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CHINESE ENGAGEMENT IN HYDROPOWER INFRASTRUCTURE IN SUB-SAHARAN AFRICA

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Abstract

Although some organizations have tried to track and analyze the scope of Chinese engagement in African hydropower, they have found it difficult to move beyond media reports, which are often inaccurate and can provide a misleading sense of the scale, pace, and nature of this engagement. We examined over 100 reported projects gleaned from media reports and lists compiled by organizations like AidData and International Rivers. In addition to our primary finding—that the Chinese are funding considerably fewer large hydropower projects than commonly believed—several of our other research findings also challenge widespread beliefs about Chinese practices. First, the Chinese are believed to make extensive use of resource-backed financing—future flow receivables transactions—in Africa, but we did not find this to be true for hydropower projects. Second, the Chinese are also widely believed to be able to move swiftly to finance and carry out projects. However, our research suggests that there can be significant lags in this process. Third, it is sometimes reported that the Chinese do not require environmental or social impact studies before undertaking a project. However, in our research we found that such studies are in fact often required. Fourth, Chinese companies are often thought to work in isolation, with little interaction between Chinese and Western companies, but at least some of the Chinese-financed projects that we identified have a European firm of consultant engineers overseeing the work. Fifth, it is often believed that Chinese companies bring in all their own labor. We found that projects normally do have a contingent of Chinese managers, engineers, and skilled technicians, but that they also hire large numbers of African workers. Finally, our research sheds light on the issue of competition. It is sometimes believed that China Eximbank does not allow countries to hold competitive tenders for projects that it finances. We did not find this to be the case for hydropower projects.

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Abbreviations and Acronyms

AfDB	African Development Bank
BC	Buyer's Credit
BOOT	Build–Operate–Own–Transfer
CARI	China Africa Research Initiative
CDB	China Development Bank
CGC	China Geo-engineering Corporation
CIRR	Commercial Interest Rate of Reference
CL	Concessional foreign aid loans
CMEC	China Machinery Engineering Corporation
CNEEC	China National Electric Engineering Corporation
Cocobod	Ghana Cocoa Board
Comilog	Ogooué Mining Company
CPI	China Power Investment Corporation
CWE	China International Water and Electric Corporation
DBSA	Development Bank of South Africa
DEC	Chinese Dongfang International Electric Corporation
EBC	Export Buyer's Credit
EEPCo	Ethiopian Electric Power Corporation
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ELC	Electro Consult
EPC	Engineering, Procurement, and Construction
Eximbank	China Export Import Bank
FMO	Dutch Development Bank
ICBC	Industrial and Commercial Bank of China Limited
IPP	Independent Power Project
IRENA	International Renewable Agency
ITPC	Itezhi-tezhi Power Corporation, Ltd.
LIBOR	London Interbank Offered Rate
MOFCOM	Ministry of Commerce of the People's Republic of China
MOU	Memorandum of Understanding
NDRC	National Development and Reform Commission
OECD	Organization for Economic Co-operation and Development
OMVS	Organization for the Development of the Senegal River
PEBC	Preferential Export Buyer's Credit
PROPARCO	Investment and Promotions Company for Economic Cooperation (France)
SC	Supplier's Credit
Sinomach	China National Machinery Industry Corporation
Sinosure	China Export and Credit Insurance Corporation
SOGEM	Manantali Energy Management Company
ZESCO	Zambia Electricity Supply Corporation Limited

1. Introduction and Overview

China's engagement in hydropower finance and construction in Africa has a long history. China began financing projects in the 1970s and 1980s in Guinea (Kinkon and Tinkisso), Congo (Bouenza), and Sierra Leone (Goma). In recent years Chinese banks and engineering companies have accelerated their engagement in African hydropower considerably. This paper provides an overview of Chinese philosophy and practice in financing and constructing large—over 50 megawatts (MW)—hydropower projects in sub-Saharan Africa, and outlines some of the institutional implications of this finance.

Although some organizations have tried to track and analyze the scope of Chinese engagement in African hydropower, they have found it difficult to move beyond media reports, which are often inaccurate and can provide a misleading sense of the scale and pace of this engagement. We examined over 100 reported projects gleaned from media reports and lists compiled by organizations like AidData and International Rivers (see Appendix I). With these sources as a starting point, we investigated each case further, dividing the projects into four groups: (1) those with at least some Chinese finance; (2) projects financed by others, but constructed by Chinese companies; (3) projects in which Chinese banks and companies continue to show active interest, but that have not (yet) been financed; and (4) those we classified as inactive, where the newest reports of Chinese interest or engagement are several years old. We eliminated duplicate reports where the same project was listed under different names, as well as cases where we could not find confirmation of any interest beyond a single, vague media report. Excluding these, we found a total of 51 cases where Chinese companies or banks showed a sustained interest in a large hydropower project between 2000 and 2013; 12 of these are now considered inactive.

Of the 51 cases we identified, we are confident that only 17 hydropower projects had commitments of at least some finance from Chinese banks by the end of 2013. When complete, these 17 projects will add approximately 6,771 MW of power in Sub-Saharan Africa. The total cost of these projects is about US$13.3 billion, of which Chinese finance is believed to contribute US$6.5 billion. However, the extent of Chinese contribution per project varies considerably. In the Upper Atbara project in Sudan, for example, the Chinese finance comes to only about 7 percent of the total project cost; the remaining costs are being met by the Sudanese government and by a group of Middle East financiers.

We can compare our findings to those of other data collection efforts (see Appendix I). The AidData project team identified 21 large hydropower projects in Africa as having commitments of finance from China, totaling US$8.8 billion.[1] While their estimate of Chinese finance is 35 percent higher than ours, they misclassified nearly 50 percent of these hydropower projects. We found no evidence of Chinese finance for 7 projects listed by AidData as having finance from China, and we found a further 3 projects with Chinese finance that were not identified by AidData. International Rivers listed 16 projects as having finance from China. However, we could not confirm 4 of these projects, and we found an additional 5 projects that were not on

their list. The 16 projects from International Rivers total US$12.2 billion.[2] We also compared our list with a list of "Chinese-funded power projects in Africa, 2010 – 2013" prepared over a year ago by Justin Lin and Yan Wang.[3] Of the 29 large hydropower projects that they reported as funded by China, we could only confirm 15, and we identified 2 projects that were not on their list.

Of the 17 projects we identified as having at least some Chinese finance commitment, China Export Import Bank (Eximbank) has been involved in all but one. Industrial and Commercial Bank of China, the world's largest bank, played a minor role in financing turbines for Ethiopia's Gilgel Gibe III. According to our research, the China Development Bank (CDB) has not yet played a role in financing hydropower projects in Africa, although it was involved in discussions over the public-private partnership proposed for Zambia's Kafue Lower Gorge project, and it is currently discussing financing the transmission lines for Mozambique's Mphanda Nkua dam as part of a package.[4]

The terms of China Eximbank finance for hydropower projects vary. We identified financing terms for eleven projects, one of which was financed after 2013, and one of which—Bui Dam—is funded through multiple loans. Most of the Chinese loans are preferential export buyer's credits or concessional loans, with a fixed interest rate of 2 percent, and a 20 year term usually with a five year grace period. During the grace periods only interest and fees are paid.[5]

In addition to the 17 projects with at least some Chinese finance commitment, Chinese companies are also building seven large hydropower projects that are being financed by other funders. These projects will total about 962 MW of new power. Some of the projects have government funding, such as the Tekeze project in Ethiopia, which was apparently fully funded by the Ethiopian government. Others, like Upper Atbara and several other dams in Sudan, are funded by a consortium of Middle East banks and funds. Most of the Chinese firms were contracted under ordinary, turn-key engineering, procurement and construction (EPC) contracts. However, some projects, such as Itezhi-Tezhi in Zambia, are being built under lump sum contracts financed by multiple banks and interests.

Overall, there is widespread misinformation and misunderstanding surrounding China's engagement in hydropower infrastructure projects in Africa. In addition to our primary finding—that the Chinese are funding considerably fewer large hydropower projects than commonly believed—several of our other research findings also challenge widespread beliefs about Chinese practices.

First, the Chinese are believed to make extensive use of resource-backed financing—future flow receivables transactions—in Africa, but we did not find this to be true for hydropower projects. One of the 17 aforementioned projects, the 120 MW Djibloho project in Equatorial Guinea, was apparently financed under a US$2 billion oil-backed credit line, while another, Grand Poubara, was originally part of a financing package arranged specifically for the Bélinga iron ore project.[6] The Bélinga project was later canceled, suggesting that this kind of package

comes with significant risk. Several other hydropower projects proposed to be financed by a resource-secured package—Kongou Falls (also called Bélinga) in Gabon, and Busanga in the Democratic Republic of Congo (DRC)—have also been delayed or canceled due to problems with the mining component.

Second, the Chinese are also widely believed to be able to move swiftly to finance and carry out projects. However, our research suggests that there can be significant lags in this process. For example, the first Chinese feasibility study for the Imboulou project was carried out in 1982, yet the project was not financed until 2003.[7] Sinohydro first began discussions on the Bui dam in 1998, but it took a decade to begin construction. Most Chinese financing requires the host government to supply 10 to 15 percent of the project cost up front, and sometimes construction firms begin the preliminary work while waiting for China Eximbank to appraise the project and approve a loan. Approval is not always forthcoming, which often creates confusion about the status of the project.

