YANNING CHEN

A COMPARATIVE ANALYSIS: THE SUSTAINABLE DEVELOPMENT IMPACT OF TWO WIND FARMS IN ETHIOPIA

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Abstract

This paper evaluates the sustainable development impact of Chinese energy projects in Africa, focusing specifically on HydroChina's involvement in the Adama Wind Farm project in Ethiopia. It compares HydroChina's practice to that of Vergnet, a French firm involved in the construction and financing of the Ashegoda Wind Farm. Sustainable development impact is evaluated along three dimensions: environmental and social impact, technology transfer, and employment creation. Since the exponential growth of Chinese-financed energy projects in Africa, the international media and politicians have singled out Chinese companies for their involvement in projects with poor sustainable development benefits. Many attribute the poor delivery and outcomes to donor country characteristics. Yet, little research has explored how stakeholders can influence sustainable development impact. This paper aims to fill in this gap. Through interviews with key stakeholders and detailed analysis of the negotiation and construction processes in both projects, the research presented here shows that the Chinese-financed and constructed Adama Wind Farm provided similar sustainable development benefits as the French-financed and constructed Ashegoda Wind Farm. Moreover, I find that donor country characteristics are not the main determinants of sustainable development impact. Rather, the host country has can play a crucial role in maximizing sustainable development benefits through targeted policy action.

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Corresponding Author

Yanning Chen
Email: ychen282@jhu.edu

Acronyms

AFD	French Development Bank
CARI	China-Africa Research Initiative
CGCOC	CGC Overseas Construction Group
DPP	Diesel Power Plant
FOCAC	Forum on China Africa Cooperation
EEP	Ethiopian Electric Power
EEPA	Ethiopian Environmental Protection Agency
EEPCo.	Ethiopian Electric Power Corporation
EEU	Ethiopian Electric Utility
EIA	Environmental Impact Assessment
EPC	Engineering, Procurement and Construction
ESIA	Environmental and Social Impact Assessment
GDP	Gross domestic product
GTP	Growth and Transformation Plan
GTZ	German Corporation for International Cooperation
HPP	Hydro Power Plant
IISD	International Institute for Sustainable Development
IMF	International Monetary Fund
IPP	Independent Power Project
KNBE	Kariba North Bank Extension Project
MoU	Memorandum of Understanding
MoWIE	Ministry of Water, Irrigation and Electricity
O&M	Operation & Maintenance
SOP	Standard Operating Procedure
WRI	World Resource Institute

1. Introduction

Chinese overseas finance in Africa has increased significantly in the last decade. The China-Africa Research Initiative (CARI) at the Johns Hopkins University's School of Advanced International Studies estimates that China loaned over US$86.9 billion to Africa between 2004 and 2014. Chinese engagement with Africa's energy sector has grown as well, with at least US$17.6 billion in China-Africa loans during the same period. Ethiopia is the second-largest recipient of Chinese loans, receiving US$12.3 billion between 2000 and 2014.[1] China's growing importance as a financier of African projects has sparked debate about the motivation behind and sustainability of China's increased role. The 1972 Stockholm Convention on the Human Environment defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."[2] "Sustainable development" emphasizes intergenerational equity and responsibility in development as a means of poverty alleviation.[3]

The Chinese government has, on more than one occasion, stressed the importance of long-term "win-win" cooperation between China and Africa. In 2015, Chinese President Xi Jinping titled his opening speech at the Johannesburg Summit of the Forum on China Africa Cooperation (FOCAC), "Opening a New Era of China-Africa Win-Win Cooperation and Common Development." But is Chinese engagement with Africa truly "win-win" when it comes to sustainable development?

On the one hand, Chinese loans fill the growing financial gap in Africa's infrastructure and energy sectors. Infrastructure investments have a huge multiplier effect on economic development. In 2010, research in Egypt showed that an increase in infrastructure expenditure from 5 to 6 percent of gross domestic product (GDP) would raise the annual GDP per capita growth rate by 0.5 percentage points in a decade's time.[4] In particular, Downs found that compared to their western counterparts, Chinese companies often offer attractive development packages that combine company investment projects with the construction of infrastructure for public use, adding to the social benefit of Chinese investments.[5] Moreover, Chinese investments may contribute to economic stability. Lee compared Chinese mining practices to those from western companies in Zambia during the financial crisis. She found that western companies suspended production and laid off 30 percent of their employees, while Chinese mines pledged no layoffs, no production reduction, and no salary cuts.[6] They kept their pledge.

On the other hand, many criticize Chinese engagement in Africa as unsustainable and self-serving, representing a new form of economic-colonialism. These arguments have appeared in official remarks, media reports, and published books. Critiques mainly revolve around three themes. First, some claim that Chinese aid, loan finance, and investment are all part of a "grand strategy" to secure resources in Africa, essentially in an effort to establish a "China, Inc.," where various actors, such as development banks, and private and state-owned enterprises, are all coordinated under a centralized plan by the Chinese government to secure energy supplies and engage in systematic land grabs. This view is supported by evidence of highly publicized resource-backed loans in some African countries. In June 2011, then U.S. Secretary of State Hillary Clinton gave a speech in Zambia warning Africa against countries that "come in, take out natural resources, pay off leaders and leave."[7] Second, some argue that Chinese companies import poor labor and environmental practices to the region, and suggest that Chinese

projects are often constructed swiftly at the expense of environmental and social standards. Economy and Levi reported that the Zambian government approved an environmental impact assessment (EIA) submitted by one Chinese firm for a copper mine investment, even though it was in Chinese—a language no one in the Ministry of Environmental Protection could read.[8] Due to lack of written policies and clear corporate social responsibility standards, as well as China's poor domestic track record in environment protection, many conclude that Chinese operating overseas inevitably subscribe to a lower level of environmental and social standards.[9] Finally, the Chinese are widely criticized for loose labor standards and for crowding out local labor by bringing in their own workers.[10] In July 2015, President Obama offered thinly veiled criticism of Chinese labor practices in Ethiopia, stating, "Economic relations can't simply be about building countries' infrastructure with foreign labor."[11]

