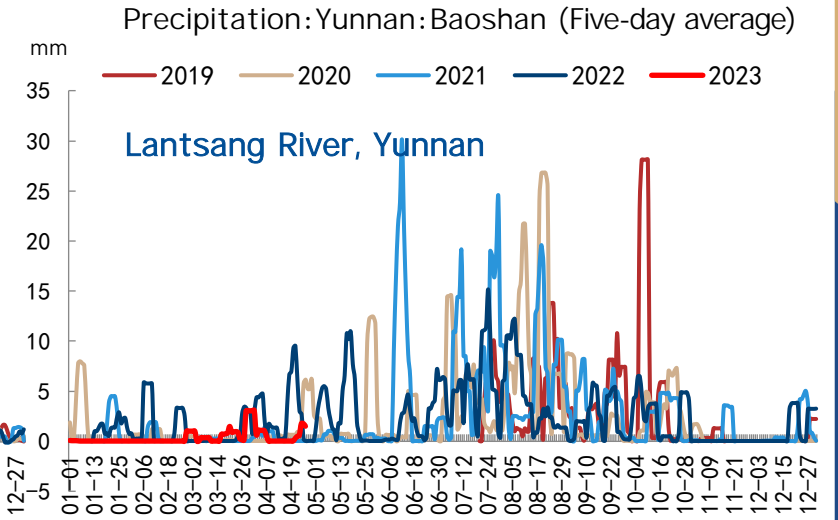
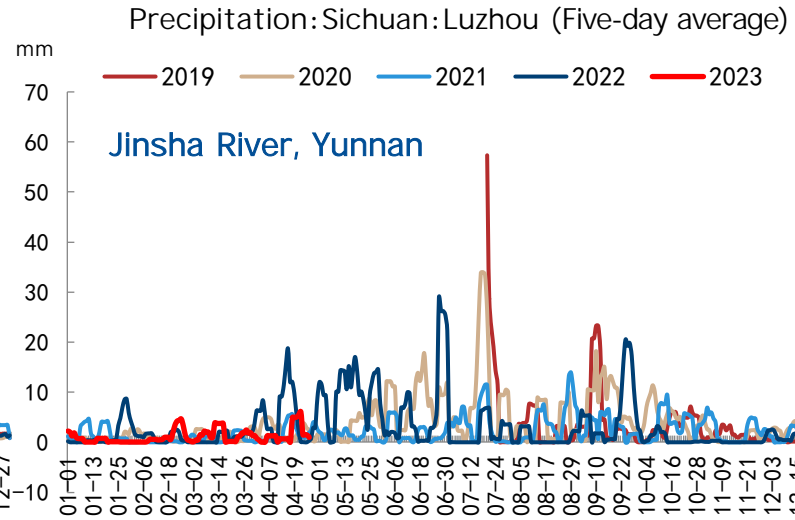
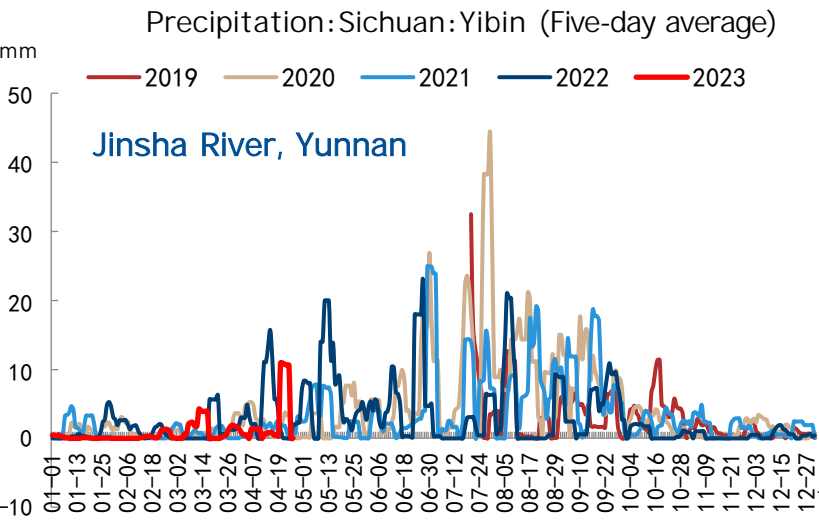
Date	Qinghai-Tibet Plateau		Yunnan											Sichuan				
	怒江发源地	澜沧江发源地	Jinsha River						Lantsang River				Nujiang	Minjiang			Tuojiang	
	那曲	昌都	德钦	丽江	攀枝花	昭通	宜宾	泸州	保山	思茅	临沧	澜沧	腾冲	成都	眉山	乐山	广元	南充
2023/3/30	1.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023/3/31	0	1.3	0	0	0	2.4	9.5	0	0	0	0	0	0	0	0	0	11	0
2023/4/1	0.3	0	2.5	0	0	0	0	0	0.2	0	0	0	1	0	0	0	0	0
2023/4/2	7.2	0	10.9	0	0	0	0	0	2.9	0	0.2	0.8	6.2	0	0	0	5.1	0
2023/4/3	4.3	0.3	0.2	0	0	0	0	0	2.3	0	1.1	0	7.4	0	0	0	20.4	2
2023/4/4	0.2	0	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023/4/5	0	2.6	1.3	0	0	0	0	0	0	0	0	0	0	6.8	2.2	3.9	1.7	4.8
2023/4/6	0	1.5	0.1	0	6.2	6.8	0	0	0	0	0	0	0	4.5	3	12.1	0	4
2023/4/7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023/4/8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.2
2023/4/9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023/4/10	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10.6	0
2023/4/11	0.2	0	0	0	0	0	0	0	0	0	0	0	0	0.1	4.5	0.1	0	0
2023/4/12	0	0	0	0	3.2	3	0	0	0	0	0	0	0	0	4.4	1.5	0	2.1
2023/4/13	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1	0	2.7	5.6	0
2023/4/14	0	0	0	0	0	1.2	2.4	0	0	0	0	0	0	0	0.9	3.8	0	0
2023/4/15	0	0	0	0	0	0	12.1	0	0	0	0	0	0	0	0	0	0	0
2023/4/16	0.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2023/4/17	0	0	0.4	0	0	1	0	0	0	0	0	0	0	0	0	0.3	0	0
2023/4/18	0	0.5	0	0	24.6	0.7	0.1	0	0	0	0	0	0	8.1	10.9	4.7	0	16.3
2023/4/19	0	0	0	0	0	0	9.4	0	0	0	0	0	0	0	0	1.9	0	0
2023/4/20	0	0.1	0.1	0	0.4	52.7	0	0	0	0	0	0	0	6.5	5.4	11.1	0	0
2023/4/21	0	0	0.1	0	2.3	0	0	0	1.3	1.7	0	0	0	5.1	32.8	9	27.4	12.4
2023/4/22	1.3	0	0	0	3	0.1	0	0	1.1	0	0.1	0	3.3	0.1	0.5	1.3	9.8	51.6
2023/4/23	3.9	0	0	0	1.6	0	0	0	0.5	0	0	0	6.9	0	0.1	3	0	5
2023/4/24	0	2.8	0.9	0	0.1	0	0	0	5.9	0	2.7	1.8	6.4	0.3	1.3	0.5	0	0
2023/4/25	4	0	0	0	0	0	0	0	0	0	0	0	0.1	0.1	0.2	4	0	0
2023/4/26	0	0	0	0	0	0	0	0	0	3.7	0	0.5	1.5	0	0.2	2.8	0	0
2023/4/27	1.6	0	0	0	0	0	0	0	0	0.1	0.4	0	0	0	0	0.3	0	0
2023/4/28	8.4	4.7	0.2	0	9.6	12.7	1	0	0	0.1	0	0	2.3	8.4	5.9	11.5	0	2.9