Third, it is sometimes reported that the Chinese do not require environmental or social impact studies before undertaking a project. However, in our research we found that such studies are in fact often required. China Eximbank sometimes commissions studies by a trusted European firm such as Pöyry, a Finnish consulting and engineering firm, or the UK-based consulting firm Environmental Resources Management, which conducted an impact study of the Bui Dam project.

Fourth, Chinese companies are often thought to work in isolation, with little interaction between Chinese and Western companies, but at least some of the Chinese-financed projects that we identified have a European firm of consultant engineers overseeing the work. For example, the German firm Gauff Engineering were consultant engineers on the Grand Poubara Dam in Gabon; the French firm Coyne et Bellier were the consulting engineers for the Bui Dam in Ghana; the Imboulou Dam in Congo had the German firm Fichtner as consulting engineers; and Lahmeyer International were the consultant engineers on the Upper Atbara dam in Sudan.

Fifth, it is often believed that Chinese companies bring in all their own labor. We found that projects normally do have a contingent of Chinese managers, engineers, and skilled technicians, but that they also hire large numbers of African workers. In 2010, Reuters Africa reported that China Machinery Engineering Corporation (CMEC), the contractor of the Imboulou Hydropower Project in the Republic of Congo, hired 2,000 Congolese, 400 Chinese, and 20 Germans. According to the Ghana Trade Union Congress, as of January 2013, "1,676 Ghanaians (including 22 women), 100 Chinese and 60 Pakistanis" had been employed in the construction of the Bui Dam.[8]

Finally, our research sheds light on the issue of competition. It is sometimes believed that China Eximbank does not allow countries to hold competitive tenders for projects that it finances. We did not find this to be the case for hydropower projects. It is true that many Chinese companies would prefer to get their projects without having to compete with other

firms, and the Eximbank will finance projects secured through limited or even no bidding.[9] However, the Eximbank does not stipulate in advance that no bidding will be allowed. In Uganda, for instance, China Eximbank agreed in advance to finance the Karuma dam, but required only that the work be done by a qualified Chinese company.[10] We found that Chinese contractors sometimes win projects under competitive tenders and then are unable to secure the financing, which can lead to problems. In Zimbabwe, for example, China Machinery Engineering Corporation won a bid for the Hwange thermal power station expansion, but was unable to secure funding within a year, and consequently had the tender cancelled before the contract was signed.[11] Moreover, it has been reported that Chinese companies do not compete with each other—another claim that we have not been able to substantiate through our research. Chinese companies have actually been known to each partner with a different Chinese financing partner in order to compete as a package. This happened in Ecuador's 1,500 MW Coca-Codo Sinclair project, where Sinohydro and China Eximbank competed against Gezhouba and China Development Bank.

The following sections of this paper examine the major Chinese players and financing practices in hydropower infrastructure in Africa. Section two examines five of the major Chinese firms that are engaged in African hydropower construction; section three provides a brief background of Chinese national hydropower practices; section four discusses Chinese hydropower financing practices in Africa; and section five outlines the major—over 50 megawatt—hydropower projects in sub-Saharan Africa with a Chinese finance or construction connection between 2000 and 2013. Finally, this paper concludes with eight case studies that serve as illustrative examples of the relationships between the myriad parties engaged in financing and building these hydropower projects.

2. Major Chinese Construction Firms in Hydropower

Five major Chinese firms are active in hydropower construction in Africa.

SINOHYDRO

Sinohydro is a Chinese state-owned hydropower engineering and construction company. In 2013, the company was ranked 14th on the Engineering News-Record (ENR) list of the top 250 international contractors based on its revenue of RMB 26.3 billion (approximately US$4.2 billion[a]).[12] Sinohydro provides services from project consultancy, financing, surveying, design, and engineering to construction, fabrication, installation, and operation in power, hydropower, transportation, and municipal projects in China and overseas. Since 2000, it has acted as the main contractor for approximately 50 percent of the Chinese-financed and/or constructed hydropower projects in Africa, cementing its position as the primary Chinese contractor involved in African hydropower construction.

[a] All RMB/USD exchange rates calculated at the current rate of 6.21 as of August 9, 2015

GEZHOUBA (CGGC)

China Gezhouba Group Corporation was initially founded in 1970 to plan and construct Gezhouba, the first large-scale hydropower project in China. Today it has transformed into one of the largest construction companies in the world, ranking 71st on the ENR list as of 2011, with business in over 35 countries. A state-owned firm, Gezhouba is the second-largest Chinese construction company active in hydropower construction in Africa. It has undertaken several key projects including Finchaa-Amerti-Neshe, Tekeze, and Genale-Dawa III in Ethiopia, and Kapichira Phase II in Malawi, and has been in active discussions regarding several other projects in Sudan and South Sudan.

THREE GORGES CORPORATION

China Three Gorges Corporation was founded in 1993 to manage the planning and construction of the Three Gorges Project in China. The company is a wholly state-owned enterprise specializing in large-scale hydropower development and operation. Its principal operations include hydropower project engineering, construction and management, electricity production, and provision of related technical services. Only in the last five years has the company started to bid for projects in Africa. It was selected as the EPC contractor for a handful of projects including Kaleta in Guinea and Upper Atbara in Sudan.

CHINA INTERNATIONAL WATER AND ELECTRIC CORPORATION (CWE)

China International Water and Electric Corporation, a wholly-owned subsidiary of China Three Gorges Corporation, is another leading player in China's hydropower industry. CWE specializes in overseas engagement, and can trace its history back more than 50 years to its origins as an international engineering company affiliated with the Chinese Ministry of Water Conservancy and Electric Power responsible for carrying out China's overseas foreign aid projects. In addition to expertise in hydropower construction, the company has diversified into other types of infrastructure projects including transmission lines, roads and bridges, and ports. In Africa, CWE is involved in the construction of Kaleta in Guinea and Upper Atbara in Sudan as part of the Three Gorges group. In 2012, CWE lost the contract of the Karuma project in Uganda to Sinohydro due to alleged procurement corruption.

CHINA MACHINERY ENGINEERING CORPORATION

China Machinery Engineering Corporation emerged out of the reorganization of its predecessor, China National Machinery & Equipment Import & Export Corporation, which was also active in China's foreign aid program. Founded in 1978, CMEC was the first large engineering and trade company in China, and was listed on the Hong Kong stock exchange in 2012. For many consecutive years, CMEC has been ranked among China's top 10 contractors by the Chinese Ministry of Commerce based on revenue from overseas contract projects.

3. Chinese Practices in Building National Water Infrastructure

Chinese expertise in hydropower infrastructure can be traced to the country's own efforts to develop hydropower resources. Driven by the imminent need to fuel economic growth, and simultaneously constrained by limited access to sources of conventional energy, China resorted to hydropower to meet its demand for electricity. China's first hydropower project, Shilongba Hydropower Station, was constructed in 1910 and became operational in 1912. However, hydropower did not start to take off in China until the 1970s due to warfare, political instability, and lack of financing and technological capabilities.

Two key milestone projects—Gezhouba and Three Gorges—marked the rise of China's hydropower development. Construction of the 2,715 MW Gezhouba, China's second largest hydropower project, began in 1974 and concluded in 1988, costing RMB 4.848 billion (approximately US$777 million). The Three Gorges Dam, with 22,500 MW installed capacity and an estimated cost of RMB 180 billion (approximately US$29 billion), started construction in 1994 and began operation in 2003, and is now the world's largest hydropower project. As of the end of 2012, China's total installed capacity from hydropower reached 249,000 MW, representing 22.6 percent of total power generation capacity.[13]

FINANCING: GRADUAL DECENTRALIZATION AND PRIVATIZATION

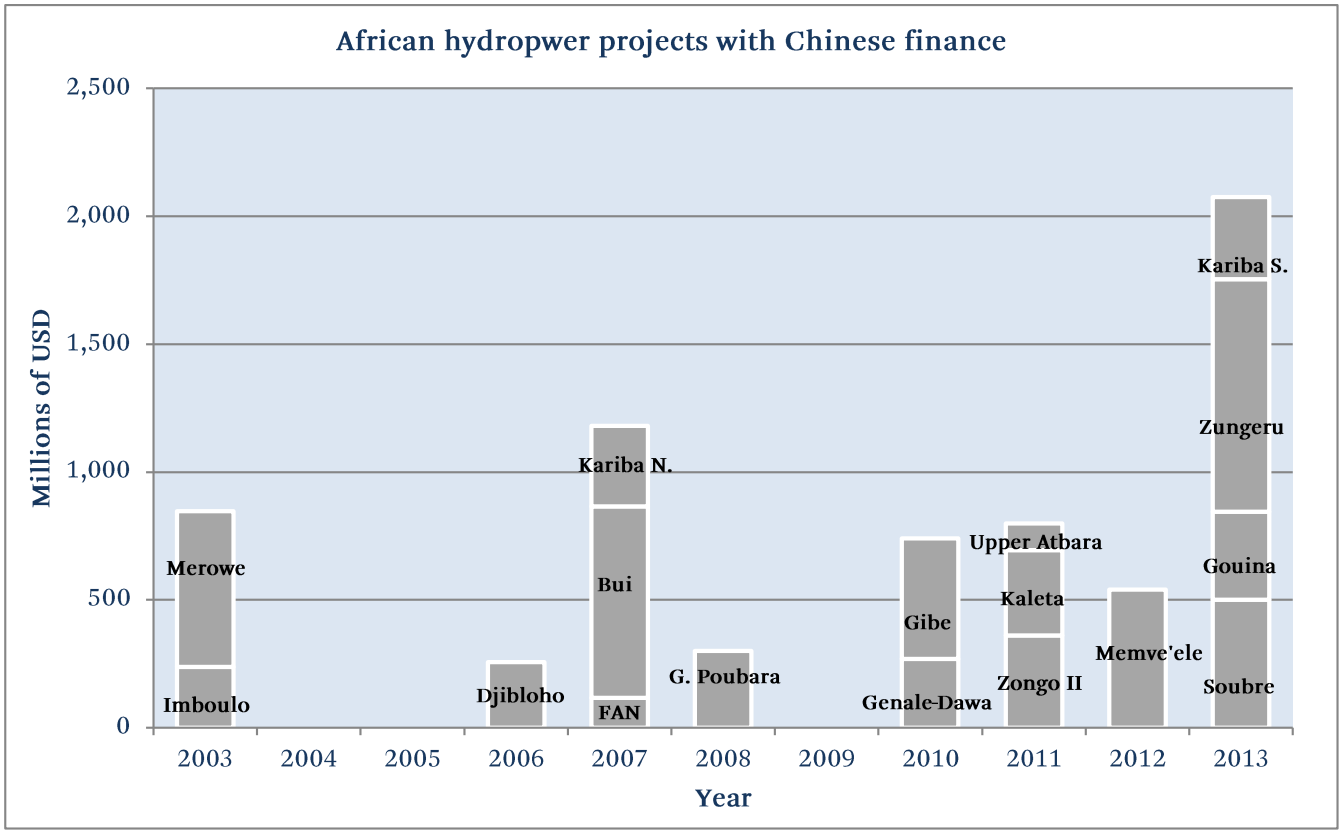
When China first started its hydropower construction spree in the 1970s, the central government assumed ownership and financing responsibility for the projects by providing direct funding through a five-year plan. When China Development Bank was established in 1994 as a policy bank, one of its missions was to support the development of key projects of strategic importance, including hydropower projects.