In recent years, many researchers have investigated these claims. Several researchers have concluded that China does not offer better loan terms to resource-rich countries in Africa. Li Ruguo, President of the Chinese Export-Import Bank, explained that China looks at development sustainability in addition to debt sustainability when making loan decisions. Unlike the IMF and World Bank, which will rule out an entire country due to high indebtedness, China evaluates investment opportunities on a project-by-project basis, issuing loans at a normal rate if the project is deemed commercially viable.[12] Gonzalez-Vicente observed that growing exports from Latin America to China are not driven by a top-down foreign policy strategy; rather firms envision China as their final commodity destination and seek to utilize their comparative advantage in market access.[13] Researchers also found that Chinese banks sometimes contract out EIAs to trusted European independent firms.[14] Last but not least, Sautman and Yan compiled research conducted in twelve separate studies on the localization of workforces in Chinese enterprises and projects across Africa. They found that generally the longer Chinese firms stay in Africa, the more they localize. In fact, they found the percentage of local employees to be above 80 percent in all but one case examined.[15]

Despite a growing number of studies on the impact of Chinese engagement, there is little research that evaluates the impact through a comparative lens. In one of the few comparative studies that exist, researchers found that Chinese companies performed no worse than their Western counterparts. For example, in researching Shougang's environmental and social practices in Peru, Irwin & Gallagher concluded its practices do not stand out as having an unusually negative environmental or social record compared to other foreign companies in Peru.[16]

In addition, most research assumes that China, the donor country, is the only stakeholder in its investment, especially in enforcing environmental and social safeguards. Recently, a small but growing number of studies have refuted these claims. Looking at Sinohydro's involvement in the Kariba North Bank Extension Project (KNBE) in Zambia, Hou found that its influence as a Chinese contractor in the EIA process was somewhat limited, as the project owner was the main stakeholder and was responsible for ensuring that the project complied with the EIA regulations. Here an EIA process assesses the environmental consequences of a project prior to construction to avoid or minimize unnecessary risks.[17] Similarly, an examination of Sinohydro's role in the highly controversial Bui Dam project in Ghana revealed that Sinohydro was not involved in any of the planning, including the environmental impact assessment, resettlement plan, or the dam design.[18] Both researchers noted that Chinese contractors

largely abided by conditions set out in the environmental impact assessment study and were willing to make revisions in the construction for environmental and social considerations.[19] This paper adds to this growing area of research.

This paper examines the impact of Chinese energy finance and construction practices on sustainable development in Africa, focusing specifically on the Adama Wind Farm in Ethiopia. It places Chinese practices in comparative perspective with the French-financed and constructed Ashegoda Wind Farm in the same country. The sustainable development impact is evaluated along three dimensions: environmental and social impact, technology transfer, and employment creation. Although Chinese wind power projects in Africa are greatly overshadowed by the rest of China-Africa trade and loan finance, they warrant more in-depth research because of their significant potential in mitigating climate change, their reputational gains to China as a global renewable energy leader, and their place in the broader context of growing trade between China and Africa. Mitigating the impact of climate change requires wide adoption of renewable energy, such as wind, hydro, solar, geothermal and nuclear power. As the largest total CO2 emitter in the world, China has placed a heavy emphasis on the development and deployment of clean energy since 2005. Over the past decade, China has emerged as a leading investor in global renewable energy infrastructure, particularly in wind power.

In 2013, the World Resources Institute (WRI) surveyed and identified at least 43 Chinese overseas wind projects in 21 countries. Of the 43 projects, 27 were focused on electricity generation (wind farms), and of the 21 countries, three are in Africa: Ethiopia, Tanzania, and South Africa. Xiaomei Tan, Yingzhen Zhao, Clifford Policarp and Jianwen Bai note that excessive manufacturing capability, China's "going out" strategy, and host countries' policies drive these large overseas wind and solar projects.[20] In addition, Bjorn Conrad, Mercedes Fernandez, Bamshad Houshyani identify reputation as another motive in China's overseas renewable energy projects.[21] Not only does China bolster its influence in developing countries through these projects, but it also gains recognition from developed countries as a contributor to climate change mitigation and builds its reputation as a global leader in green energy technology. With this motivation, Chinese engagement in overseas wind projects will undoubtedly continue to grow. As it does, Chinese wind companies will have to compete with established Western wind companies in the global market. Africa's energy sector offers enormous transformative potential for climate change mitigation efforts and opportunities for both Chinese and Western wind companies.

This research into a Chinese wind project in Ethiopia offers a unique opportunity to examine how China's emerging wind industry compares to its Western counterparts, especially in terms of sustainable development impact. It finds that the Chinese-financed and constructed Adama Wind Farm provided similar sustainable development benefits as the French-financed and constructed Ashegoda Wind Farm. More importantly, the research presented here shows that donor country characteristics are not the main determinants of sustainable development impact; the host country has considerable capacity and can play a crucial role in maximizing sustainable development benefits through targeted policy. These findings defy popular wisdom that Western contractors are better at delivering sustainable development impact than Chinese contractors. Moreover, they draw attention to the vital role of the host government in the process.

Based on these findings, the Ethiopian government should: (1) improve its current regulatory framework to increase the predictability and attractiveness of investments in wind energy; (2) promote and institutionalize university-industry collaborations and joint ventures; (3) increase human capital through education and technological exchange; (4) combine international standards and China's own development experience to facilitate cooperation between the Chinese, the host country, and the western contractors; and (5) acknowledge the benefits of Chinese overseas investment and learn from China's strengths.