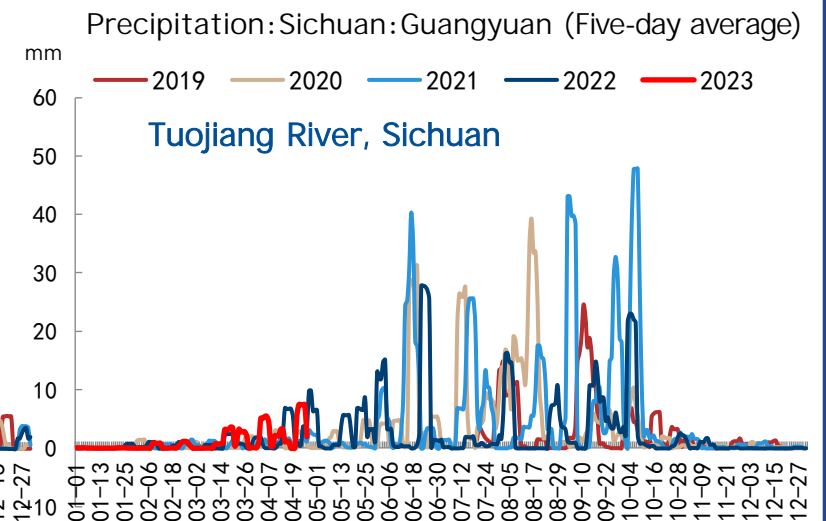
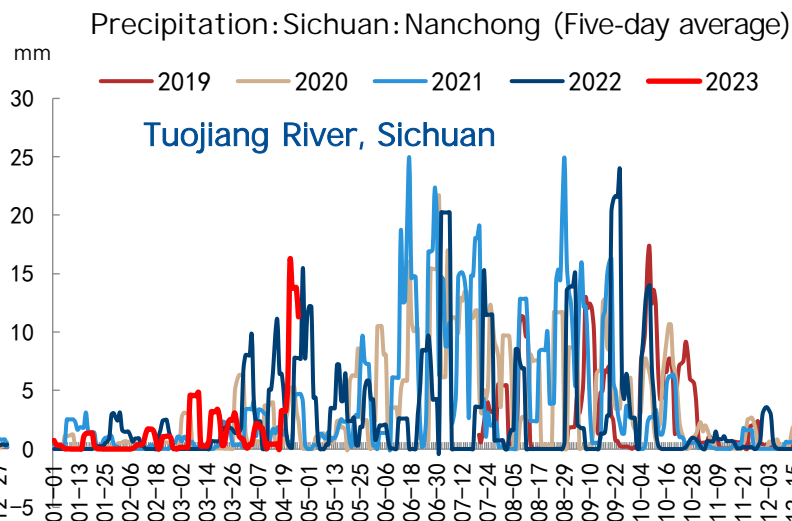
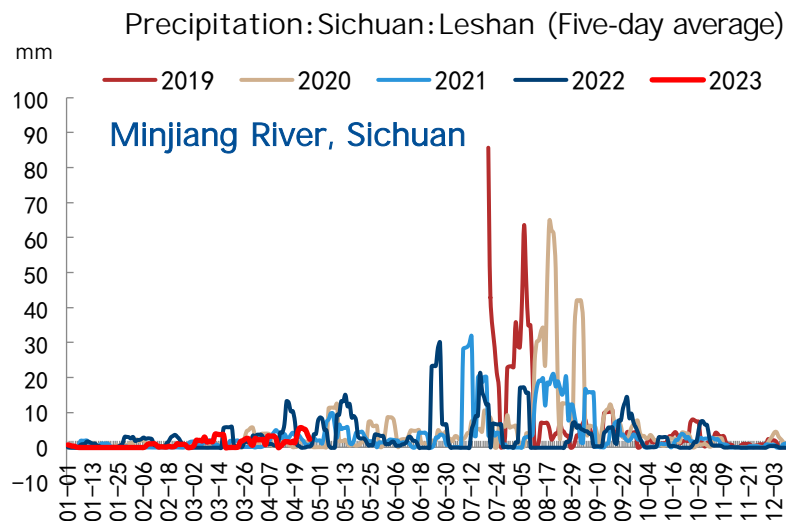
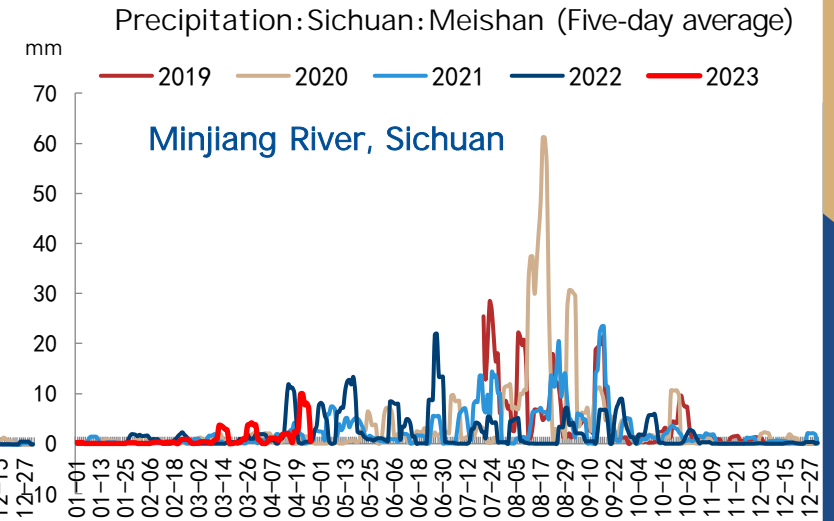
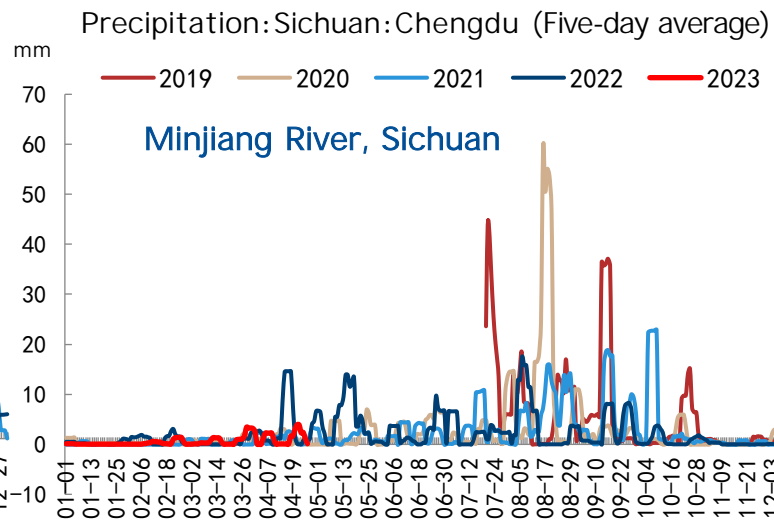
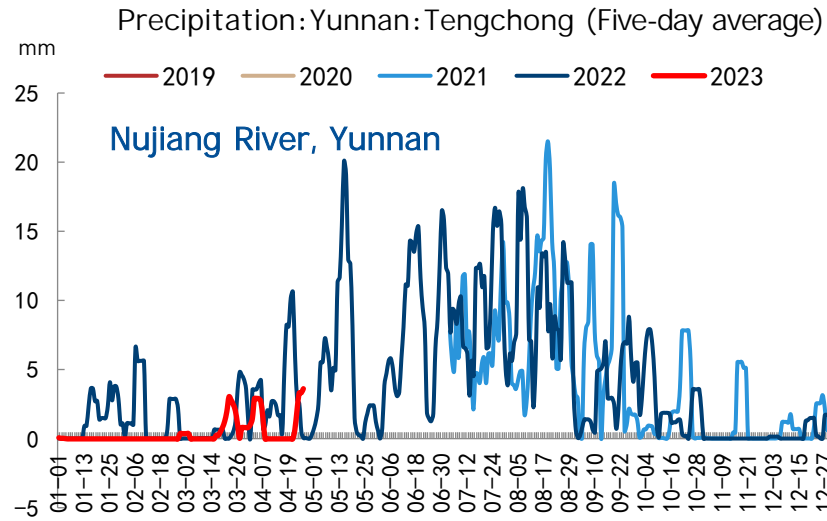
# Precipitation Observation: Seasonal charts of daily precipitation in river basin (Qinghai-Tibet Plateau, Jinsha River)