Against the backdrop of the rapid development of China's capital market, hydropower projects increasingly started to utilize market-based alternatives to financing such as equity and debt financing from private sector institutional and retail investors. China Gezhouba Group Corporation, initially founded for the construction of Gezhouba, has evolved into a holding company owning, building, and operating a portfolio of hydropower projects both domestically and overseas. Their publicly-listed CGGC Ltd. subsidiary provides access to capital markets to raise equity financing for ongoing and planned construction of other hydropower projects in its portfolio.

4. Chinese Hydropower Financing Practices in Africa

Chinese hydropower construction projects in Africa can be financed by international funds, host government funds, or through Chinese loans. China Eximbank is China's official export credit agency, and China's primary financier of hydropower projects in Africa. Between 2003 and 2014, China Eximbank provided at least some finance for 19 large-scale (over 50 MW) hydropower projects in Africa, sometimes as sole financier, and sometimes as part of a consortium. China's largest commercial bank, Industrial and Commercial Bank of China (ICBC), financed the electro-mechanical works for the Gigel Gibe III project in Ethiopia. We have not seen any hydropower projects financed by China's other major policy bank, China Development Bank, in Africa.[14]

Figure 1: Value of Chinese-financed hydropower projects in Africa, 2003 - 2013



China Eximbank has four types of loan instruments: export seller's credits, export buyer's credits, preferential export buyer's credits (PEBC), and concessional foreign aid loans (CL). The latter two have subsidized interest rates. China Eximbank is the only Chinese bank authorized to provide loans with interest rates subsidized by the Chinese government. Concessional foreign aid loans require a loan framework agreement signed between the two governments, providing a sovereign guarantee, while export buyer's credits can be signed

directly with the agency approved to borrow. Export seller's credits are lent to the hydropower company, which then negotiates the finance directly with the client.

The dominant loan instrument China Eximbank uses for hydropower finance in Africa is the export buyer's credit, which is sometimes subsidized ("preferential"), and is usually offered in foreign currency, most often US dollars. As described by China Eximbank in 2008, export buyer's credits are usually issued at competitive commercial interest rates that parallel the rate set for China's government bonds:

> The operations generally follow the Arrangement on Guidelines for Officially Supported Export Credits as developed by OECD...The interest rate could be either a fixed interest rate on the basis of the Commercial Interest Reference Rate (CIRR) as monthly announced by OECD, or a floating interest rate on the basis of London Interbank Offered Rate (LIBOR) plus a certain interest rate spread. For special cases, the interest rate could be negotiated and decided between the lender and the borrowers.[15]

The Chinese government sometimes provides offers of large lines of export credit on pre-arranged terms that can be drawn on to finance various projects. These special state loans are first negotiated between the Chinese banks and the China Export and Credit Insurance Corporation (Sinosure). They usually require a sovereign guarantee from the host government's Ministry of Finance. Risks for these lines of credit can be lowered with the requirement that repayment be secured via exports channeled through an escrow account (this system can, in some cases, substitute for a sovereign guarantee).[16]

Loans issued under these lines of credit are usually for less than 20 years, and include a grace period covering the construction period, and use an interest rate of LIBOR plus a margin. The advantage is that approval time is much faster, usually about six months, as the terms of the finance are pre-negotiated. However, these large lines of credit are relatively rare in Africa. The majority of the hydropower projects we studied were financed as stand-alone projects, usually by preferential export buyer's credits in dollars, with a 20 year term and a fixed interest rate of 2 percent (Table 1).

Project owners generally apply for the export credit before the EPC contract is signed, although they sign the loan agreement only after the EPC contract. Most projects require the owner to advance at least 10 percent of the cost of the project to the contractor, and this is not normally covered by the Chinese export buyer's credit, which generally only finances 85 percent of the project costs. These advance payment requirements are often a stumbling block for poor countries, leading to delays in project execution. Export credits need to be approved and insured by Sinosure, and are advanced to the contractor in installments, on instruction from the project owner. Some hydropower loan financing packages, such as the finance for Bui Dam (discussed further in detail in section six below), have also used concessional foreign aid loans,

which are usually issued in RMB, but this appears to be relatively rare. A concessional foreign aid loan can cover 100 percent of the project costs.

Table 1: Terms of Chinese finance for hydropower projects

Year	Country	Project Name	Lenders	Type of Credit	Chinese Finance (US$ millions)	Interest Rate	Term (Grace Period)
2003	Rep. Congo	Imboulou	Eximbank	SC	238	n/a	15
2006	Eq. Guinea	Djibloho	Eximbank	Framework	257	5.5%	5 (2)
2007	Ghana	Bui Dam	Eximbank	CL	306	2%	20 (7)
2007	Ghana	Bui Dam	Eximbank	BC/SC	292	6.13% (CIRR)	17 (5)
2010	Ethiopia	Genale-Dawa III	Eximbank	EBC	270	2.43%	12 (3)
2010	Ethiopia	Gibe III Electric- and Hydromechanics	ICBC[1]	PEBC	235	3.067%	11 (4)
2011	DRC	Zongo phase II	Eximbank	PEBC	360	2%	20
2012	Ghana	Bui Dam	Eximbank	PEBC/CL	75	2%	20 (5)
2012	Ghana	Bui Dam	Eximbank	-	76	0%	14 (2)
2013	Guinea	Kaleta	Eximbank	PEBC	335	"33% grant element"	
2013	Côte d'Ivoire	Soubre	Eximbank	loan	500	2%	20 (9)
2013	Nigeria	Zungeru	Eximbank	PEBC	910	2.5%	20
2013	Zimbabwe	Kariba South	Eximbank	CL/PEBC	320	2%	20 (5)
2014	Uganda	Isimba	Eximbank	CL	482.5	2%	20 (5)

Note: Not all projects have loan terms available; only those with loans terms are included in this table.

1. Interviews with the Ethiopian Electrical and Power Company (EEPCo) and with the Ethiopian Ministry of Finance and Economic Development (MOFED) yielded conflicting results, with EEPCo attributing all financing to ICBC, and MOFED attributing all funding to Eximbank. We reconciled the two sources as much as possible, and attributed Tranche A to ICBC, funding the electric- and hydro-mechanic works, and Tranches B & C to Eximbank, which funded the transmission lines and substations, which are not covered in this report.

Chinese contractors can also finance projects through export seller's credits, although this is far less common.[17] In this case, the contractor provides the funding directly, drawing on their own resources and/or on loans or strategic credit facilities provided to them by Chinese banks as part of the "Going Out/Going Global" strategy. A 10 percent advance payment is required. The contractor takes out an insurance policy with Sinosure directly, and sometimes also arranges a guarantee from their parent company. CMEC has used export seller's credits for projects in Angola, the Republic of Congo, and Sudan. In 2003, CMEC financed at least part of the Imboulou hydropower project in Congo-Brazzaville through an export seller's credit.

Chinese banks normally require the project owner to buy export credit insurance from Sinosure (with the bank as beneficiary). Sinosure might require a separate guarantee. Clients can also secure the loan directly with a guarantee in favor of the financing bank. The finance for Imboulou was apparently secured by Congolese oil exports to China.[18]

CHINESE CONTRACTORS' ROLE IN FUNDING

Chinese companies secure projects through one of three processes: tender negotiations, tender invitations, or public bid invitations. Tender negotiations are private and non-competitive, with terms that are negotiated between the two parties. Tender and public bid invitations involve predetermined terms for the contract and technical qualifications. Tender invitations involve targeted invitations to a pre-defined group of qualified engineering contractors, while public bid invitations are open to all contractors.