2. Background

Ethiopia has vast hydro, wind, solar, and geothermal renewable energy potential. It has the second-largest hydropower potential in Africa after the Democratic Republic of Congo. The total exploitable reserves of hydro and wind energy are 45GW and 10GW respectively.[22] Only about 5 percent of Ethiopia's hydro resources, and less than 1 percent of Ethiopia's wind resources have been developed thus far.[23] As of 2014, hydropower accounted for 88 percent of Ethiopia's total installed electricity capacity, while wind power contributed just 8 percent.[24]

Although Ethiopia does not envision wind power being its primary power source in the future, it will undoubtedly be a crucial component. First, wind farms are less controversial and can be built more quickly than hydropower plants, which usually take many years to construct and often cause irreparable damage to the surrounding environment and local communities. Reservoirs may have net positive greenhouse emissions if large areas of vegetation and trees are submerged, and studies have found that impounded water can contribute to methane emissions.[25] Although wind power is more environmentally and socially friendly, the construction of wind farms still poses social and environmental challenges such as land clearing, which requires relocation or compensation for local farmers. Yet, studies have shown that once wind farms are operational, the land can still be used for farming and grazing in many cases. Second, the development of hydropower in Ethiopia has broad regional water security implications. Several major rivers in Africa originate in the Ethiopian highlands. Damming these rivers may reduce downstream water flows, sparking conflict between Ethiopia and its neighbors. Third, wind power complements hydropower in Ethiopia. Ethiopia has a distinct dry-wet season climate. Water flow is lower during the dry season from October to March, which also happens to be the windiest period in Ethiopia. While the generating capacity of Adama Wind Farm accounts for less than 10 percent of the total generating capacity in Ethiopia, it provides over 15 percent of electricity for the country in the dry season.[26] Generation data from Ethiopian Energy Power, the nation's state-owned power company, reveals that drought is impeding hydropower electricity production. As Table 1 shows, about half of the hydroelectric dams in Ethiopia are operating below capacity due to low water levels. Finally, the cost of electricity generated from wind power is cheaper than existing diesel power products (DPP). Due to the lack of grid connectivity, many businesses and consumers have to resort to diesel generators. Studies show that cost of wind-sourced electricity is around US$0.06 per kWh compared to US$0.129 per kWh for DPP.[27]

Table 1: Operating capacity of current hydroelectric power projects[28]

	Name	Designed Capacity (MW)	Current Capacity (MW)	Difference due to low water level (MW)
1	Tekeze HPP	300	50	155
2	Gilgel Gibe-1 HPP	184	180	4
3	Amerti Neshi HPP	97	5	70
4	Melka Wakena HPP	153	90	25
5	Koka HPP	42	5	17
6	Awash-2 HPP	32	7.5	25
7	Awash-3 HPP	32	7.5	20

The project cycle of a wind farm project follows typically includes four phases: identification, development, construction, and operation. In the identification phase, the project owner, through a feasibility study, selects potential projects for development. During the development phase, the project owner selects the EPC contractor through open tender, closed tender, or tender negotiation, based on prices, experience, financing, and technology. This process usually involves prolonged negotiation between the contractor and project owner to determine the terms of the contract. Once a project is started, construction begins and progresses relatively quickly. After construction is completed, the wind farm is transferred to the project owner for operation, per the terms of the Operations and Maintenance (O&M) agreement. Throughout the project cycle, the project owner can hire an Owner's Engineer, an independent third party representative, to ensure that the contractors are adhering to the project specification. Wind farms are designed and built to be operational for about two to three decades.

Plans to develop Ethiopia's vast wind resources can be traced back to 2006 when the Ethiopian government, supported by a grant from GTZ, contracted German company Lahmeyer to conduct a feasibility study of potential wind farm sites in Ethiopia. They identified several potential sites for wind farms including Ashegoda, Adama, and Messebo-Harena. In 2008, EEP signed an EPC contract with Vergnet of France to develop a 120 MW wind farm at Ashegoda. Located a few kilometers from Mekelle, one of the largest cities in northern Ethiopia, Ashegoda Wind Farm cost US$289.7 million and was financed by the French Development Bank (AFD) and BP Paribas through three loans, of which the Ethiopian Government covered 9 percent.[29] The first loan was a 42-month tied commercial loan from BNP Paribas for €33.6 million (approximately US$37.71 million*) with an 18 month grace period. The second loan was an 11-year loan for €130 million (approximately US$145.9 million) from OECD members backed by COFACE[30] with a 36 month grace period. The third loan was a 15-year, €45 million loan from AFD with a 4 year grace period.[31] The project commenced in 2009, and was inaugurated in 2013. In addition to the wind farm, the project consists of civil works, such as access roads, turbine foundations, transmission lines, and substations.

*Using the August 2016 Euro/USD exchange rate of 1.12 (http://www.bloomberg.com/quote/EURUSD:CUR).

In 2009, HydroChina, financed by a grant from the Chinese government, carried out a survey of solar and wind power potential in Ethiopia. Subsequently, through tender invitation, HydroChina and CGCOC signed an EPC contract with EEP to develop a 51 MW wind farm at Adama. Adama Wind Farm is located 95 kilometers southeast of the capital, Addis Ababa. It was the very first Chinese overseas EPC clean energy project. The Export-Import Bank of China provided financing for the project through preferential export buyer's credit. The project cost US$117 million, and the China Eximbank financed 85 percent of the total cost. Construction on the Adama Wind Farm commenced in June 2011, and was expected to last 12 months. However, Phase I was inaugurated in March 2012, three months ahead of schedule. Adama Wind Farm was the first operational wind farm in Ethiopia. After its inauguration in 2012, EEP signed another contract with HydroChina to add an additional 153 MW of capacity. Considered Phase II, this additional capacity came online in 2015. The consultation service (owner's engineer) for the project was awarded to Addis Ababa University for the first phase, and to Mekelle University and Adama University for the second phase. Adama Phase II has a generating capacity of 153 MW. Again, China Eximbank financed 85 percent of the US$345 million project. Phase II was inaugurated in May 2015 after 18 months of construction.