# Precipitation Observation: Seasonal charts of daily precipitation in river basin (Jinsha River, Lantsang River)

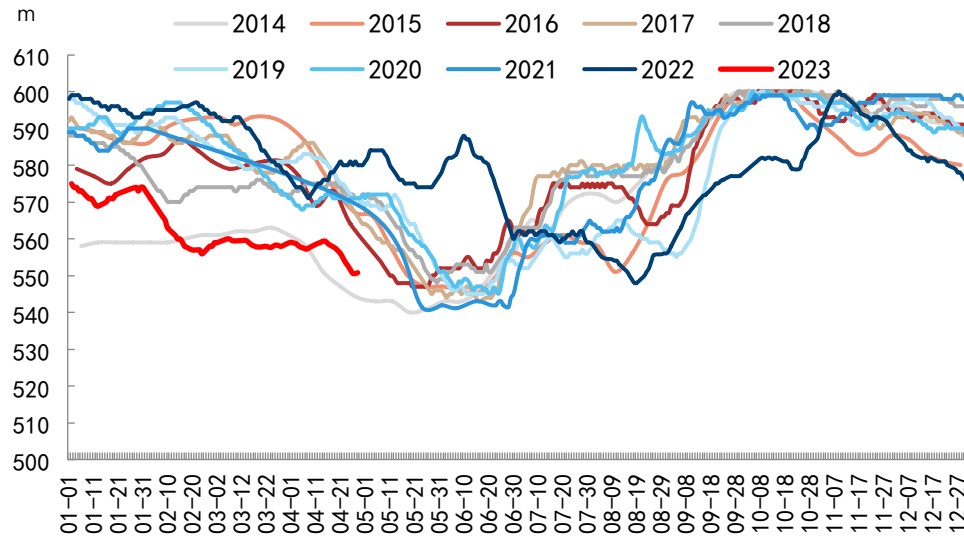


# Precipitation Observation: Seasonal charts of daily precipitation in river basin (Nujiang River, Minjiang River, Tuojiang River)