The public offering of CMEC provides some insight into their global experience: 73.6 percent of CMEC's projects were obtained through tender negotiations (议标), 16 percent through tender invitation (邀标), and 10.4 percent through public bid invitation (招标).[19] Thirty-five percent of CMEC's engineering contracting business comes from Africa.[20]

CMEC notes that one of its advantages is that it "can assist project owners in obtaining financing for projects from the PRC [People's Republic of China] financial institutions…which further enhances our chances of winning project bids. At an initial stage, we can enter into discussions with financing banks on the availability or terms of the export seller's credit or export buyer's credit."[21] Although preliminary loan discussions can occur before the tender process, project EPC contracts have to be signed before loan negotiations can actually commence.

ENVIRONMENTAL AND SOCIAL GUIDELINES

In 2007, China Eximbank published its "Guidelines for Environmental and Social Impact Assessments."[22] Influenced by China's "Green Credit" policies, the bank requires an environmental impact assessment (EIA) to be conducted, based on the host country's environmental policies and standards. However, if the host country's policies are not "complete" then the assessment should be based on China's own standards or international practice. Contractors should "openly consult" the public when projects have serious negative environmental impacts, and they should handle resettlement "properly."

If necessary, independent experts are hired by China Eximbank to review the borrower's environmental and social impact assessment report. Borrowers may be required to amend their proposals based on the results of these assessments, and China Eximbank can require that environmental and social responsibilities be included in the loan contract. If borrowers do not mitigate serious environmental and social problems caused by the project, China Eximbank reserves the right to stop loan disbursements and require early repayment. It is not

known how strict China Eximbank has been in applying these guidelines, although International Rivers has reported that concerns about environmental impact may have led China Eximbank to refuse to finance Gabon's Belinga Dam.[23]

NDRC AND STATE COUNCIL APPROVAL

Under rules approved in 2014, China's National Development and Reform Commission (NDRC) reviews and approves large overseas projects—those exceeding a value of US$300 million. Once a deal has reached the "binding" offer stage, NDRC reviews the terms and approves the investment. Investments or loans of any size in "sensitive industries," as well as projects above US$1 billion must be approved by China's State Council. Cross-border water development is included in the list of sensitive industries.[24]

5. Projects Overview

We investigated 107 water and power projects that were reported by at least one source to have had commitments of Chinese finance between 2000 and 2013 (Table 2). Of these, we found 17 large hydropower projects that we could confirm had finance from China. Another 6 had other sources of finance, but were being implemented by a Chinese contractor. Fourteen projects were still under active discussion for Chinese involvement, while 13 others once had an EPC contract or another arrangement with a Chinese firm, but have since stalled, been abandoned, or never obtained finance.

Table 2: Overview of projects

Category	# of Projects	Definition
Included in the scope of this paper		
China-financed	17	Firm evidence Chinese companies contracted and Chinese banks committed to finance
China-contracted	6	Contracted or constructed by Chinese firms but financed by non-Chinese entities
Active discussion	16	Chinese involvement being discussed as of Jan. 1, 2012 to present. Some projects have contracts
Inactive	12	Chinese construction contract but no finance; Stalled; No new reports since Dec. 31, 2011
Sub Total	51	
Excluded in the scope of this paper due to size, type of project, or lack of Chinese involvement		
<50MW	31	Hydropower projects under 50MW
Other water projects	7	Water projects mistakenly listed as hydro
Non-China inactive projects	16	No contract. No reports of active discussion of finance since Dec. 31, 2011.
Unidentified	2	AidData mentioned projects that cannot be tracked down because they are lacking key information such as name or size
Sub Total	56	
Total	**107**	

For each of the projects included in the scope of this paper, we collected key information including: capacity (in terms of MW), type and amount of credit, project cost, Chinese financiers, other financiers, contractors, and project start and completion date, to the extent information is available in the public domain. Tables 3, 4, and 5 below highlight the results of this research.

Table 3: Chinese-financed and contracted hydropower projects

#	Year Loan Signed	Country	Project Name	Total MW	Added MW	Chinese Lender	Type of Credit	Total Cost (US$ millions)	Chinese Financing (US$ millions)	Chinese Financing (%)
1	2012	Cameroon	Memve'ele	200	200	Exim.	EBC	637	541	85%
2	2011	DRC	Zongo II	150	150	Exim.	PEBC	368	360	98%
3	2006	E. Guinea	Djibloho	120	120	Exim.	EBC	257	257	100%
4	2007	Ethiopia	Finchaa-Amerti-Neshe	97	97	Exim.	EBC	155	116	75%
5	2010	Ethiopia	Genale-Dawa III	254	254	Exim.	EBC	451	270	60%
6	2010	Ethiopia	Gilgel Gibe III	1870	1,870	ICBC	PEBC	1888	234	25%
7	2008	Gabon	Grand Poubara	160	160	Exim.	CL/PEBC	398	300	75%
8	2007	Ghana	Bui	400	400	Exim.	CL&EBC	810	750	93%
9	2011	Guinea	Kaleta	240	240	Exim.	CL/PEBC	446	335	75%
10	2013	Côte d'Ivoire	Soubre	275	275	Exim.	loan	600	500	83%
11	2013	Mali	Gouina	140	140	Exim.	EBC	430	345	80%
12	2013	Nigeria	Zungeru	700	700	Exim.	PEBC	1300	910	70%
13	2003	R. Congo	Imboulou	120	120	Exim.	SC	307	238	78%
14	2003	Sudan	Merowe	1250	1,250	Exim.	EBC	2945	608	32%
15	2011	Sudan	Upper Atbara	135	135	Unclear	Mixed	1575	104	7%
16	2007	Zambia	Kariba North Exp.	1808	360	Exim.	EBC	420	315	75%
17	2013	Zimbabwe	Kariba South Exp.	800	300	Exim.	CL/PEBC	355	320	90%
		Totals			**6,771**			**$13,341**	**$6,503**	

Table 4: Projects with Chinese contractors, but no Chinese finance

#	Contract Year	Country	Project Name	Total MW	Added MW	EPC Contractor	Reported Funder	Total Cost of Project (US$ millions)
1	2002	Ethiopia	Tekeze	300	90	Sinohydro, Gezhouba	Ethiopian	365
2	2007	Kenya	Sondu-Miriu	60	60	Sinohydro-Tianjin Engineering	JBIC, Kengen	218
3	2010	Malawi	Kapichira Ph. II	130	64	Gezhouba	Malawi	55
4	2009	Mali	Felou	63	63	Sinohydro	Multiple: WB, EIB, Société de Gestion du Barrage de Manantali (SOGEM); Mali, Guinea, Mauritania and Senegal governments	115
5	2008	Sudan	Roseires Dam Phase II	1800	565	CIWEC	Multiple: Arab Fund, Islamic Development Bank, Kuwaiti Fund for Economic Development, OPEC Fund, Abu Dhabi Fund for Development, Government of Sudan	505
6	2009	Zambia	Itezhi-Tezhi	120	120	Sinohydro	Multiple: AfDB, Dutch Development Bank FMO, the Development Bank of Southern Africa (DBSA) and Propaco of France, India Eximbank	350
			Totals		**962**			**$1,608**

Table 5: Projects under active discussion (after January 2012)

#	Year of Last Word	Country	Project Name	Total MW	EPC Contractor	Description & Comments
1	2015	Benin (Togo)	Adjarala Dam	147	Sinohydro	Hydropower plant
2	2015	DRC	Inga 3	4,800	None	Part of the Grand Inga project
3	2014	Ethiopia	Geba	371	Joint Sinohydro, Gezhouba & Ethiopian SUR Construction	
4	2014	Kenya	High Grand Falls	700	CSCEC	Multi-Purpose
5	2015	Namibia	Baynes/Orokawa	600	"Chinese"	Hydropower plant
6	2015	Nigeria	Gurara 2	360	None	Multi-Purpose
7	2012	South Sudan	Biden	540	Gezhouba	Hydropower plant
8	2013	Sudan	Kajbar Dam	300	None	
9	2013	Tanzania	Masigira	118	Sinohydro	Hydropower plant
10	2013	Tanzania	Rumakali	222	Gezhouba	Hydropower plant
11	2014	Tanzania	Mpanga	144	Sinohydro	Hydropower plant
12	2013	Uganda	Ayago	600	Gezhouba	Hydropower plant
13	2014	Zambia	Lusiwasi Lower	86	Was CNEEC, contract rescinded	Hydropower plant
14	2013	Zimbabwe and Zambia	Batoka Gorge	2,400	None	Hydropower plant
15	2014	Uganda	Karuma	600	Sinohydro	Hydropower plant
16	2014	Uganda	Isimba	183	CWE	Hydropower plant

Table 6: Inactive projects (no progress since December 2011)

#	Latest Year of News re: Chinese Engagement	Country	Project Name	Total MW	Reported EPC Contractor
1	2011	DRC	Semuliki	72	Sinohydro
2	2015	DRC	Busanga	240	Sinohydro
3	2009	Ethiopia	Gigel Gibe IV	2000	Sinohydro
4	2009	Ethiopia	Halele Werabesa	422	Sinohydro
5	2015	Ethiopia	Chemoga-Yeda	278	Sinohydro
6	2013	Gabon	Belinga Dam	50	CMEC
7	2007	Guinea	Souapiti dam	515	CPI, Sinohydro
8	2015	Nigeria	Mambilla	3050	CGGC/CGC
9	2011	Nigeria	Zamfara Dam	100	CGC
10	2014	Sudan	Shereik	420	Gezhouba
11	2012	Zambia	Kalungwishi	219	CNEEC
12	2014	Zambia	Kafue Gorge Lower	750	Sinohydro

6. Case Studies

The case studies in this section were researched using existing desk resources. They provide further detail on financing and implementation, or raise issues that we believe are useful to explore further.