Table 2: Summary of Ashegoda and Adama Wind Farms

	Ashegoda Wind Farm	Adama Wind Farm I	Adama Wind Farm II
Feasibility	2006	2009	2009
Contract Signing	2008	2009	2012
Capacity (MW)	120 MW	51 MW	153 MW
Total Project Cost	US$289 million	US$117 million	US$345 million
Financiers	BNP Paribas; AFD; Ethiopian Govt.	China Eximbank; Ethiopian Govt.	China Eximbank; Ethiopian Govt.
Commencement	2009	2011	2012
Inauguration	2013	2012	2015

Several policies and institutions support the development of wind energy in Ethiopia. Both Adama and Ashegoda projects were part of Ethiopia's Growth and Transformation Plan (GTP), a five-year economic plan that sets ambitious targets for economic growth, poverty reduction, and infrastructure expansion between 2010 and 2015. Specific to electricity generation, the Ethiopian government planned to quadruple its power generation from 2,000 MW to 10,000 MW between 2010 and 2015, mostly through hydropower development.[32] By the end of 2015, Ethiopia had added 2,194 MW of hydro and wind power, with an additional 6,254 MW expected to come online before 2017. After completion of the GTP, GTP II (2015-2020) was passed by the Ethiopian Parliament at the end of 2015. GTP II sets even loftier goals, adding over 17,000 MW to the national grid in five years.[33] The government has already identified four sites for wind farm development: Aysha Wind Farm (300 MW), Mesebo-Herena Wind Farm (42 MW), Assela Wind Farm (100 MW), and DebreBerhan Wind Farm (100 MW).[34] As of June 2016, Assela Wind Farm had secured a grant from African Development Bank to conduct a feasibility study and complete an ESIA report.[35] The EPC contract for Aysha Wind Farm has been awarded to China Dongfang Electric; China Eximbank will provide 85 percent of the US$257 million total cost.[36]

Development of wind energy falls under the purview of the Ministry of Water, Irrigation, and Electricity (MoWIE), the agency responsible for overall planning and management of energy resources, as well as for creating, coordinating, and monitoring policies and programs for energy development in Ethiopia. The Ethiopian Environmental Protection Authority (EPA) has comprehensive guidelines for conducting environmental and social impact assessments. However, these documents are fairly outdated and the government is in the process of revising and finalizing the language. MoWIE has its own internal environmental and social development directorate, which also includes guidelines for renewable energy development.[37]

The sole executing agency for wind energy projects is the Ethiopian Electric Power Corporation (EEPCo), which is engaged in the generation, transmission, distribution, and sale of electricity in Ethiopia. In recent years, the Ethiopian government has taken steps to encourage development of independent power projects (IPPs). The Energy Proclamation of 2013 effectively ended the monopoly of state-owned enterprises in the power sector by splitting EEPCo into two entities: Ethiopian Electric Power (EEP) and Ethiopian Electric Services (EES). EEP retains control over electricity generation project development and transmission, while EES focuses on managing distribution, sales, and operations of electricity in Ethiopia.[38]

3. Methodology

The goal of this research is to examine the sustainable development impact of the Chinese-financed Adama Wind Farm in Ethiopia, and to compare its practices to the French-financed Ashegoda Wind Farm. Sustainable development is a vague concept. Building on the definition from Our Common Future, the Johannesburg Declaration† further elucidated the concept to include three interdependent and reinforcing pillars: economic development, social progress, and environmental development.[39] This paper draws its definition of sustainable development from a recently published literature review of studies on the impact of Chinese outward direct investment conducted by International Institute for Sustainable Development (IISD). The IISD report reviewed a total of 384 papers in three languages—English, Chinese and Spanish—and reflects the most comprehensive overall assessment of the sustainable impact of Chinese overseas investments to date. The report evaluated the sustainable impact of Chinese investments along four dimensions: economic, community, environment, and governance, In doing so, it used 11 parameters to measure sustainable development: infrastructure development, economic development, local industry linkages, market competition, technology, knowledge and skill transfers, resource curse, employment creation, employment conditions, welfare of local residents, environmental pollution, renewable energy, and governance (see Table 3).[40]

† Our Common Future was a report produced by the 1987 United Nations World Commission on Environment and Development, in which "sustainable development" was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs"; the Johannesburg Declaration was produced by the 2002 World Summit on Sustainable Development.

Table 3: IISD sustainable development impact indicators[41]

Categories	Impact Issues
Economic Impact	Infrastructure development for host countries
	Economic development
	Technology, knowledge, and skill transfer
	Local linkages
	Market competition
	Resource curse
Community Impact	Job Opportunities
	Local residents' welfare
	Employment Conditions
Environment Impact	Environmental pollution
	Renewable Energy
Governance Impact	Transparency, corruption, etc

The research presented here stems from 24 days of fieldwork on Ashegoda and Adama Wind Farms in Ethiopia, during which I conducted semi-structured interviews with numerous stakeholders. At MoWIE, I interviewed the director and members of the Directorate of Energy Study and Development to understand the motivation and history behind Ethiopia's push for wind power, as well as current national policies and goals on a macroeconomic level. I also spoke with the director of MoWIE's Impact Assessment and Social Development Directorate, who has followed and monitored the Adama Wind Farm project closely throughout its development. Ethiopian Electric Power is the owner of both the Ashegoda and Adama Wind Farms. Since both projects have commenced, I tracked down negotiators and project managers for both wind farms in order to gain insight into the negotiation, construction, and maintenance of wind farms. To obtain a more comprehensive perspective, I also talked to the manager of the Ashegoda project and to Adama's project manager from HydroChina. In addition, since I am particularly interested in technology transfer and capacity building, I interviewed university professors, including one who participated in both the Adama and Ashegoda Wind Farm projects. Finally, I interviewed EEP's Operations and Maintenance director for all power plants in Ethiopia, including the Adama and Ashegoda Wind Farms to follow up on the current operating status of both wind farms.

In addition to semi-structured interviews, I visited the Adama Wind Farm and conducted a desk review of relevant documents, such as the Farm's Environmental and Social Impact Assessment report. I also collected information on the Ashegoda and Adama Wind Farms' current operating status from EEP. Due to the time constraints, lack of available information, and language barriers, a comprehensive analysis of sustainable development impact of the Adama and Ashegoda Wind Farms is beyond my reach.[42] Moreover, inconsistency, fragmentation, and lack of available data precluded a quantitative analysis. I instead opt for a qualitative approach.

