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# Fuelling new problems

## The impact of China's biodiesel policies

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**Fuelling new problems. The Impact of China's biodiesel policies**

**Matthew Kraus**

*Abstract.* This paper looks at China's biofuel policies and assesses their social and environmental impact domestically and abroad. It is argued that the Chinese society is not only bearing the costs in by funnelling part of its taxes in bio fuel projects; there is also evidence that they pay a significant indirect price: higher food prices and reallocation of land. But China is also externalizing the externalities to other states by supporting its companies to reach out to essentially less developed countries without providing and enforcing transparent guidelines. *Topics:* biofuel, climate change, clean energy. *JEL-codes:* Q54.

## 1. Introduction

By 2020, the Chinese government expects that fifteen percent of China's transport energy needs will be met by biofuels. "We have worked out a complete set of policies to support non-food biofuels, as they are clean energy sources with a limited negative impact on the environment," a senior official of the Finance Ministry stated, "flexible subsidies will be offered to biofuel producers who lose money on crops when crude oil prices are low."[1] The production of clean energy has been recognized by Beijing as a precondition for sustaining growth and a matter of national security. China's growing appetite for biofuel seems to support the assumption of international political economy theory that as the industrial frontier relocates to less developed countries, emerging markets will be-come increasingly aware of the environmental downside of industrial production, and on their turn incrementally try to impose tighter rules.[2]

There are a few options for developing countries to translate this "awareness" into policies. The most optimistic scenario is that governments invest in the development of technologies that make production less polluting.[3] For China this would imply a green-technological leap forward.



Second, governments can insist that enterprises internalize all costs, by asking them to pay for waste management and investing in more efficient use of energy, but this obviously will affect their country's competitive edge.[4] Third, they can have the burden shouldered by their societies and levy extra taxes to clean up companies' mess. Finally, governments can decide to externalize the externalities. This implies that environmentally harmful activities are relocated to countries that are even less developed.[5]

This paper assesses China's biofuel strategy both domestically and abroad. It starts with a concise overview of China's biofuel objectives and of the main actors involved. Subsequently, we look at the internal dimension of these policies. To which extent is the Chinese government trying to recuperate the costs from either companies or the public? Finally, an evaluation is made of the impact of the policies on other developing countries. It will be concluded that even this green step forward brings new social externalities: domestically as well as abroad.

## 2. The green leap forward

Since the 1990s, China gradually has shifted its energy policy from fixation with coal and oil to a strategy that aims at saving energy and to diversify supplies.[6] The Ninth Five-Year Plan of 1996 spent attention on the conservation of energy and instructed the exploration of alternative sources. In 1998, the State Development and Planning Commission (SDPC) and Ministry of Science and Technology launched a joint Incentive Policy for Renewable Energy. In 2001, China's Tenth Five-Year Plan highlighted renewable energy for further development in the Chinese power industry. "New energy development," the plan says, "should be a long-term strategy in energy implementation." It underlined the importance of commercializing photovoltaic and wind technologies, hydropower, bioelectricity, geo-thermal energy, etc. In 2005, the Standing Committee of the National People's Congress enacted the Renewable Energy Promotion Law that promotes the development of the

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renewable energy market by establishing standards and encouraging private and public users. Concrete aims followed in 2006, when the National Development and Reform Commission in China (NDRC), the main governmental body for economic planning, revealed a plan to allocate 266 billion USD to renewable energy by 2020. The money was to be spent on increasing hydropower production to 300 million kilowatts, wind power to thirty million kilowatts, solar energy to 1.8 million kilowatts and biomass to thirty million kilowatts. As part of the massive greenhouse gas reduction plan China will replace twelve million tons of oil with two million tons of biodiesel and ten million tons of bio-ethanol every year.