BUI DAM, GHANA

Plans for Ghana's Bui Dam have been around for nearly 100 years. Ghana originally tendered for the Bui dam in 2002, but received only one bid and did not proceed with plans. Subsequently, Sinohydro was able to obtain an MOU on the project in 2005, and a no-bid EPC contract in 2007. The finance for Ghana's 400 MW Bui Dam is not typical, but provides a well-studied example of how some hydropower projects employ packages that combine several kinds of financing instruments and security.[25]

Bui Dam was financed by Ghana's government and by four Chinese loans. The first two were negotiated successively: first, a commercial-rate export buyer's credit of US$292 million signed in September 2007 with a 17 year maturity, five-year grace period, and a rate of CIRR plus a margin of 0.75 percent,[26] and second, a concessional foreign aid loan of RMB 2.1 billion (US$306 million) signed in September 2008 with a 20 year maturity, seven-year grace period, and a fixed interest rate of 2 percent.[27] Two additional loans were later negotiated in 2012 to pay for cost overruns on the dam: a US$75.4 million loan at an interest rate of 2 percent for 20 years, with a five-year grace period, and a US$76.2 million loan at a zero percent interest rate, for 14 years, with a two-year grace period.[28]

The Chinese funding is secured through a "future flow receivables" arrangement based on cocoa, and an electricity "off-take arrangement."[29] The cocoa security is arranged through a sales agreement between Genertec Corporation of China and the Ghana Cocoa Board (Cocobod) for up to 40,000 metric tons (Mt) of cocoa beans (30,000 main crop; 10,000 light crop) annually for the first five years of the loan.[30] The cocoa beans will be sold at the prevailing market price, and the proceeds placed in an escrow account with China Eximbank. If there was negotiation about the price at which the cocoa will be sold, this has not been made public.

The off-take arrangement requires Bui Hydropower to have a power purchase agreement with the Electricity Company of Ghana: 85 percent of energy sales will be deposited into an escrow account to help repay the loan. The excess funds in the account can be withdrawn by Ghana, or they can stay in the account and earn interest. The price for the future electricity was tentatively negotiated to fall within a range of US$0.035 to US$0.055 cents per kWh. According to the World Bank, the average electricity tariff in Africa is much higher at US$0.13 per kWh.[31] Although this appears reasonable now, the details of how the price will change in the future are not transparent.

The project is overseen by the Bui Power Authority, established in 2007 by Ghana's parliament (Act 740). It was designed by the French engineering firm Coyne et Bellier, which also serves as the consulting engineer on the project. The Bui authorities commissioned an environmental and social impact assessment by UK-based consulting firm Environmental Resources Management in 2007, a requirement for China Eximbank financing.[32] Built on the Black River, the dam has trans-boundary issues, with neighboring Ivory Coast exposed to dangers of flooding during heavy rains. The reservoir formed by the dam flooded about 20 percent of Bui National Park, home to the rare black hippopotamus.

A two-week field study carried out for the German Development Institute found that Sinohydro was not involved in any of the planning, such as the environmental impact assessment, resettlement, or the dam design:

> Deficiencies in these respects are the Ghanaian government's responsibility, and it is these practices which need to be changed and improved…Sinohydro appears to abide largely by the conditions set out in the Environmental Impact Assessment study whose implementation is monitored by the Ghanaian Environmental Protection Agency and the Ghanaian Water Resources Commission.[33]

However, the consultant also observed that these institutions were weak, and did not have much standing in the government of Ghana, leaving considerable concern about the effectiveness of their supervision. Labor relations were contentious on the project. At first, Sinohydro resisted the efforts by Ghanaian workers to form a union at the Bui dam site, and were supported in this by the Bui Power Authority. Mass resignations by the workers led to mediation efforts and eventually to the formation of a union of Bui dam workers.[34] A study sponsored by Ghana's trade union congress commended the improvements in labor relations.[35]

The project was officially inaugurated on December 19, 2013. Aside from energy supply, Bui will be used to irrigate 30,000 hectares of land for agricultural production.[36] As of April 2015, the Ghanaian Minister of Power, Kwabena Donkor, had visited the construction site, and some auxiliary construction work appeared to be still in progress.[37]

CHEMOGA-YEDA HYDROPOWER PLANT, ETHIOPIA

Chinese financing for the proposed 278 MW Chemoga-Yeda hydropower plant did not go forward after protests from Egypt, a downstream country. Chemoga-Yeda would have involved the construction of five dams, located on the Chemoga, Yeda, Sens, Getla, and Bogena Rivers, combining to create a giant reservoir which would be used to generate power.[38] The controversy stems from the fact that these rivers are tributaries of the Blue Nile, also known as the Abay River in Ethiopia.

In September 2009, Sinohydro Engineering Bureau No. 4 and the Ethiopian Electric Power Corporation signed an EPC agreement for US$555 million for the two-stage project, after the company had tracked it for several years.[39] In May, Sinohydro sent a team to conduct further negotiations for three months. One year after the initial contract was signed, Sinohydro and EEPCo signed a supplementary agreement where EEPCo agreed to provide 12 percent of the contract as an advance; EEPCo apparently provided financing of US$16 million for the first year.[40] An Italian firm, Electro Consult (ELC), won a tender and was selected as the supervisory engineering firm.[41] An environmental impact assessment had been conducted previously in 2005.[42]

According to Ethiopian sources, the project developers sought finance from China Eximbank, but the Bank declined to finance the project, and it is not clear whether a loan agreement was ever signed. An Ethiopian newspaper reported: "[T]he first financier (Chinese EXIM Bank) is dragging its feet to release the necessary funds due to the conflicting interests of downstream countries on the Nile Basin. These countries have been lobbying the Chinese government to delay funding."[43] In a June 2015 interview, EEPCo confirmed that there was no Chinese finance for the project.[44] It can be argued that most, if not all, hydropower projects proposed for Ethiopia have an impact on downstream countries, Sudan and Egypt, which are "old friends" of China. China Eximbank does not appear to have financed any hydropower projects in Ethiopia after 2010, although they have financed a major wind farm. Reluctance to be involved in cross-border disputes could have played a factor here. In 2015, EEPCo released a request for expressions of interest in financing and constructing Chemoga Yeda, suggesting that Sinohydro's contract expired after failing to find funding in time.[45]

GOUINA HYDROPOWER PROJECT, SENEGAL RIVER, MALI

The Gouina-Mali power plant is expected to be constructed near Kayes, in western Mali. It involves three components, each with 47 MW, for a total of 141 MW. The project is located at a curved, 500 meter wide set of cascades along the Senegal river, and falls within the jurisdiction of the Organization for the Development of the Senegal River (OMVS), an institution established in 1972 by Mali, Mauritania, and Senegal (Guinea joined later), to help manage their shared waters.[46] First envisioned in 1922, the Gouina project has been discussed by many international actors.[47] AFD, the French development agency, the EU Africa Infrastructure Trust Fund, and the World Bank have provided funding for some social, environmental, and technical studies of Gouina.[48] A World Bank report on an OMVS capacity-building project, dated September 25, 2013, stated that the heads of state of the OMVS countries had signed an inter-state convention to finance and build the Gouina project.[49]

Sinohydro signed an EPC contract with OMVS to develop the project on December 9, 2009, but financing was not yet secured. A donor consortium discussed the project in a 2012 report. The European Investment Bank (EIB) "confirmed its interest in principle to at least partially finance the project, but noted that in order to progress, clarity would be needed over the next steps. EIB indicated that the Gouina hydropower plant and the reinforcement of transmission

lines were likely to be treated as a single project, and that a direct agreement with Sinohydro to build the hydropower plant could make it difficult or impossible to finance the transmission lines."[50] The report noted as well that the AFD was ready to provide a project loan up to €50 million (approximately US$54.8 million[b]) in support of Gouina if backed by a sovereign guarantee.

A study commissioned by the International Union of Conservation of Nature (IUCN) of hydropower dam financing processes noted the concern expressed by representatives of some donor organizations involved in power finance that Chinese funding for Gouina might not comply with western donor country social and environmental guidelines. The study noted divided opinions among interviewees as to whether the project would be implemented following "standards and practices of the donors, with an Environmental and Social Management Plan (ESMP) providing for measures mitigating and compensating the environmental and social impacts. Some observers expect that the OMVS will apply to this project the traditional donors' safeguard policies."[51] In July 2011, with EU funding, the contract for an environmental and social impact study was apparently given to the French firm Oréade-Brèche. Part of the EU funding was also slated to cover the establishment of "an expert panel responsible for reviewing the implementation of the project's environmental and social action plans throughout the different stages of implementation."[52] It will be interesting to see whether the OMVS retains this expert panel.

Chinese finance took several years to arrange. In a December 2012 report, the OMVS reported that a convention for the financing agreement for Gouina had been signed in 2011.[53] The OMVS also announced in its new year's message of 2013 that unspecified finance had been mobilized for the project.[54] Other sources reported that China Eximbank had provided a loan to finance the project, signed by the Malian government on January 9, 2013. The loan would finance 85 percent of the US$313.5 million project.[55] Mali would be responsible for raising the rest.