Using information collected and compiled through interviews, conversations, documents, and observations, I was able to develop fairly complete comparisons between the Adama and Ashegoda Wind Farms along three lines: environmental and social impact, technology transfer, and employment creation. These three areas represent three of the most hotly debated aspects of Chinese engagement in Africa. The environmental and social impact of Chinese overseas investment has always been highly contentious and subject to repeated criticism by the western media. Claims that Chinese contractors bring their own labor and thus crowd out local labor is a particularly salient issue in Africa. Lastly, facilitating technology transfer is crucial for the industrial and economic development of African countries and a vital component of win-win cooperation and sustainable development.

4. Sustainable Development Impact

Environmental and Social Impact

An environmental and social impact assessment requires investors and governments to identify a project's potential negative consequences for the environment and society, and take measures to avoid, minimize, or mitigate them. It ensures that investments are carried out in accordance with sustainable development objectives. Environmental and Social Impact Assessment (ESIA) reports have become a global standard and are integral to any project cycle. In the identification phase, the project owner has to carry out an Environmental Study and include all findings in the feasibility report. Once a project enters into development phase, the project owner is required prepare the ESIA report in accordance with national laws and regulations, as well as consultation with all affected stakeholders, such as indigenous people. Compared to an Environmental Study, an ESIA is much more detailed and requires micro-siting to determine the exact environmental and social impact of the project. Each ESIA is submitted to the MoWIE and Environmental Protection Authority (EPA) for approval. If MoWIE and EPA approve the report, it will issue the project owner a non-object to go forward with the project. Often times, the EPA or MoWIE will provide comments to the project owner requesting further information and/or corrections.

Moreover, if external financing is involved, the financiers may impose additional requirements before disbursing funds. In Ashegoda's case, representatives from EEP disclosed that French banks demanded dozens of non-objects and pre-conditions before they agreed to disperse the funds. For example, written permits from various agencies, such as banks, land-use departments, environmental groups, and local governments, must be obtained and submitted directly to AFD prior to releasing the funds. On the other hand, Chinese contractors took care of financing and interacting with the China Eximbank on behalf of EEP in the Adama Wind Farm Project. Throughout the construction phase, MoWIE and EPA monitored both projects closely with monthly progress reports and unannounced site visits. After the project is inaugurated and the wind farm enters into operation, the project owner has one year to provide a closing report summarizing actual environmental and social impact of the project.

Although the project owner and consultant are technically responsible for preparing the ESIA report, in reality, the EPC contractors are often heavily involved in the process due to

the expertise needed to carry out micro-siting. This was the case in both the Adama and Ashegoda projects. In the Ashegoda case, EEP and experts from Vergnet, the contractor, and Lahmeyer, the consultant, carried out the ESIA. For Adama, since HydroChina conducted the feasibility study in 2009, the EEP delegated even more. Moreover, because local universities were selected as owners' consultants to promote capacity building, HydroChina had to take the lead in compiling the ESIA, as these universities had little experience with wind farm projects. In preparing the ESIA, HydroChina had to take initiative in putting up posters, holding information sessions, and talking directly to affected farmers to meet MoWIE and EPA's requirement for proof of consultation with affected local communities in the ESIA.[43] The ESIA report I reviewed at MoWIE showed HydroChina as the author of the report, and was very comprehensive and clearly written.[44] MoWIE was unable to locate the ESIA report for Ashegoda, so it was not possible to make a direct comparison between the two projects.

By their very nature, wind farm projects pose a relatively small risk to the local environment and community. Neither the Ashegoda or Adama projects endangered flora, fauna, or migratory birds, nor did they require resettlement of any households. However, there was temporary and permanent loss of farmland in order to build the wind farms and the necessary access roads. Feasibility study suggests that Ashegoda Wind Farm needed about 20 hectares of permanent land, and the loss of temporary grain during the construction phase was estimated to be around 100 tons. The ESIA calculated that the Adama Wind Farm Phase II required a total of 128 hectares of land, 72.3 hectares of which were permanent and 53.7 hectares of which were temporary. Compensation was calculated using a pre-designed formula, where affected farmers received money for ten years' worth of grain for permanent loss of farmland, and three years' worth of grain for temporary loss of farmland. EEP paid a total of 39.1 million birr (US$1.81 million) in compensation for the land used to construct the Ashegoda Wind Farm, and a total of 17.5 million birr (US$810,000) in compensation for the Adama Wind Farm Phase II.[45] Compensation was distributed and farmers were highly encouraged to use banks to save their money. The project manager of the Ashegoda Wind Farm recalled that many farmers were able to use the extra income to buy large farming equipment.[46] Vergnet reported that there was no problem with land acquisition.[47] On the other hand, HydroChina reported that the payment process was slow and the company had to pay out of its own pocket first so that the project could move forward.[48]

Neither company carried out any social development projects other than those required by the government, yet the local community benefited from increased infrastructure associated with the project, such as access roads and water pumps. In both cases, there were few environmental or social consequences that negatively impacted the local community. Both projects were built on largely arid land with low population density. Cattle and goats graze freely in the fields next to the Adama Wind Farm; the wind turbines do not appear to disturb them. Households are scattered across the wind farm site and there are regular buses running through the access roads, providing transportation to the households. In addition, neither Vergnet nor HydroChina went out of its way to provide additional services or to mitigate risks. However, they were both responsive to EEP's demands. For example, the site for Ashegoda Wind Farm was moved several kilometers just prior to commencement due to objections from a nearby airport. Upon request from EEP, HydroChina held multiple information sessions and seminars to educate the local residents on impacts of wind farms.[49]

Technology and Knowledge Transfer

At first glance, the extent of technology and knowledge transfer differed between the Ashegoda and Adama Wind Farm projects. In the case of the Adama Wind Farm, local universities, such as Adama University, Addis Ababa University, and Mekelle University, were selected to serve as consultant engineers for EEP. Moreover, according to EEP, the operations and maintenance at the Adama Wind Farm Phase I site have been fully transferred to EEP with Ethiopian staff and engineers on site. In comparison, reports on Ashegoda did not highlight any particular efforts to facilitate technology or knowledge transfer.