Renewable energy also is a clear priority in the Eleventh Five Year Plan, whose main ambition is the promotion of socially and ecologically sustainable growth. In June 2007, China issued its National Climate Change Program, the first ever drafted by a developing country. This document encompasses various initiatives to restructure its economy, promoting clean technologies and improving energy efficiency. If these targets are achieved, China will emit 1.5 billion tons less carbon dioxide by 2010 while still continuing to grow rapidly. By 2020, it plans to develop 120,000 megawatt of renewable power. This would account for twelve percent to sixteen percent of its total installed energy production capacity. China has set an objective of fulfilling thirty percent or more of its total energy needs with renewable sources by 2050.[7] All in all, the People's Republic's clean energy policy rests on two main pillars: increasing efficiency and switching to less polluting sources. The latter includes renewable energy like wind, water and solar power as well as the cleaner use of finite sources like clean-coal, gas and nuclear energy.

Biofuels are certainly not at the centre of the government's clean energy policy, but the NDRC has nonetheless maintained their importance throughout the various new policies that have been released. In 2002, the NDRC started tests with ethanol-mixed gasoline in Henan and Heilongjiang provinces, and in 2004 proposed to the State Council's National Leading Energy Group to implement biofuel projects on a larger scale. In the Eleventh Five-Year Plan (2006-2011) the goal was set to cover fifteen percent of the transportation fuel needs with biodiesel, and an extensive subsidy programme was green lighted for new projects. A national ethanol



promotion team was established to encourage local governments and companies. In 2008, China passed the E10 law that requires all fuel sold in certain provinces to be mixed with at least ten percent bio ethanol.[8] The law is not in effect in all provinces; however in the Guangxi, Henan, and Heilongjiang provinces E10 is making the most headway. The E10 program started in three cities in Henan province: Luoyang, Zhangzhou, and Nanyang.[9] It later expanded into selected cities in Heilongjiang, Jilin, Hubei, Hebei, Anhui, Shandong, Jiangsu, Guangxi, and Liaoning provinces.[10]

There are two types of biofuel that can be yielded from plants, bio-ethanol and biodiesel. Bio-ethanol can be used in modern cars and is created by converting natural oil into ethanol. Biodiesel can only be used in diesel engines. However, biodiesel can be synthesized from both natural oils and waste oils that have been used, such as fry oil. Although there are difference between them this paper will refer to the collectively as biofuels. Biofuel oils can be extracted from various crops. *Jatropha curcas,* cassava, sorghum and maize are the most prevalent. There are currently experiments underway to find and engineer crops that will yield more oil for conversion. Maize is the most commonly used feedstock and also most controversial, because it is a staple food crop. Cassava and sorghum are possible food sources. The tubers produced by cassava and the grains produced by sorghum are edible. The two plants are not at the center of the Chinese diet, however in times of food shortage or famine they could be used as sources of nutrient diversification. *Jatropha curcas* can yield a berry that contains up to 40 percent oil.[11] This plant is capable (although it produces less) of surviving in nutrient deprived soils, which makes it an excellent choice for fringe land farming. Furthermore it can survive drought and is relatively free of diseases. Jatropha use has many advantages compared to traditional grain and maize biofuel crops. Its ineligibility for food, and consequently its immunity to the fuel vs. food argument is one of them. Unfortunately *Jatropha* plantations take several years to develop.