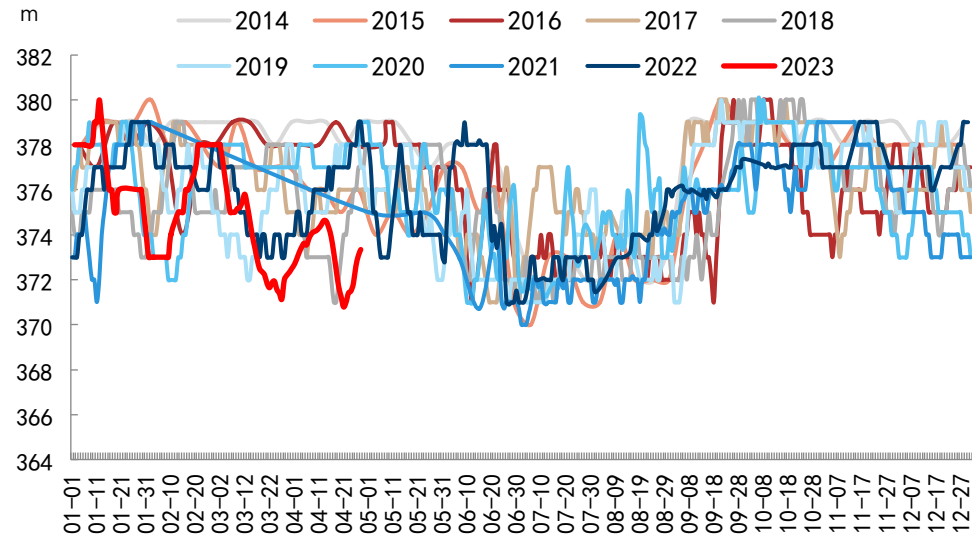


# Water Level Observation: Tracking of water level and storage capacity of major hydropower stations on Jinsha River in Yunnan

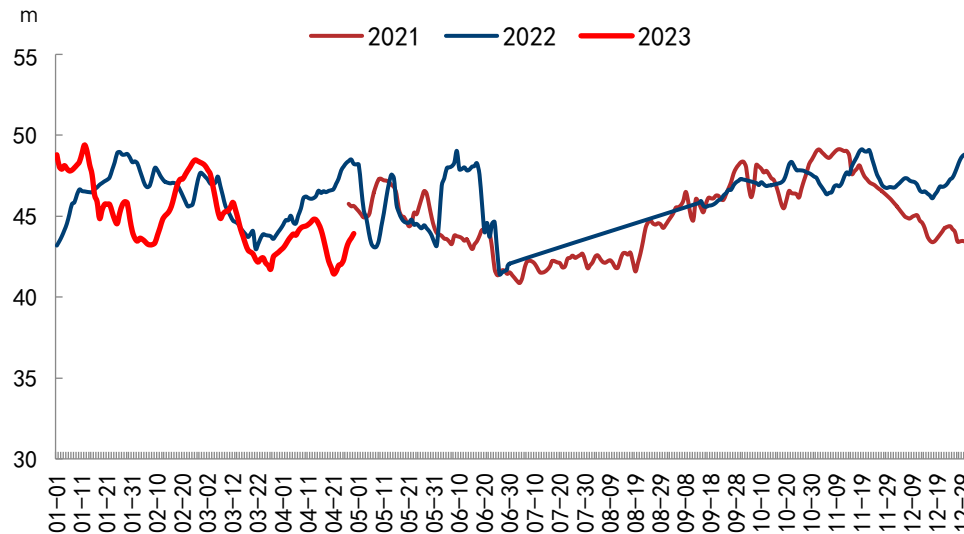
Xiluodu Reservoir: Water level: 8 a.m. (Day)



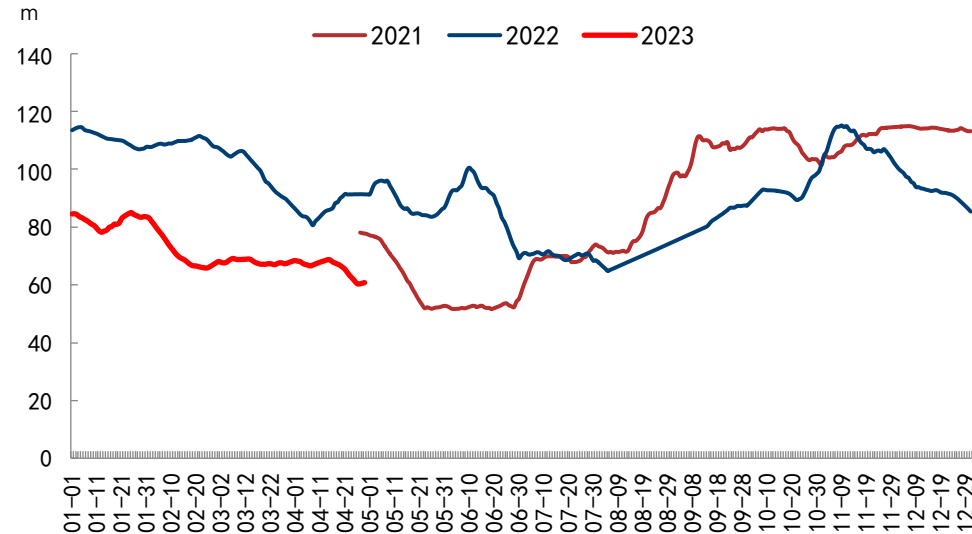
Xiangjiaba Reservoir: Water level: 8 a.m. (Day)