However, interviews with relevant stakeholders in both wind farm projects painted a more comprehensive picture. The EPC contract for Ashegoda required Vergnet to provide onsite training. According to both Vergnet and EEP, 35 engineers from EEP participated in specially designed class-room training, where Vergnet brought instructors from France, as well as practical training sessions, where engineers received testing, commissioning, and safety training. Of the 35 engineers, 30 were trained to take over the wind farm during the operations phase. Five of them would go on to use their knowledge for other projects. In addition to onsite training, EEP's engineers also gained a lot of knowledge working side-by-side with Vergnet engineers and, in particular, "doubling" as consultants for the project.[50] Although Lahmeyer was contracted to serve as EEP's consultant for Ashegoda, it only had one resident engineer in Ethiopia. This created opportunities for EEP engineers to interact with Vergnet engineers, which facilitated technology transfer. Because Ashegoda was expected to be the first wind farm in the country, EEP signed a five-year operations and maintenance (O&M) agreement with Vergnet to operate the wind farm for five years.[51]

Moreover, at the beginning of the project Vergnet approached the local university, Mekelle University, about using its labs for testing purposes. This initial cooperation prompted the university professors to contemplate playing a larger role in the Ashegoda Wind Farm project. Shortly after construction on Ashegoda had begun, Mekelle University actively lobbied EEP and the Ethiopian government to involve its students and faculty in order to take advantage of this unique capacity-building opportunity. In June 2012, Mekelle University signed a Memorandum of Understanding (MoU) with EEP to officially participate in the Ashegoda project. The MoU included two components: student internships and a professor consultancy. Since 2012, a few students from Mekelle University have been selected each year to participate in an internship program at the Ashegoda Wind Farm. During the internship, students can observe and gain valuable exposure to wind farm technology. Moreover, Mekelle University organizes field trips and tours on a regular basis and uses the Ashegoda Wind Farm as a practical classroom.[52]

Collaboration with the Ashegoda Wind Farm has enabled Mekelle University to add an Energy-Technology concentration to its Master's program. For professors and university staff hoping to gain hands-on experience at the Ashegoda Wind Farm, the MoU provided the opportunity for them to serve as observing consultants, sitting in on all the meetings, and providing suggestions and comments to EEP on technical issues. A total of seven professors from three fields participated in the Ashegoda project: four mechanical engineers, two civil engineers, and two electric engineers. As of early 2016, there were thirty Ethiopian engineers and seven foreigners operating the Ashegoda Wind Farm. [53]

The terms of technology and knowledge transfer in Adama's case are similar to that of Ashegoda. For Phase I, HydroChina trained 20 EEP engineers on site from both the generation and operations departments. In addition, 30 engineers, including four from Ethiopia's national grid control center, flew to Beijing for a month of training, during which they toured wind farms, manufacturing facilities, and control centers. For Phase II, HydroChina trained 30 EEP engineers and sent all of them to Beijing for additional training. Of these 30 people, 22 engineers came from the Operations and Maintenance department, and will later take over wind farm operations. The remaining eight, mainly mechanical and electric engineers, were from the construction department, and will later move on to new projects.[54] Successful collaboration between Mekelle University and Vergnet strengthened the Ethiopian government's determination to promote university-industry linkage. Similarly, Adama University can organize field trips and tours of Adama Wind Farm and use it as a practical classroom. Instead of using a MoU, the Ethiopian government selected local universities, rather than a foreign firm, as EEP's direct engineering consultants for the Adama Wind Farm. Addis Ababa University served as a consultant for Phase I. Mekelle University and Adama University served as consultants for Phase II. This helped facilitate technology transfer and capacity building.

As observing consultants on the Ashegoda project, the professors' exposure was limited since they mostly dealt with EEP engineers rather than Vergnet directly. Moreover, they could only observe, and their suggestions and comments had no direct impact on Vergnet's construction process. Yet, serving formally as consultant engineers for the Adama Wind Farm allowed them to play a much bigger role in the project. Seventeen professors from Adama University and Mekelle University participated in the Adama Wind Farm Project Phase II. They consisted of three teams: civil, electrical, and mechanical engineers. Consultants focused on ensuring that the quality was on par with the specific terms of the contract and that the Chinese companies, which lacked international experience, followed international standards. The consultants had access to the master plan, a progress tracker, and lists of work to be completed by the contractor. They often needed to sign off on equipment received and quality of work completed. They could inspect, discuss, and even stop the construction process, as they believed necessary. To arrange an inspection, they would give an inspection notice 24 hours in advance to the contractor and the team leader would assign appropriate engineers to conduct the inspection. Following the inspection, the team leader could give directives advising contractors to make corrections, if needed. For example, since all of the wind turbines have to be imported from China, consultants were responsible for assessing the condition of the turbines when they arrive. If the contractor and consultant disagreed, they would hire a third party to assess the impact and maintain the parts.[55]

In Adama II's case, professors serving as consultants significantly increased the level of communication and technology transfer between HydroChina and Ethiopian scholars, as they would actively ask the HydroChina engineers questions and request more information on parts or procedures they didn't understand. At the same time, since they held the power to halt construction, HydroChina engineers were often patient and provided them with the information they requested, even if this was rather unconventional practice.

After completion of Adama Wind Farm Phase I, the Ethiopian government signed a 20 month O&M agreement with HydroChina. This is much shorter than the O&M agreement with

Vergnet. Officials from EEP explained that they prefer shorter O&M agreements, but a five-year O&M is standard practice for Vergnet; HydroChina was more flexible in their O&M terms. As the Adama Wind Farm Phase II was approaching completion, EEP was considering an O&M support agreement rather than an O&M contract.[56] Unlike an O&M contract, where contractors continue to operate and maintain the wind farm, an O&M support agreement transfers operations and maintenance to EEP. This decision reflects an increase in EEP's technological capacity.