### 3. Domestic problems

This section examines who is paying for the costs of the promotion of biofuels: the government by spending segments of its revenues on projects, companies by paying for their own projects as a part of the production process, or specific sections of Chinese society in case groups are required to disproportionally shoulder negative consequences. State subsidies are the main driver of Chinese biodiesel production. In the Eleventh Five-Year Plan China has set aside 101 billion USD to meet fifteen percent of its transportation energy needs through the use of biofuel by 2020, which equates to twelve million tons of biofuel.[12] Most of the money has been allocated to provinces such as Henan, Anhui, Jilin and Heilongjiang, which has led to a proliferation of local state-owned companies, often with a background in agriculture. These firms rapidly started to expand their activities towards the production of biofuel.[13] Large national state-owned enterprises also benefit from these subsidies and various advantageous credit lines from policy banks. China National Petroleum Corporation recently worked out a deal with the National Forest Bureau to each develop biomass plants in Yunnan and Sichun capable of producing 10,000 to 30,000 tons of biofuel that utilize *Jatropha curca* feedstock.[14] Chin National Petroleum Corporation (CNPC) "intend[s] to establish a biofuel experimental base with an annual production of 0.6 million tons of sweet potato fuel ethanol and 0.1 million tons of Barbados nut biodiesel oil during the Eleventh Five-Year Plan".[15] China National Offshore Oil Corporation (CNOOC) has signed deals with the Sichuan and Hainan provinces for *Jatropha curca* plantations.[16] The Sichuan plant, located in West Panzhihua city, plans to produce 100,000 tons of biofuel annually by 2010.[17] The Hainan facility located in Dongfang City will produce 600,000 tons annually.[18] The third major oil company in China, Sinopec, is also making a move into the biofuel market. In July 2006, Sinopec signed a Framework Agreement with the Municipal Government of the Sichuan Province to build a biodiesel production plant with an annual output of 100,000 tons in Panzhihua as well. The Plant will have an

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auxiliary energy forest base of 400,000-500,000 mu (up to 128 square miles).[19] These large state-owned companies, which control the downstream energy market, have attracted a large number of private companies. Enterprises like Gushan Environmental Energy and the American China Clean Energy can only sell their products to SINOPEC and CNPC who blend the ethanol with gasoline and distribute E10 to gas stations.[20] A whole multi-billion sector is thriving on brand new government money, but privately speaking, many experts of large energy companies reckon that unless prices of fossil fuels will double or triple, the E-10 strategy will not be sustainable without heavy state subsidy.[21]

While biofuel projects drain away billions of government money, the indirect socio-economic costs are mounting too. As the production of biofuel continues to grow, a debate has started about the risks for food security. Wang Xiaobing, a senior official at the Agriculture Ministry stated: "In China the first thing is to provide food for its 1.3 billion people, and after that, we will support biofuel production."[22] In China, food security traditionally has been one of the main sources of legitimacy for the government. Many Chinese citizens still remember the food scarcity of the late 1950s and early 1960s. Food security "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life."[23] The Chinese government strives to provide this for its citizens. China's rate of per capita farmland occupation amounts only to 0.26 to 0.30 acres.[24] This leaves very little for food production, not to mention flora for fuel production. Yet, the Chinese government contradicts itself. On the one hand discouraging the use of grain for biofuel production, while on the other hand it rewards officials with better chances for promotion if the goals of biodiesel production are met, and offers financial incentives to energy companies to reach the E-10 targets, which has already rendered China more dependent on foreign supplies of palm oil, cassava, and maize.

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China's geography is not ideal for the production of crops. "On average, per capita arable land is about 0.27 hectares and per capita fresh

water availability less than 2,000 m3/year."[25] Northern China has a good amount of land however it suffers from water scarcity. While in the south it is opposite, there is plenty of water but not a large amount of suitable farmland. In many areas, agriculture is practiced on very fragile land, which causes serious soil and water erosions and ecosystem degradation.[26] The low amount of arable land marginalizes the production of biofuel compared to food. Originally biofuel production began by using the reserve grain and maize that had gone stale. "About seventeen percent to eighteen percent of grain produced every year is reserved in case of poor harvest or natural disaster… twenty percent to thirty percent is substituted by fresh grain every year."[27] With the exhaustion of stale grain biofuel producers have turned to using fresh maize and grain.[28] In 2006, maize constituted around ninety per cent of the feedstock for China's fuel ethanol production.[29] The Chinese have been quick to recognize the conflict between biofuel production and food security. There are plans to solve problems. The most realistic proposal is planting Jatropha plants on marginal land that would not be able to support normal crop growth. The weed has been dubbed the "Ideal Source for Biofuel."[30]

The water impact also is an aversion to growing of biofuels. Some form of feedstock, sugarcane, can consume up to four gallons of water per day. Durning water shortages, this may provide a problem because this amount of water consumption is more than some cash crops including maize. The water consumption is very important in India and in the dry arid parts of China. In China, 550 of its largest 600 cities already face water shortages, and its cities and industry compete with farmers and rural areas for access to water.[31] Wang Hongguang, director general of China's National Center for Biotechnology Development, said that "the concerns put forward… have already been considered, and solutions have been found that won't threaten the country's water resources, farmland, and food security. Sorghum and cassava consume up to half of the water of maize, and these crops also grow in the south where water resources are rich.[32] By carefully selecting crops that are drought resistant and can be grown on marginal lands the Chinese can begin tackling some of the major negative side effects of growing feedstock for biofuel conversion.