The cornerstone of the project was laid on December 13, 2013 by the four heads of state, signifying both the importance and the cooperative aspects of the project.[56] Energy produced by the project would be shared among the four states. However, obstacles to the project's implementation still exist. At the April 2014 opening ceremony of the 58th Special Session of the Council of Ministers of the OMVS, the Chairman said he was particularly keen to "remove barriers to the implementation of the proposed hydroelectric dam Gouina."[57] So far, the project does not appear on Sinohydro's website and it is not clear what the barriers might be, aside from Mali's challenge of raising the 15 percent required finance. On June 19, 2015, a media report quoted Mohamed Salem Ould Béchir of OMVS stating that Mali appeared to still be working out how to pay their 15 percent share of the cost.[58]

[b] All EUR/USD calculated at a current exchange rate of 1.10 as of August 9, 2015

ITEZHI-TEZHI HYDROPOWER PROJECT, ZAMBIA

Zambia's Itezhi-Tezhi dam was constructed by the Chinese in the 1970s as a foreign aid project, to store water for Kafue Gorge hydropower plant. The current project will use the existing reservoir, which requires some modification of the Itezhi-Tezhi dam, and will add a 120 MW power plant and transmission line. Developed as an Independent Power Project (IPP), Itezhi-Tezhi hydropower station is being constructed as a turn-key project by Sinohydro on a fixed time, fixed price, "lump sum" basis, covering the infrastructure works, civil and hydro-mechanical works, and the electromechanical aspects. Sinohydro won an international competitive tender for the project.[59] French firm Alstom has the contract to provide turbines and generators for Itezhi-Tezhi. There is no Chinese finance for this project, which, along with the transmission lines, relies on a multitude of financiers: the African Development Bank; the Dutch Development Bank; the Development Bank of Southern Africa; the Investment and Promotions Company for Economic Cooperation (PROPARCO), part of the French Development Agency (Agence Française de Développement); the European Investment Bank; and India Eximbank.

All of the participants in the financing of the transmission line agreed to use the African Development Bank's procurement rules and guidelines. The total cost of the project is estimated to be US$350.41 million, including the power plant (US$239.05 million) and the transmission line (US$111.36 million).[60] The project has two owners, Tata Africa and ZESCO, each of which has 50 percent of the equity. ZESCO and Tata created a special purpose vehicle, Itezhi-Tezhi Power Corporation, Ltd. (ITPC), to operate the station. This corporation will operate the station for 25 years on a "build-operate-own-transfer" (BOOT) basis, after which ZESCO will become the sole owner. ITPC and ZESCO signed a 25 year power purchase agreement to sell power to ZESCO on a "take or pay" basis. A three-month escrow account will be established for revenues from power sales, enhancing security.[61] ZESCO, which is financially weak, was only able to participate in the equity shares of this PPP through concessional financing arranged through the African Development Bank and other financiers.

The project was supposed to be completed in 2015. In December 2014, the Lusaka Times reported that the Zesco Managing Director, Cyprian Chitundu, stated that 73 percent of the project was complete and that "the project is scheduled to be commissioned sometime in October next year [2015]."[62] Another media source reported on June 15, 2015 that 88 percent of the project is complete and should be operational by November [2015].[63] This suggests that the project is delayed since the project's financial close was originally planned for May 2015.[64]

GRAND POUBARA HYDROPOWER PROJECT, GABON

The 160 MW Grand Poubara hydropower project was constructed between 2008 and 2013 in the Gabonese province of Haut-Ogooué at a total cost of US$398 million under an EPC contract with Sinohydro.[65] A second phase is now envisaged and preparations have begun. According to the Gabonese government, China Eximbank financed 75 percent of the cost; the remaining

25 percent was covered by the Government of Gabon.[66] According to the Ministry of Commerce (MOFCOM), the Chinese finance was divided into two parts: a preferential loan, and a preferential buyer's credit.[67] The plant began operating in September 2013, and is set to supply power to the city of Franceville, the third-largest city in Gabon, as well as Comilog's (Compagnie minière de l'Ogooué) ferromanganese plant, a project originally supported by the World Bank in 1959, when Gabon was still a French colony.[68] In 2010, Comilog, the world's second largest manganese producer, signed an agreement for the supply of electricity produced by Grand Poubara for its Moanda facility.[69]

Although the details of the Grand Poubara project are not well known, some sources note that the project may have been linked to the Bélinga iron ore mining package, a failed resource-secured package deal negotiated between 2005 and 2006. This US$3.5 billion deal encompassed the proposed 50 MW Ivindo hydropower dam, a railway line, and a new port, all to be secured by an off-take arrangement from a new iron ore venture, Bélinga, allocated for development to Comibel, a consortium headed by a major Chinese construction company, CMEC. The Ivindo (Belinga) dam was scheduled to be built at the Kangou Falls in one of Gabon's national parks.[70] International protests apparently caused the scope of the project to be renegotiated, raising questions about its profitability.[71] At the same time, the global financial crisis and the illness and death of Gabonese president Omar Bongo in June 2009 caused uncertainties and further delays in the project. A report by International Rivers noted that "According to Marc Ona, the Director of Brainforest [a local environmental NGO], the Chinese Ambassador to Gabon told him that civil society issues and environmental impacts had been a factor in China Exim Bank's decision to hold off on the financing for the Bélinga [Ivindo] Hydropower Project."[72]

In late 2012, the Bélinga concession was taken away from Comibel on the grounds that there had been too little progress in its development. When this happened, a Gabonese newspaper noted that China Eximbank representatives came to Gabon to discuss (among other things) how the debt for Grand Poubara would be paid. Given the termination of the Bélinga concession, the article noted, the two sides should develop a new cooperation agreement for the Grand Poubara project: "In other words, with the mining counterpart to the agreement no longer assured, China must know how the Gabonese government intends to address its debt."[73] In a 2014 interview, the manager of Sinohydro-Gabon noted that the Gabonese government was reluctant to finance its infrastructure investments through debt, and that this was impeding the business efforts of Chinese firms in Gabon.[74]

The project was ultimately completed in September 2013.[75] The German engineering firm Gauff did basic planning and construction management for the project and was responsible for verification of the studies presented by the Chinese general contractor, basic planning and planning documents, mediation and securing financing, and environmental surveys.[76] Grand Poubara is owned by the Gabonese Ministry of Mines, Petroleum and Hydrocarbons, Energy, Water Resources, and New Energy Promotion.

GILGEL GIBE III HYDROPOWER PROJECT, ETHIOPIA

The Gilgel Gibe III Hydropower Project in Ethiopia is located on the lower course of the Omo River, about 155km downstream from the Gigel Gibe II Project, and roughly 470km from Addis Ababa by road. [77] The Ethiopian Electric Power Corporation signed an engineering procurement (turnkey) contract with the Italian construction firm, Salini Costruttori S.p.A. on July 19, 2006.[78] The project was slated to be completed in 2015; as of July 2015 it is still ongoing.[79] Upon completion, it is expect to generate 1,870 MW.

This project has proved to be controversial due to its environmental and social impact. International Rivers calls Gigel Gibe III "the most destructive dam being built today."[80] The dam is expected to reduce the natural flooding cycle of the Omo River, which may have negative consequences for the indigenous farming and ranching population along the river, and may reduce the flow into Lake Turkana.[81] Friends of Lake Turkana, an NGO who sent a complaint to EIB on March 5, 2009, states that the Omo River provides 80 percent of the replenishing flow into Lake Turkana, the world's largest permanent desert lake located downstream in the Kenyan Rift Valley.[82, 83]

At one point, AfDB and EIB both considered funding the Gibe III project, and both EEPCo's website and Gibe III's official project website still list these two organizations as funders. However, both organizations discontinued their funding in 2010.[84] Although International Rivers suggests that they did not want to get "involved in a project that caused an international outcry and clearly violated their social and environmental safeguard policies," both organizations stated that they were no longer funding the project because Ethiopia found alternative sources of funding.

The total cost of the project is estimated to be approximately US$2 billion, and most of the finance is being provided directly by the Ethiopian government. While the civil works are being done by Salini Construttori, the electromechanical and the hydraulic steel structures contracts were tendered out for international bidding. On May 12, 2010, EEPCo and the Chinese Dongfang International Electric Corporation (DEC) signed two contracts totaling US$495.51 million for these works.[85] In 2010, ICBC provided approximately $235 million and in 2011, China Eximbank provided $189 million in two separate PEBCs for the project.[86] Dongfang brought Sinohydro into the project in January 2011.[87]

ZUNGERU HYDROPOWER PROJECT, NIGERIA

On December 11, 2012, the consortium of China National Electric Engineering Co., consisting of CNEEC (a Sinomach subsidiary) and Sinohydro, signed a US$1.29 billion EPC contract with the Ministry of Electric Power in Nigeria to construct the 700 MW Zungeru hydropower plant. Located on the Kaduna River in Zungeru Town, Niger State, it is expected to be the largest financing project in Africa using the "Chinese Government Concessional Loans and

Preferential Export Buyer's Credit" of Eximbank. CNEEC had been following this project for five years prior to the contract signing.[88]

In April 2007, CNEEC had signed an EPC for the 950 MW Zungeru project, with funding from the Excess Crude Savings Account. However, a subsequent feasibility report "recommended that, as a consequence of declining hydrology, the optimal plant capacity should be 525 MW with the possibility of future expansion to 700 MW."[89] On September 29, 2013, Eximbank signed a preferential loan agreement with the Nigerian Ministry of Finance in Abuja. The contract states that the Eximbank will provide 75 percent of the contract funding in the form of PEBC, about US$970.5 million.[90]

The construction commencement ceremony took place on May 28, 2013,[91] and at the time the project was expected to be finished in 2018.[92] In February 2014, the Nigerian Minister of Power, Chinedu Nebo, stated that CNEEC-Sinohydro had completed considerable preliminary work. Nebo also responded to complaints that the project was too expensive, citing International Renewable Agency's (IRENA) estimation that the cost of a large hydropower project will range from US$1.05 million to US$7.6 million per MW.[93] The cost of Zungeru is roughly $1.85 million per MW.