Despite a clear evolution in the level of technology and knowledge transfer from the Ashegoda to the Adama Wind Farm project, as exemplified selecting university professors as owner's consultant in the Adama project, two important distinctions are worth noting: First, in both cases, the Ethiopian government largely drove technology and knowledge transfer, mainly through government policies and contract negotiation; Second, technology and knowledge transfer was not systematic and mostly occurred on an individual level, i.e. university professors and EEP engineers. Neither company actively sought to facilitate these transfers; both regarded the requirement of local capacity-building as inefficient. In Ashegoda's case, despite using resources from Mekelle University, Vergnet did not engage with the university professors. Even after the MoU allowed Mekelle University professors to participate in the project, the professors interacted mostly with engineers from EEP rather than from Vergnet. In Adama's case, HydroChina complained that it would prefer working with a professional international consulting company rather than a local university as some local university professors lacked both the time, as well as the experience and knowledge to serve as consultants, resulting in miscommunication and delays.[57] Lastly, language remained a barrier for more efficient technology and knowledge transfer, especially between Ethiopian engineers and the Chinese contractors. EEP officials and employees complained that the English instructions on Chinese equipment were often missing or poorly translated.

Employment Creation

Employment creation is closely linked to technology and knowledge transfer. As noted above, through the training programs designed by Vergnet and HydroChina, the Adama and Ashegoda Wind Farms now employ almost 100 engineers with more advanced skills. In addition to this long-term job creation, the construction of the wind farms also provided many short-term employment opportunities for local residents and companies. Ethiopia has strict labor laws. Companies are only allowed to bring in expatriate experts only if their expertise, knowledge, and skills are not available in the country. Any request for a work permit must be accompanied by a formal explanation describing the expatriate's expertise, signed by the EEP project manager. A work permit allows an expatriate expert to do a specific type of work for three years and it must be renewed annually. A company can hire qualified expatriate experts, but the expatriate must be replaced within a set period of time by an Ethiopian.

In Ashegoda's case, the construction phase employed about 800 workers, including 50 expatriates from different countries. In addition to employing Ethiopian workers, Vergnet subcontracted logistics, electromechanical works and civil works to local companies. Normally

Ethiopia also requires projects like this to use Ethiopia's own state-owned shipping line, but Vergnet received a special waiver to use its own shipping lines, as Ethiopia had no appropriate vessel to load the over-sized components, such as the blades.

In Adama's case, the construction phase employed close to 1,500 employees, about 1,000 Ethiopians and 400 Chinese. HydroChina only subcontracted the logistics work, such as shipping, insurance, and customs clearance, to local companies. Unlike Ashegoda, which commenced first, HydroChina did not receive a special waiver for shipping and had to use the Ethiopian shipping company. According to HydroChina's Adama project manager, shipping was a challenge as the ships were relatively outdated and the crew unaccustomed to shipping large wind farm equipment.[58] Undoubtedly these local workers and companies gained important experience and knowledge for future wind farm projects.

Unfortunately, employment from local content was very limited in both cases. On one hand, Ethiopia lacks a sophisticated manufacturing capacity. On the other hand, both projects had either an explicit or implicit requirement that the majority of the content shall come from the donor country. For instance, there was a prerequisite for the BNP Paribas loan that more than 50 percent of the supplies must be of French origin.[59] In the Adama project, financed through China's export credit agency, it was understood from the outset that most of the inputs would come from China.

According to HydroChina's representative, the planning for the Adama Phase III project intends to transfer part of the manufacturing process to Ethiopia to expand local capacity and save logistics costs.[60] Localization of the manufacturing process will not only facilitate technology transfer, but will also create high value-added employment opportunities. Vergnet performs relatively better at employment creation than HydroChina by bringing in fewer expatriates and creating more backward linkages in its supply chain. At the same time, HydroChina hired a considerable number of local workers and has long-term plans to localize. Representatives from HydroChina attributed its higher number of Chinese workers in Adama Wind Farm to the shorter construction period, language barrier, and lack of trusted local suppliers.[61] On the other hand, the Ethiopian government still plays an important role in pushing for local employment opportunities within these wind farm projects through stringent labor laws and adjusting its labor requirements based on timely evaluation of domestic companies' capabilities.

5. Discussion and Policy Suggestions

The above comparisons show that the Ashegoda and Adama Wind Farms have had a similar sustainable development impact according to the criteria used in this study. Vergnet and HydroChina performed similarly in terms of environmental and social impact. Although Vergnet formed more backward linkages and employed more local workers than HydroChina, HydroChina transferred a higher level of technology and knowledge to local engineers and universities. More importantly, donor country differences played little role in the variations. In fact, the host government's expectations and demands contributed to the variations in sustainable development impact.

Interestingly, both representatives from HydroChina and Vergnet responded "demanding" when asked about their impression of working with their Ethiopian client.[62] Even though many of these demands seemed to inconvenience the contractors, they guaranteed a level of sustainable development for Ethiopia. As such, contrary to conventional wisdom, the financing country played a very limited role in determining the level of sustainable development impact in this case. Instead, Ethiopia as the host government demonstrated significant capacity to maximize its benefit from development.

In addition, many critics accuse Chinese contractors of cornering the market with their cheap labor and unbeatable prices. However, during my discussion with the Ethiopian project manager for Ashegoda Wind Farm, I learned that in addition to Vergnet, Sinohydro, one of the biggest renewable energy developers in the world, also submitted a tender for the Ashegoda Wind Farm project. He disclosed that developers are evaluated using four criteria: technology, prices, financing, and experience. In fact, Vergnet and Sinohydro offered very similar terms in terms of prices and financing schemes. In Ashegoda's case, Vergnet won the contract. It was not until 2009, when the Chinese government provided financing for HydroChina to conduct a feasibility study in Adama, that HydroChina was able to win the closed-door contract.[63]

In interviews, an EEP project manager who worked on both the Adama and Ashegoda projects remarked that nationality of the contractors did play an important role in how he interacted with them. However, he said, host countries cannot rely solely on the contractors to do their job. Contractors are profit-driven; it is up to the project owner to ensure and monitor the quality and safety of the project. For example, the Ashegoda Wind Farm contract dictated that turbines must receive certification from an independent party before they were installed. However, Vergnet installed the turbines without securing adequate certification. EEP's project manager only found out about the non-compliance after construction had begun. Following the terms of the contract, EEP's project manager asked Vergnet to change the turbines. Upon insistence from EEP, Vergnet switched the turbines during the middle of the project. As a result, the Ashegoda Wind Farm uses two types of turbines: thirty 1 MW 2-blade Vergnet turbines and fifty-four 1.5 MW 3-blade Alstom turbines.[64]

Finally, EEP's Adama project manager noted the differences in dealing with the French and Chinese contractors. Unlike the French contractors, Chinese contractors were more flexible. The Chinese contractors are willing to cater and adjust to EEP and MoWIE's demands both in the contract negotiating phase and construction phase. For example, even though it is customary for developers to operate and maintain the wind farms for several years after completion, HydroChina was open to the idea of shortening the O&M contract for Adama I and signing only an O&M support agreement for Adama II. However, at the same time, he noted that one has to be firm and explicit in making demands and creating expectations when communicating with Chinese contractors.[65] In both cases, the host government bears responsibility for monitoring and enforcement of contracts.