China: Pondage: Reservoir: Xiangjiaba

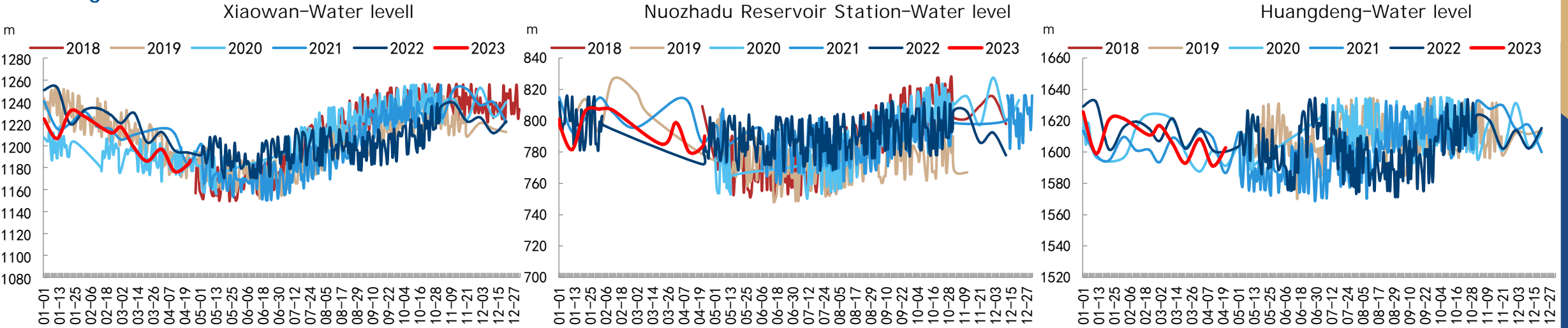


China: Pondage: Reservoir: Xiluodu

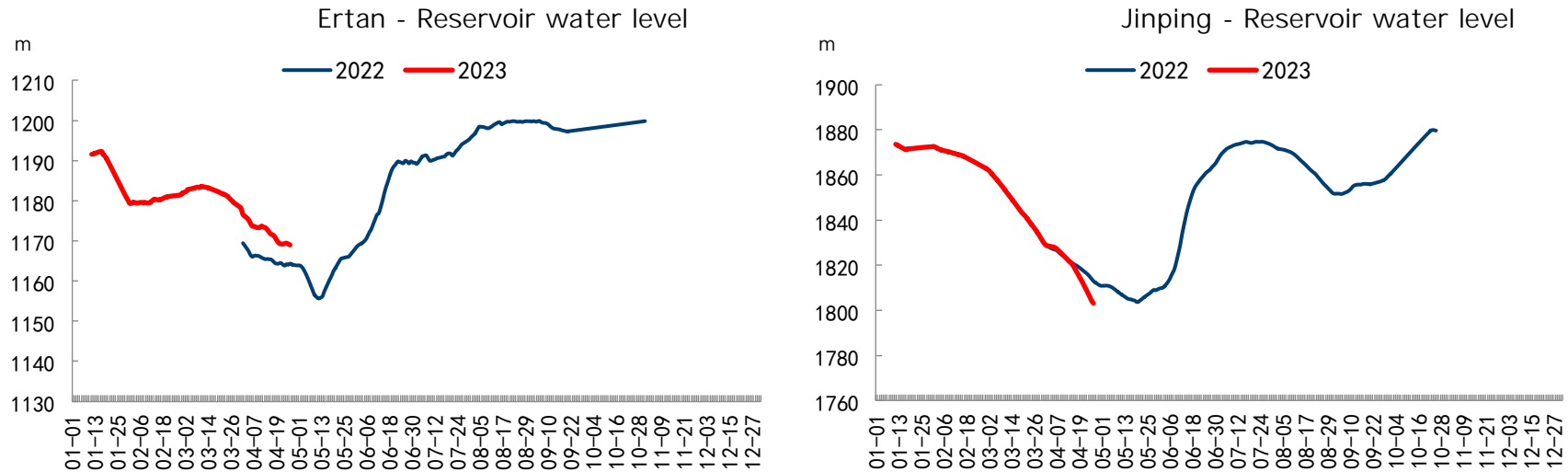


# Water Level Observation: Tracking of water level at major hydropower stations on Nujiang River in Yunnan, Yalong River in Sichuan