The Nigerian government established the Zungeru Community Relations Committee as a "hands-on platform and a one-stop point for the resolution of all community related issues."[94] Some 22,100 people, 15,958 farms, and 6,762 properties across 98 communities were expected to be impacted by the project. Nebo also stated that the compensation for buildings and structures are based on World Bank guidelines.[95] Nigeria's *Daily Trust* reported on February 17, 2015 that the start of the project, originally planned for the end of 2014, was delayed due to conflicts between the Ministry of Power and the Ministry of Finance.[96]

ISIMBA HYDROPOWER PROJECT, UGANDA

The Isimba Hydropower Project is a 183 MW low head hydropower project located on the Ugandan section of the White Nile, 120 kilometers northeast of Kampala in Kayunga District. On September 6, 2013, Three Gorges subsidiary, China International Water & Electric Corporation, signed a US$568 million EPC contract with the Ministry of Energy and Mineral Development to construct the power plant as well as the associated transmission lines.[97] This is the first contract CWE has won in Uganda.[98] Of the US$568 million contract, US$551 million will be used for the dam, $US11 million for the Isimba-Bujagali transmission line, and $US5 million for the constructing substations.[99]

The ground-breaking ceremony of the project occurred on October 5, 2013, and construction was expected to take 40 months, putting the estimated date of completion at February 2017.[100] By the end of February 2014, site survey, evaluation, geological testing and other basic pre-construction work had been completed, yet the project had still not secured funding.[101]

Eximbank president Li Ruogu visited Uganda from May 6 to 9, 2014. During the visit, Uganda solicited funding from Eximbank for Isimba, as well as for the Karuma hydropower project.[102] Eventually the Eximbank extended a loan of US$482.5 million, which Uganda's Parliament approved on March 5, 2015.[103] The loan has a 2 percent interest rate, 20 year repayment period, and 5 year grace period. CWE took a risk by starting the project before the funding had been approved. Its eagerness could have stemmed from the fact that in 2012 it lost the contract of an even larger Ugandan hydropower project, Karuma, to Sinohydro amid allegations of corruption.[104]

Appendix 1: All hydropower projects over 50 MW considered by any of these four sources to be financed by Chinese loans

#	Country	Name	CARI (Dec. 2013)	AidData (Dec. 2013)	Lin/Wang (May 2013)	I-Rivers (Nov. 2014)
1	Cameroon	Memve'ele	Implemented	Implemented	Construction	Construction
2	E. Guinea	Djibloho	Completed	Completed	Completed	Completed
3	Gabon	Grand Poubara	Completed	Implemented	Construction	Completed
4	Ghana	Bui	Completed	Implemented	Completed	Completed
5	Guinea	Kaleta	Implemented	Implemented	Construction	Construction
6	Ivory Coast	Soubre	Implemented	Implemented	Construction	Construction
7	Nigeria	Zungeru	Implemented	Pipeline: commitment	Construction	Construction
8	R. Congo	Imboulou	Completed	Completed	Construction	Completed
9	Zambia	Kariba N. Bank Ext.	Implemented	Completed	Completed	Construction
10	Sudan	Merowe	Completed	Completed	Completed[1]	Completed
11	Zimbabwe	Kariba South Exp.	Implemented	Pipeline: commitment	Construction	Proposed
12	Ethiopia	Genale-Dawa III	Implemented	Implemented[4]	Construction	-
13	DRC	Zongo II	Implemented	Implemented	Construction	Proposed
14	Mali	Gouina	Loan signed	Implemented	*Post-publication*[2]	*No financer*
15	Ethiopia	Finchaa-Amerti-Neshe	Completed	Pipeline: pledge[3]	Completed	Completed
16	Sudan	Upper Atbara/Rumela	Implemented	*Not in database*	-	Financed by Sudan
17	Ethiopia	Gilgel Gibe III	Implemented	*Not in database*[12]	*Not in database*	Construction
18	Zambia	Kafue Gorge Lower	Inactive	Implemented	Construction	Construction
19	Nigeria	Mambilla	Inactive	Pipeline: commitment	Construction	Proposed
20	Mauritius	Bagetelle/Terre Rouge	Other Water	Implemented	Construction	Water supply
21	South Sudan	Biden	Active-Discussion	Pipeline: commitment	Construction	Proposed
22	Malawi	Kapichira II	Other-financed	Implemented	*Not in database*	Construction
23	Uganda	Karuma	Active-Discussion[10]	*Not in database*	Agreement	Construction
24	Ethiopia	Tekeze	Other-financed	*Not in database*	Completed	China Eximbank?[11]
25	Ethiopia	Halele Werabesa	Inactive	Pipeline: pledge	*Not in database*	Construction
26	Sudan	Roseires	Other-financed	Vague TBD flow[5]	Completed	Proposed
27	DRC	Busanga/Busuanga	Inactive	*Suspended*[6]	Construction	Proposed
28	Ethiopia	Chemoga-Yeda	Inactive	*Not in database*[7]	Agreement	Proposed
29	Sudan	Dal-Kajbar	Active-Discussion	*Not in database*	-	Proposed
30	Uganda	Ayago	Active-Discussion	*Not in database*	-	Proposed
31	Ethiopia	Gibe IV	Inactive	*Not in database*	Construction	Proposed
32	Mozambique	Mphanda Nkua	Non-China	Pipeline: pledge	Agreement	*Not in database*

33	Benin/Togo	Adjarala	Active-Discussion	Suspended[8]	Construction	Proposed
34	Cameroon	Douala	Other Water	Implemented[9]	*Not in database*	*Not in database*
35	Ghana	Akosombo/Kpong	Other-financed	Pipeline: commitment	*Not in database*	Financed by WB
	Total "Chinese Financed"		**17**	**21**	**29**	**16**

Note: The statuses above are listed exactly as they appear in each database. We consider the following statuses from each source as "Chinese-financed":

- **CARI:** Loan Signed, Implemented, and Completed
- **AidData:** Pipeline: commitment, Implemented, and Completed
- **Lin & Wang:** Agreement, Construction, Completion, and the unspecified "-".
- **International Rivers:** Construction, Completion

All projects considered to be Chinese-financed by this definition are highlighted in blue.

1. Merowe was said to be financed by China Eximbank in the text of Lin & Wang's paper, although it did not appear in the table included in the paper.
2. "Post-publication" status in Lin & Wang indicates projects with Chinese financing that were signed after the publication of the report.
3. Finchaa-Amerti-Neshe is not a separate energy project, but is folded into a master loan program (Project ID-725) that includes other projects as well.
4. Genale Dawa III is mislabeled as Gibe III by AidData in the project title, but the project description and finance amount refer to those of Genale Dawa III.
5. AidData lists the finance type as "Vague TBD," so the financing may not be a loan.
6. AidData considers Busanga to be part of the Sicomines project (Project ID-450). Though the project description suggests that Busanga may be under implementation, Sicomines project as a whole is considered "Suspended," so Busanga is not included here as Chinese-financed.
7. Chemoga-Yeda is considered a transmission line project, not a hydropower project.
8. Adjarala is AidData Project-ID 2170. It can no longer be found through a keyword search, but is mentioned in the description of an economic cooperation agreement that is in implementation.
9. Douala is classified as an energy sector project, despite the project description indicating it as a water supply project.
10. Karuma and Isimba's loans were signed in 2014, past this paper's 2013 cut-off date.
11. International River suggests that the Chinese funding is still in doubt.
12. Although AidData has a project titled "China Exim loans Ethiopia 270 million USD for Gibe III Hydroelectric Dam" Project-ID 34942, the content of the project actually describes Genale Dawa II. Genale Dawa III is described in another entry, Project-ID 1379, entitled "Concessional Loan for Halele Werabesa Dam," but classified as "Other Multisector" in AidData Database 1.2.