Chinese engagement in overseas wind energy will undoubtedly rise in the future. This article concludes by offering five policy recommendations for the Ethiopian government, Chinese contractors, and western contractors.

Ethiopian Government

a) Improve the current regulatory framework to increase predictability and attractiveness of investments in wind energy.

Although Ethiopia's Energy Proclamation of 2013 set up regulatory framework to introduce private developers to its energy industry, neither Vergnet nor HydroChina were confident about the actual implementation of the policy.[66] Moreover, Ethiopia's regulatory framework for wind energy development is still in its infancy. It does not offer any targeted wind energy subsidies, tax exemptions, or feed-in tariffs to stimulate foreign investments.

b) Promote and institutionalize university-industry collaboration and joint ventures.

The Ashegoda and Adama Wind Farms provide examples of effective university-industry collaboration. On several occasions the Ethiopian government has expressed the desire to continue this collaboration in future projects, but local universities have not yet been involved in the new wind farm projects. The Ethiopian government should establish a regulatory protocol to involve the local universities in all future projects. In this way, local experts can participate from the beginning. Many disputes and problems in the construction phase find their origins in the development and negotiation phase. Early involvement will grant professors who are training the next generation of local experts a more comprehensive understanding of projects as they develop. In addition to university-industry collaboration, the Ethiopian government should consider deepening business relations by encouraging joint ventures. Considering that Adama III will locate part of its manufacturing in Ethiopia, the government may impose local content requirements to ensure that other companies follow suit. However, these policies must be carefully evaluated as they may discourage potential investors.

c) Increase human capital through education and technological exchange.

Lack of human capital remains a significant barrier to technology and knowledge transfer. In order to reap the full benefit of China's engagement, Ethiopia should invest in education to provide a knowledgeable work force that can fill meaningful positions in Chinese construction projects. The Ethiopian government should work closely with Confucius Schools in Addis Ababa and Mekelle to increase the language skills of its students so that they can become recipients of knowledge and technology transfer. In addition, the Ethiopian government should form domestic technology centers in local universities and promote formal technology exchanges and cooperation between local and Chinese technological centers. At the moment, Mekelle U has held multiple seminars on both the technical aspect, such as electro-mechanical works of the wind farms.[67]

Chinese Contractors/Government

d) Improve adherence to international standards and use China's own development experience to promote cooperation between Chinese overseas investment companies and the host country.

In addition to the widely cited language barrier, the lack of standard operating procedures (SOP) for Chinese contractors also hinders effective cooperation with project owners. Chinese contractors should develop SOPs according to international standards in order to facilitate Chinese overseas projects. SOPs are essential for any Chinese company looking to expand its global influence. More importantly, China should impart to Ethiopia its own experience developing domestic wind farm industry in the past decade. So far, China has hosted 54 workshop and training seminars on small hydropower where over 30 Ethiopian officials and engineers have participated.[68] China should consider setting up similar workshop and seminars for wind power. Chinese companies are seeking to export Chinese standards and technical specifications abroad with these EPC wind farm projects.[69] Sharing China's developmental experience will be an ideal way for its standards to go global. In this process, China will reap reputational gains and Chinese companies will become international brands.

Western Companies

e) Acknowledge the benefits of Chinese overseas investment and learn from China's strengths.

Compared to Chinese contractors, western companies are rigid and have little regards for China's strength.[70] Many western companies worry the rise of Chinese contractors using Chinese standards will lock countries into an inferior standard. While Chinese contractors still have a lot to improve, western companies should recognize China's growth and engage Chinese contractors in forming better standards together.

6. Conclusion

This paper compares the sustainable development impact of the Chinese-financed Adama Wind Farm in Ethiopia to that of the French-financed Ashegoda Wind Farm. Examining the two projects' environmental and social impact, technology transfer, and employment creation shows that the Adama and Ashegoda Wind Farms performed similarly in terms of delivering sustainable development. More importantly, this research reveals that, at least in this case, donor country characteristics played only a limited role in determining the level of sustainable development benefits. Instead, Ethiopia as the host country demonstrated its relatively extensive engineering capacity and ability to facilitate and maximize sustainable development benefits. Still, the important role of the host government by no means absolves any Chinese or foreign contractor of their social responsibility to the host country and society. Rather, Ethiopia's experience can encourage other host governments to become more assertive in pursuing sustainable development benefits for their people. Findings from this research should be used as a standard to further evaluate Chinese overseas wind projects. Due to time constraints and a lack of data, this paper was only able to gather qualitative data on

three aspects of these projects' sustainable development impact. Future research can aim to examine these same issues quantitatively, thereby expanding our understanding of the scope of sustainable development impact.

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does not have strong English language skills, especially the farmers who live near the wind farms. Moreover, even though Amharic is the official language of Ethiopia, in Mekelle, where the Ashegoda Wind Farm is located, the most commonly used language is Tigray.

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Author

Yanning Chen is a first-year PhD student at Johns Hopkins University SAIS International Development Program. Her research interest focuses on promoting renewable energy in Africa.

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SAIS China-Africa Research Initiative
1717 Massachusetts Avenue, NW, Suite 733 Washington, DC 20036
www.sais-cari.org ■ Email: sais-cari@jhu.edu