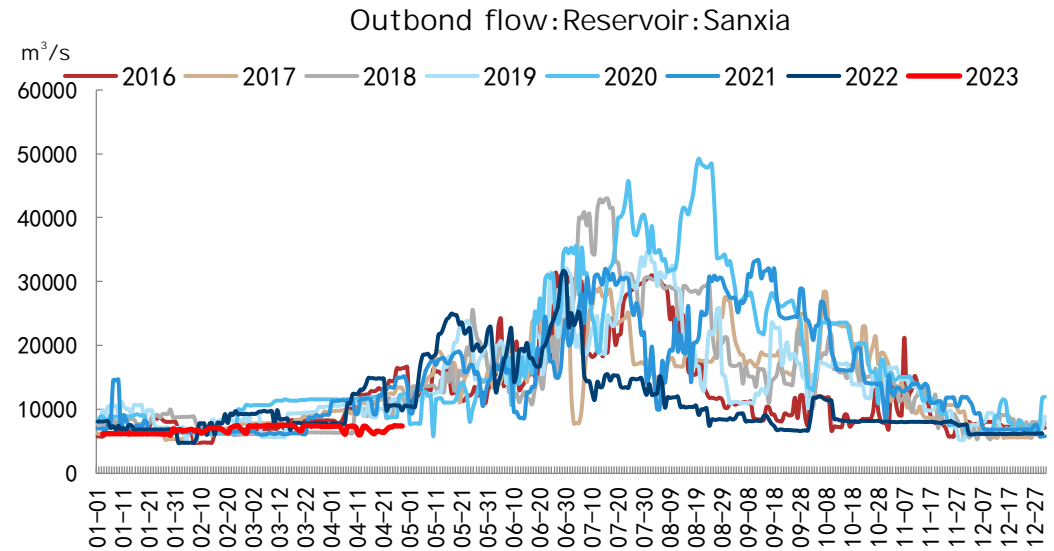
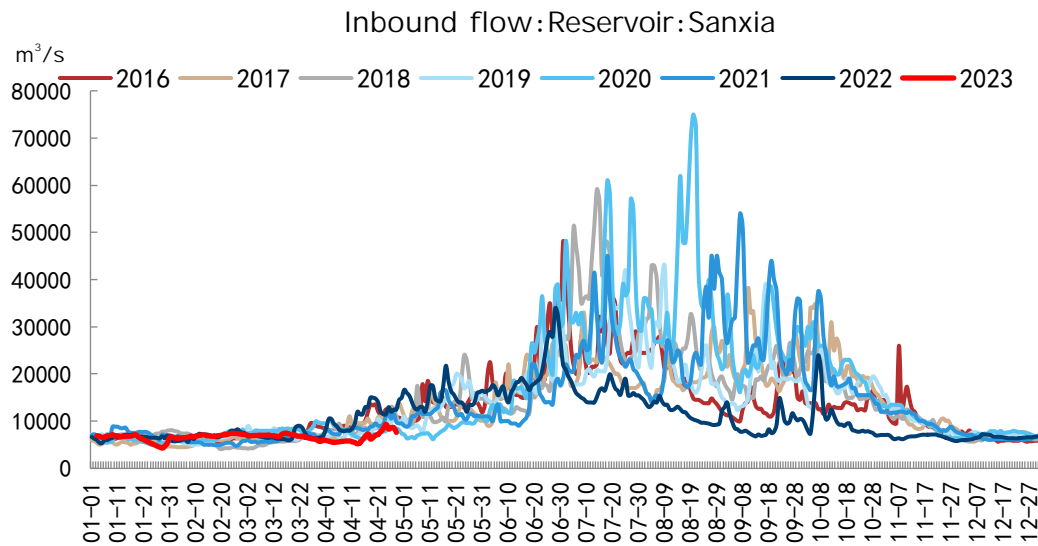
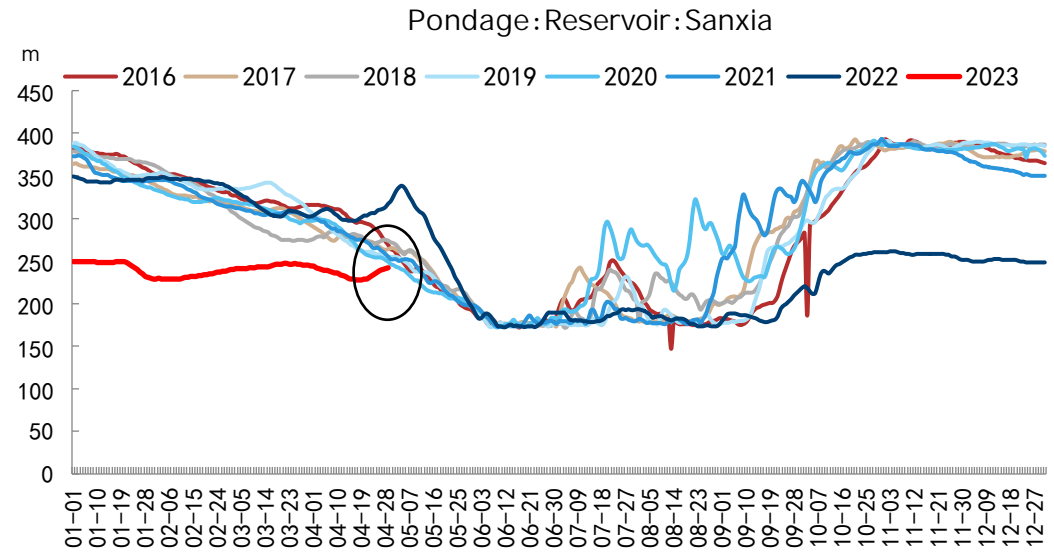
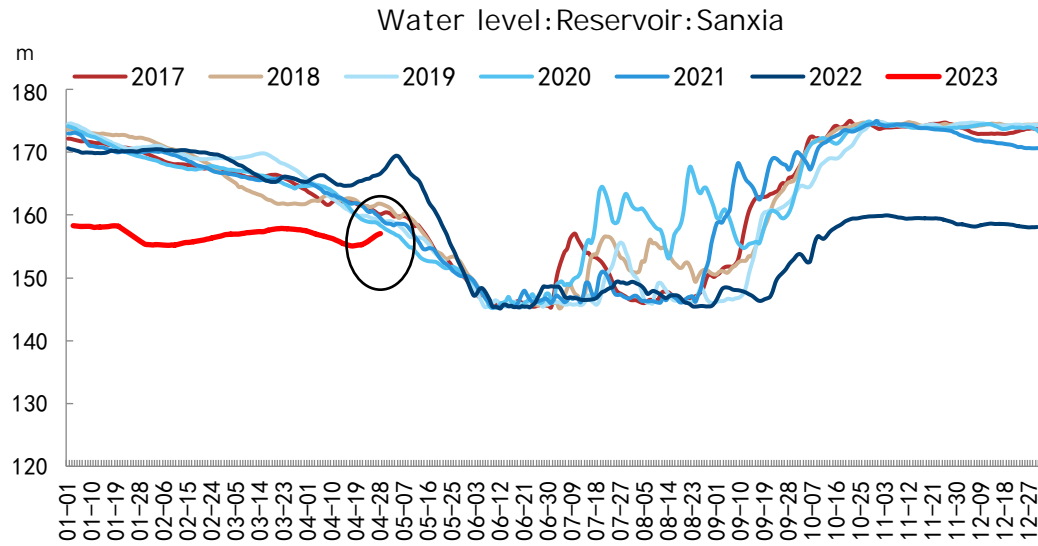
## Lantsang River:



## Yalong River:



# Water Level Observation: Tracking of water level, pondage, inbound and outbound flow of major hydropower stations on Yangtze river basin (downstream of Jinsha River)



# Long-term consideration: To what extent can Southwest hydropower be developed?

The Hengdun Mountains in the southwest are geological fault zones. If the unconstrained reservoirs are continuously superimposed one reservoir after another, it is still unknown what impact it will have on the geology of the southwest region as a whole.



The background features a dark blue gradient with a faint, semi-transparent financial candlestick chart. The chart shows price fluctuations with vertical bars and horizontal lines. Various numerical values are scattered across the background, including -0.15, 1683, 1800, 53.6, 18.3, 13.80, +1.89%, -0.36, and 1834133. A large white number '03' is prominently displayed on the left side, partially overlapping a blue and gold geometric shape that resembles a stylized arrow or a section of a chart.