Increased food prices are one of the arguments against the biofuel industry. The rise in biofuel production could endanger food stores, and increase food prices. The IMF estimated that the increased demand for biofuels accounted for seventy percent of the increase in maize prices and 40 percent of the increase in soybean prices that occurred between 2006 and 2008.[33] In 2003 China exported sixteen million tons of maize, in 2006 the figure dropped drastically to three million tons, an evolution that can be attributed to a large extent to increasing activity in the biofuel industry.[34] Biofuel is not the only contributor in the rise of food prices, low harvest, increased consumption, and other variables also play a role in price increases. The production of biofuel from maize is fuelling the allocation of more cropland to maize. In the Jinlin province, maize planted areas increased by 264,000 acres from 2007 to 2008, while soybean planted areas decreased by over 165,000 acres, various other crops experienced similar reductions.[35] The feedstock for biofuel plants and the need for sufficient grain stores have increased while other crops have suffered. When lower amounts of these crops (soybean) are planted there is less surplus. The supply may not meet the demand, which could drive up prices of these marginalized crops. Higher food prices will increase rural income, but as the food prices rise, rural farmers and families will the "most adversely effected".[36] Other foods and meats will increase in price as well. The increased income that the farmer would receive from growing maize would be spent buying more expensive foods. Not only do biofuels have an impact on grain prices; they also have an effect on the live stock prices. As more grain and maize is diverted for biofuel production there is less grain for cattle and other livestock. This can be seen in the rise of pork prices. Maize is the main diet of pigs. The price of pork has gone up by 43 percent.[37] Raising animals for meet production "involves a grain-to-meat input-to-output ratio of between three to one and eight to one" depending on what animal is being raised.[38]

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In conclusion, Chinese biofuel programs have many obstacles on their way, one of the largest being food shortage and rises in food prices. In and effort to combat this Xu Dingming, vice director of the Office of the

National Energy Leading Group said "Food-based ethanol fuel will not be the direction for China."[39] However energy is a rising problem and China has appropriated 188 million USD in financial subsidies to ethanol producers each year.[40] Most of the subsidies are going to maize and grain based biofuel plants, because cassava, Jatropha, and sorghum are not yet abundant enough to have a real impact. There are plans in the works to combat potential issues. One solution to the food versus biofuel battle is to continue planting sweet sorghum and Jatropha. Sweet sorghum is drought tolerant and can survive in saline and alkaline soils that cannot sustain grain crops in northern China.[41] This would utilize vast amounts of land that are normally unused. Similarly Jatropha can be grown on marginal lands that cannot sustain harvestable plant growth. By creating plantations for these two types of vegetation China will be able to make a long term move away from producing biofuels from staple foods. These crops would relieve the pressure put on maize and grain, by creating non-editable sources of biofuel oils that do not compete with staple food for land or water.

**4. International Investments and Biofuel Effects**

China has been investing in various countries to secure its biofuel needs. It is the chief importer of oils from the Pacific islands and has developed plantations to create biofuel oils for China. There are also many Chinese sponsored biofuel plants. There have been Chinese investments in Africa and around the world to attempt to satisfy the Chinese hunger for energy and oil. There are both national and private investors each investing in different aspects of biofuel production. The investments take many different forms from plantations for feedstock, to actual biofuel plants, to simple research reports to ascertain whether or not a country or location is eligible for development. China had been very carful to keep its investments in biofuel quiet. Most of the investments are not widely publicized.