Appendix II: Complete list of reported projects (2000 to July 2015)

No.	Country	Name	Description	Category	Status
1	Cameroon	Memve'ele	Hydropower plant	1. China Financed	Under construction since 2012
2	DRC	Zongo II	Hydropower plant	1. China Financed	Under construction since 2012
3	E. Guinea	Djibloho	Hydropower plant	1. China Financed	Completed 2012
4	Ethiopia	Finchaa-Amerti-Neshe	Hydropower plant	1. China Financed	Completed 2011
5	Ethiopia	Genalle-Dawa III	Hydropower plant	1. China Financed	Under construction since 2008
6	Ethiopia	Gilgel Gibe III	Hydraulic & electro works	1. China Financed	Under construction since 2006
7	Gabon	Grand Poubara	New dam/power plant	1. China Financed	Completed 2013
8	Ghana	Bui	New dam/power plant	1. China Financed	Completed 2013
9	Guinea	Kaleta	New dam/power plant	1. China Financed	Completed 2015
10	Ivory Coast	Soubre	New dam/power plant	1. China Financed	Under construction since 2013
11	Mali	Gouina	New dam/power plant	1. China Financed	Funding secured since 2013
12	Nigeria	Zungeru	New dam/power plant	1. China Financed	Under construction since 2013
13	R. Congo	Imboulou	Hydropower plant	1. China Financed	Completed 2011
14	Sudan	Merowe	Dam & power transmission	1. China Financed	Completed 2008
15	Sudan	Upper Atbara	Hydropower plant	1. China Financed	Under construction since 2011
16	Zambia	Kariba N. Bank Ext.	Expansion of existing plant	1. China Financed	Completed in 2014
17	Zimbabwe	Kariba South Exp.	Hydropower plant	1. China Financed	Under construction since 2014
18	Ethiopia	Tekeze	Hydropower and water	2. Other-Financed	Completed 2009
20	Kenya	Sondu-Miriu	Hydropower plant	2. Other-Financed	Completed 2009
21	Malawi	Kapichira Ph. II	Phase II, adding 2 turbines	2. Other-Financed	Under construction since 2014
22	Mali	Felou	Hydropower plant	2. Other-Financed	Completed 2013
23	Sudan	Roseires Dam Phase II	Hydropower plant	2. Other-Financed	Completed 2013
24	Zambia	Itezhi-Tezhi	Hydropower plant	2. Other-Financed	Under construction since 2012
25	Benin (Togo)	Adjarala Dam	Hydropower plant	3. Active Discussion	Active Discussion
26	DRC	Inga 3	Part of the Grand Inga project	3. Active Discussion	Active Discussion
27	Ethiopia	Geba	Hydropower plant	3. Active Discussion	Active Discussion

28	Kenya	High Grand Falls	Multi-purpose dam	3. Active Discussion	Active Discussion
29	Namibia	Baynes/Orokawe	Hydropower plant	3. Active Discussion	Active Discussion
30	Nigeria	Gurara 2	Multi-purpose dam	3. Active Discussion	Active Discussion
31	South Sudan	Biden	Hydropower plant	3. Active Discussion	Active Discussion
32	Sudan	Kajbar Dam	Hydropower plant	3. Active Discussion	Active Discussion
33	Tanzania	Masigira	Hydropower plant	3. Active Discussion	Active Discussion
34	Tanzania	Mpanga	Hydropower plant	3. Active Discussion	Active Discussion
35	Tanzania	Rumakali	Hydropower plant	3. Active Discussion	Active Discussion
36	Uganda	Isimba	New dam/power plant	3. Active Discussion	Under construction since 2013
37	Uganda	Karuma	Hydropower plant	3. Active Discussion	Under construction since 2013
38	Uganda	Ayago	Hydropower plant	3. Active Discussion	Active Discussion
39	Zambia	Batoka Gorge	Hydropower plant	3. Active Discussion	Active Discussion
40	Zambia	Lusiwasi Lower	Hydropower plant	3. Active Discussion	Active Discussion
41	DRC	Busanga	Hydropower plant	4. Inactive	Inactive
42	DRC	Semuliki	Hydropower plant	4. Inactive	Inactive
43	Ethiopia	Chemoga-Yeda	Hydropower plant	4. Inactive	Inactive
44	Ethiopia	Gigel Gibe IV	Hydropower plant	4. Inactive	Inactive
45	Ethiopia	Halele Werabesa	Hydropower plant	4. Inactive	Inactive
46	Gabon	Belinga Dam	Hydropower plant	4. Inactive	Inactive
47	Guinea	Souapiti dam	Hydropower plant	4. Inactive	Inactive
48	Nigeria	Mambilla	Hydropower plant	4. Inactive	Inactive
49	Nigeria	Zamfara Dam	Hydropower plant	4. Inactive	Inactive
50	Sudan	Shereik/Sherik	Hydropower plant	4. Inactive	Inactive
51	Zambia	Kafue Gorge Lower	Hydropower plant	4. Inactive	Inactive
52	Zambia	Kalungwishi	Hydropower plant	4. Inactive	Inactive
53	Angola	Ganjelas Dam	Irrigation dam	5. <50 MW	
54	Angola	Lomaum	Hydropower plant	5. <50 MW	
55	Angola	Lua Sim	Hydropower plant	5. <50 MW	
56	Angola	Mabubas	Hydropower plant	5. <50 MW	
57	Burundi	Gikonge	Hydropower plant	5. <50 MW	
58	Burundi	Mugere	Hydropower plant	5. <50 MW	
59	Burundi	Ruvyironza	Hydropower plant	5. <50 MW	
60	Cameroon	Lagdo	Expansion and repair of existing hydropower plant	5. <50 MW	
61	Cameroon	Lom Pangar Dam	Hydropower plant	5. <50 MW	
62	Cameroon	Mekin	Hydropower plant	5. <50 MW	
63	CAR	Boali No.3	Hydropower plant	5. <50 MW	
64	DRC	Ivugha	Hydropower plant	5. <50 MW	
65	Guinea	Kinkon Dam	Rehabilitate old hydropower plant	5. <50 MW	
66	Guinea	Tinkisso	Rehabilitate old hydropower plant	5. <50 MW	

67	Kenya	Songoro	Hydropower plant. Extension of the Sondu-Miriu project	5. <50 MW	
68	Madagascar	Ambodiroka	Hydropower plant	5. <50 MW	
69	Madagascar	Andekaleka	Hydropower plant	5. <50 MW	
70	Mali	Taoussa	Hydropower plant	5. <50 MW	
71	Mozambique	Moamba-Major	Hydropower plant	5. <50 MW	
72	R. Congo	Bouenza/Buangza/Moukouloukou	Hydropower plant	5. <50 MW	
73	Rep. Congo	Liouesso Dam	Hydropower plant	5. <50 MW	
74	Sierra Leone	Bankasoka	Hydropower plant	5. <50 MW	
75	Sierra Leone	Charlotte	Hydropower plant	5. <50 MW	
76	Sierra Leone	Dodo	Hydropower plant	5. <50 MW	
77	Sierra Leone	Makali	Hydropower plant	5. <50 MW	
78	Sierra Leone	Port Loko/Gbanka Soka	Hydropower plant	5. <50 MW	
79	South Sudan	Kineti	Hydropower plant	5. <50 MW	
80	Zambia	Chishimba	Hydropower plant	5. <50 MW	
81	Zambia	Lunzua	Hydropower plant	5. <50 MW	
82	Zambia	Musonda	Hydropower plant	5. <50 MW	
83	Zamibia	Lusiwasi Upper	Hydropower plant	5. <50 MW	
84	Botswana	Dikgatlhong Dam	Water supply dam	6. Other Water Projects	
85	Botswana	Lotsane Dam	Water supply dam	6. Other Water Projects	
86	E. Guinea	N/A	Water supply dam	6. Other Water Projects	
87	Kenya	Sasamua Dam - Rehabilitation	Water supply dam	6. Other Water Projects	
88	Lesotho	Polihali Dam - Highlands Water Project Phase II	Water supply dam	6. Other Water Projects	
89	Mauritius	Polihali Dam - Highlands Water Project Phase II	Water supply dam	6. Other Water Projects	
90	Zimbabwe	Gwayi-Shangani	Water supply dam	6. Other Water Projects	

91	Ethiopia	Grand Renaissance	Hydropower plant	7. Non-China	
92	Ghana	Akosombo	Old hydropowe rehab	7. Non-China	
93	Ghana	Ankobra	Hydropower plant	7. Non-China	
94	Ghana	Kpong	Old hydropowe rehab	7. Non-China	
19	Ghana	Pra at Sekyere Heman	Hydropower plant	7. Non-China	CWE contract signed in 2014
95	Ghana	Pra at Awisam	Hydropower plant	7. Non-China	
96	Ghana	Tana	Hydropower plant	7. Non-China	
97	Liberia	Mount Coffee	Rehabilitate old hydropower plant	7. Non-China	
98	Mozambique	Boa Maria Dam	Water supply dam	7. Non-China	
99	Mozambique	Mphanda Nkuwa dam	Hydropower plant	7. Non-China	
100	Niger	Kandadji	Hydropower plant	7. Non-China	
101	R. Congo	Chollet	Hydropower plant	7. Non-China	
102	Sierra Leone	Bumbuna II	Hydropower plant	7. Non-China	
103	Tanzania	Kilombero	Hydropower plant	7. Non-China	
104	Zambia	Lumangwe Falls	Hydropower plant	7. Non-China	
105	Zimbabwe	Kunzvi	Hydropower plant	7. Non-China	
106	R. Congo	N/A	$700mn project by Sinohydro	8. IRivers only	
107	Tanzania	N/A	Hydropower plant	8. IRivers only	

Endnotes

[1] The AidData projects include all energy generation and supply projects involving dams. We do not include transmission line projects. We followed AidData practice by labeling a project as "Chinese-financed" if it has a status of "Completed," "Implementation," "Pipeline: commitment," or "Pipeline: Pledge." The dollar amount taken from AidData is, like our numbers, not adjusted for inflation. For the total value of these projects, we included all loan tranches listed by AidData in these categories long as they were not coded as duplicates. AidData has mislabeled Genale-Dawa as Gigel Gibe III; since it was still classified as an energy project, its dollar value is included in the sum, yet the project is not included in the 23 AidData vouched-for Chinese loan-financed hydropower projects. Finchaa-Amerti-Neshi and Upper Atbara/Rumela are not listed as independent energy projects by AidData, although they were mentioned as parts of other projects.

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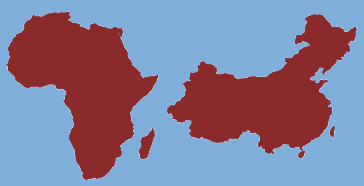

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