03

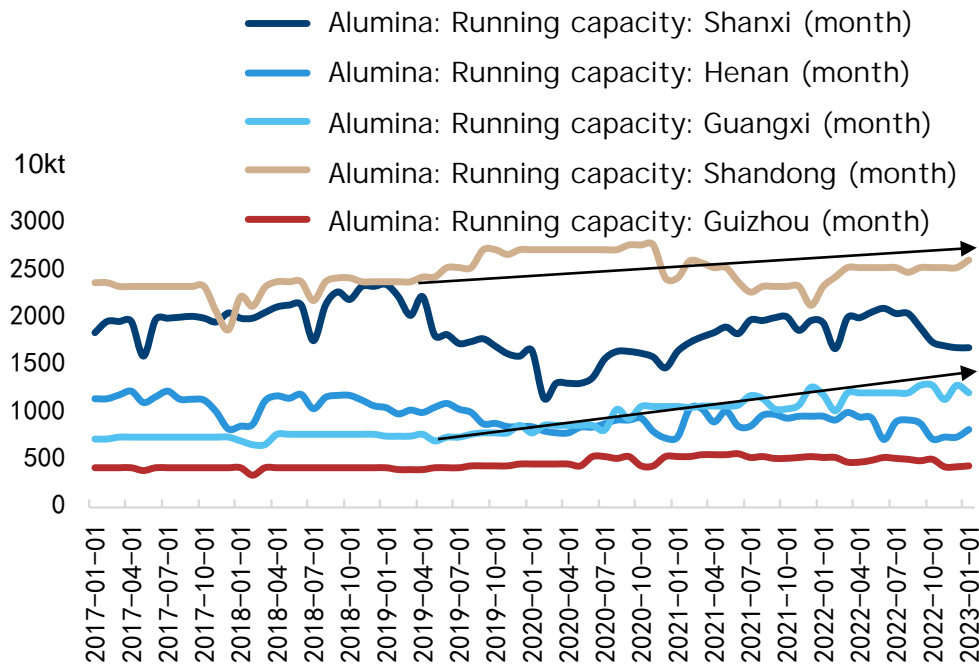
Spillover Effect of  
Southwest Hydropower on  
Alumina Capacity Pattern  
and Industry Cost



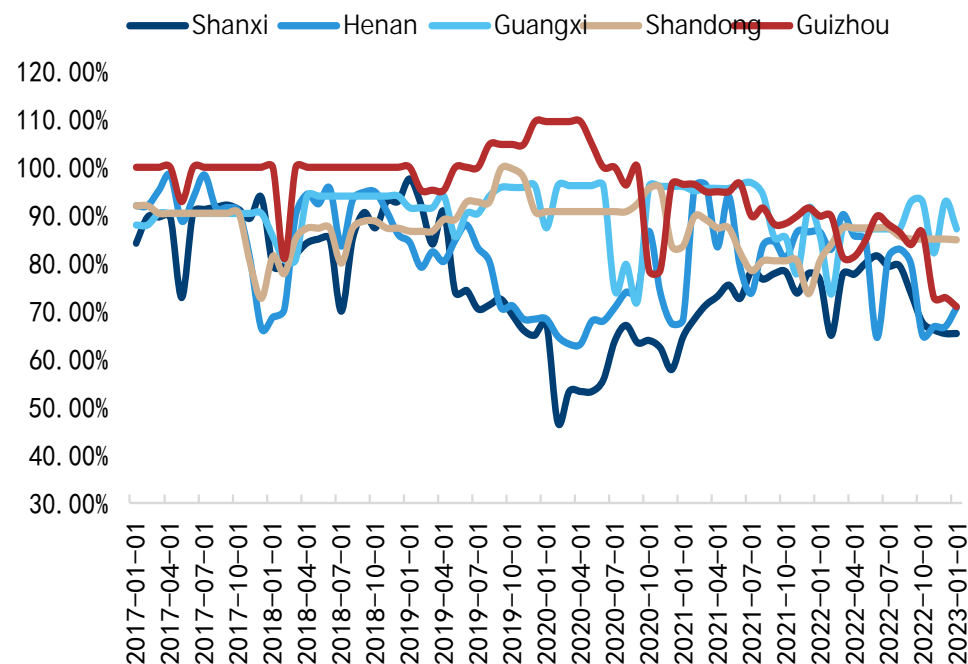
# Changes in China's alumina production pattern: "Retreating from west, advancing to east". Coastline is the new lifeline for alumina industry

- ◆ The changes in China's alumina production capacity pattern showed a clear trend of "retreating from the west and advancing to the east" in the past five years. The eastern coastal areas have gradually become the main force for the marginal release of alumina supply. This has a great positive correlation with the depletion of inland bauxite resources, the increasing emphasis on mining environmental protection and security inspection, and the increasing dependence on imports of ore.
- ◆ Judging from the operational capacity of alumina in the five main production areas of the country, the production capacity of Shanxi and Henan has dropped significantly since the beginning of 2019 (as a watershed), and the increase in production capacity mainly occurred in the coastal areas of Guangxi and Shandong. In terms of operating rate, Shanxi dropped sharply from 97.5% to 65.3%, Henan dropped from 84.4% to 70.8%, Guangxi and Shandong also saw a certain decline (due to the shrinking profits of the entire industry), but the range was relatively mild, falling from 91.6% to 87.1%, and from 86.6% to 84.8%, respectively.

Alumina production capacity increments appear in Guangxi and Shandong after 2019



Decline in operating rates in Guangxi and Shandong is relatively moderate after 2019



# Surplus alumina output in Guangxi basically flows to the southwest primary aluminum production area, and more are expected to go north in the future

- ◆ As the production of primary aluminum in Southwest China hits a bottleneck, more of the surplus alumina output in Guangxi would be supplied to the northern region.
- ◆ Taking shipments to Inner Mongolia as an example, if the alumina price difference between the north and the south (such as the price difference between Guangxi and Shandong) is RMB120/t (USD17.27/t) or more, the market will gradually shift to the "south-to-north shipment" model.

Alumina and Primary Aluminum Production by Region in 2022

Provinces	Alumina	Aluminum	Matching condition
Gansu	0	263.7	-506.3
Guangxi	1244	202.6	855.1
Guizhou	496.4	129.3	248.1
Henan	900.5	199	518.4
Inner Mongolia	46	606.5	-1118.5
Ningxia	0	119.2	-228.8
Qinghai	0	278	-533.8
Shandong	2438.2	796.7	908.6
Shanxi	1960.4	113.7	1742.1
Xinjiang	0	615.2	-1181.1
Yunnan	149.6	426.5	-669.4

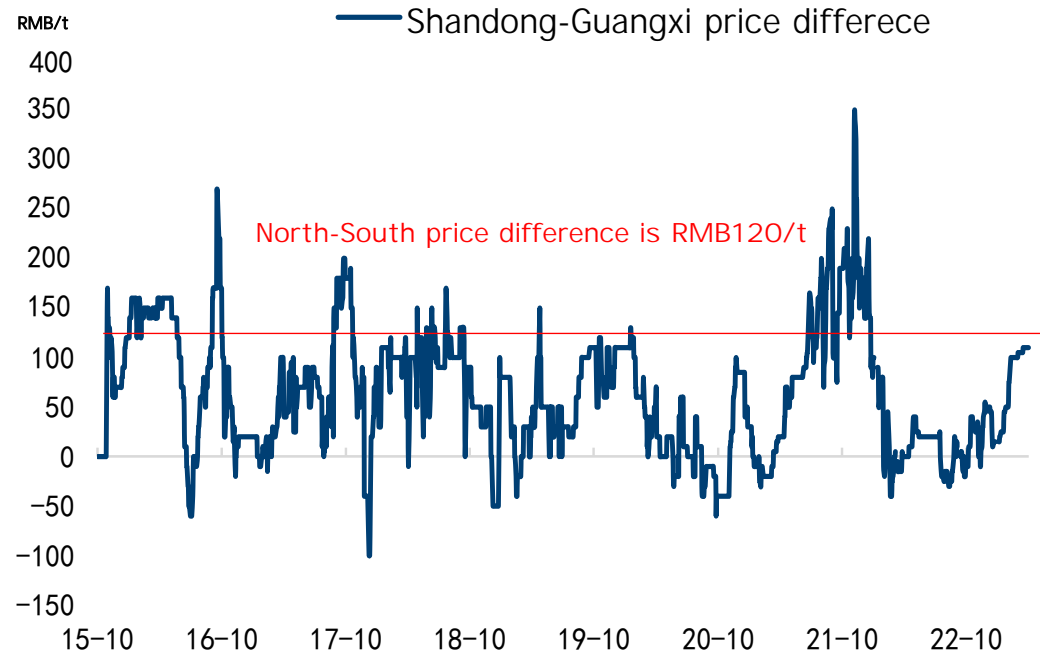
Alumina Trade Flow in China



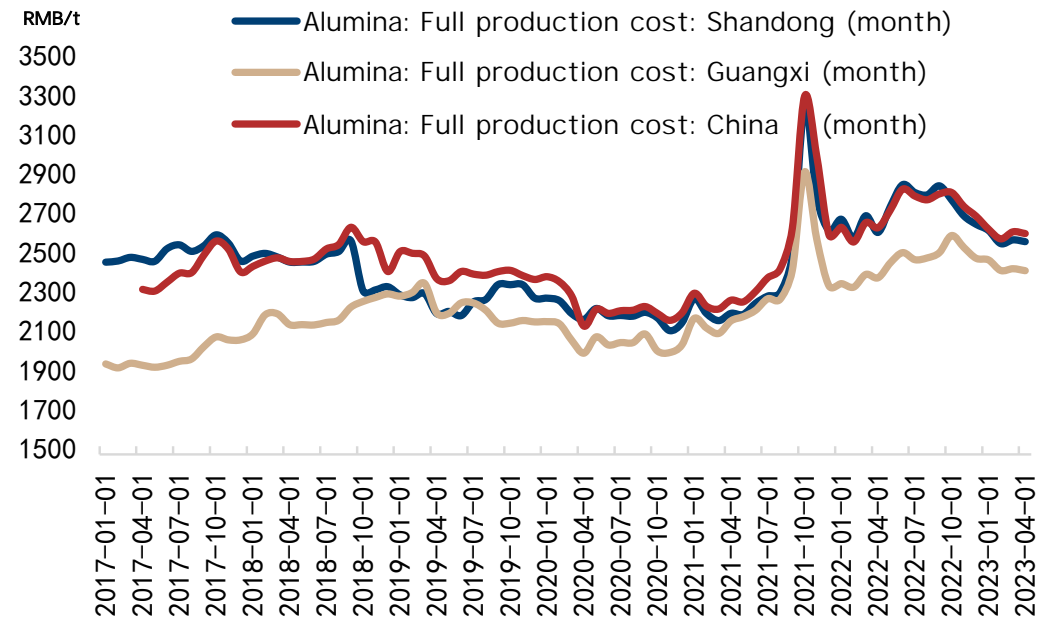
# The general trend of alumina cost pricing has not changed, but the use cost of primary aluminum smelter might be relatively raised

- ◆ If it is only based on microscopic supply and demand considerations, it is unlikely that the price of alumina will fall or rise in the future, and it will basically fluctuate around the cost line (observe the operation of the futures listing).
- ◆ Assuming that there is no bottleneck in the production of primary aluminum in Southwest China, given the current worries about the supply of water and electricity in Southwest China, the cost of alumina consumption in the primary aluminum industry as a whole may be relatively raised—*The proportion of raw materials that use long-distance transportation will increase (considering freight pricing); logistics will increase the degree of disturbance to supply and price.*

Alumina North-South Price Difference



The nationwide and regional cost center of alumina has not dropped significantly since 2017



04

## Conclusion and Outlook

# Conclusion and Outlook: How will hydropower crunch in Southwest China affect primary aluminum and alumina industries?

◆ **Primary Aluminum Certainty:** **Supply tends to be less stable**—power supply shortage. The transfer of primary aluminum production capacity to southwest production areas represented by Yunnan may be nearing an end. In addition, frequent reductions and resumptions of production also bring about an **increase in hidden costs**.

◆ **Southwest Hydropower Dynamic Tracking:** Short-term water supply improves, long-term concerns remain.

——Overall, the precipitation in the Qinghai-Tibet Plateau and the Lancang River Basin in Yunnan would improve slightly in the short term. However, since the water levels of Xiangjiaba and Xiluodu in Yunnan are lower than the same period in previous years, the overall hydropower generation in Yunnan may still be weaker than in previous years. **In the future, it is necessary to focus on the water inflow and storage in Yunnan.**

——Long-term consideration: To what extent can Southwest hydropower be developed? Has the global climate pattern reversed?

◆ **Spillover Effect of Southwest Hydropower on Alumina Capacity Pattern and Industry Cost**

——When primary aluminum production in Southwest China reaches the bottleneck, the mode of "south-to-north shipment" of alumina is likely to become the norm.

——The general trend of alumina cost pricing remains changed, but **the use cost of primary aluminum smelter might be relatively raised.**

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