China is by far is the world's largest importer of palm oil. In 2007, it imported a total of five million tons of palm oil.[42] China imports most of its oil from regions in the Southeast Asia, specifically Indonesia and Malaysia.



In 2007 China imported 3.6 million tons of palm oil from Malaysia equalling 2.6 billion USD and 1.4 million tons from Indonesia equalling one billion USD.[43] Palm oil is used for both consumer and biofuel purposes. Some of the palm oil that is imported from these regions is used to create biofuel.[44] China is not only buying vast amounts of raw palm oil but has been buying used and waste palm oil as well.[45] Waste palm oil can be refined and converted into biodiesel. Palm oil exporting is a major industry in Southeast Asian counties, especially Malaysia and Indonesia. China's extensive importation of the commodity boosts local economies. Palm oil farms provide jobs and income for many people in the south pacific. The People's Republic has also become the largest buyer of cassava from Thailand, receiving approximately three fifth of the total amount exported.[46] Almost all the imported cassava is used for the production of biofuel.

One of the biggest countries that China has invested in is Indonesia. National oil cooperation's such as SINOPEC have invested five billion USD into Indonesia, Papua and East Kalimantan regions; they will cooperate with PT Puri Usaha Kencana to build processing plants and plantations.[47] CNOOC plans to build three biofuel plants in West Kalimantan, investing 5.5 billion USD. They will be built in the districts of Sanggau, Sambas and Ketapang there are also other private investors that are setting up shop in Indonesia.[48] By 2025 Indonesia's palm oil estate is expected to grow from 6.5 million ha today to 16.5 to 26 million ha.[49] The biofuel industry is supporting the expansion of palm oil plantations. This will cause deforestation and possibly homelessness as more land is converted to palm oil plantations, but it could also form a new source of income to rural areas of Indonesia if investments were to be efficiently controlled. China has been investing in other s

In Malaysia, a joint venture has been set up between Van Der Horst Biodiesel and The Institute of Environmental Science and Engineering, which is linked to the Singapore based Nanyang Technological University. They will attempt to build Singapore's first biodiesel plant using *Jatropha curcas* as feedstock. It will see an investment of around 26.3 million dollars and have an annual capacity of 200,000 tons per year.[50] The company plans to ship the biodiesel to major markets in China.[51] Guanxi Estates of China with Eastern Petroleum invested 300 million to build cassava plant in the

Philippines.[52] Fuhua Agricultural Group of China is investing five billion to develop a state-of-the-art agro-industrial park and develop one million hectares of hybrid maize farms in the Philippines.[53]

In Africa, China has been making land grabs and deals. Africa is considered a perfect place to invest in biofuels production because of available land space, favourable climate and "cheap" labour.[54] Asian "companies are coming into Africa to clear forests or take over crop-producing land for biodiesel production."[55] In Mozambique for example, China has cultivated a partnership with the Brazilian cooperation EMBRAPA to produce biofuel. China will invest 5.5 billion USD in southern Africa including infrastructure to bring biofuels to market.[56] In the Democratic Republic of Congo the Chinese company, ZTE International, is investing one billion USD in a three million hectare oil palm plantation.[57] "In Nigeria the Taraba State government announced a pact with the China based A-Dinota Ventures Ltd, to build a 19 Mgy cassava ethanol plant."[58] These are just some of the investments China has made in foreign countries in the biofuel industry. There has been an interest in African countries to create a "Green OPEC" group. These countries include: Bénin, Burkina Faso, The Democratic Republic of the Congo, Gambia, Ghana, Guinée, Guinea-Bissau, Madagascar, Mali, Morocco, Niger, Sénégal, Sierra Leone, Togo, and Zambia all of which have expressed interest in "expanding biofuel production".[59]

Biofuel could possibly present problems in Africa as well as in the Southeast Asia. Water is a major component in feedstock plantation and there are many areas in Africa, specifically western Africa, where water supply is already an issue. Building plantations may only increase these problems and create more demand for a commodity that is already scarce.[60] China's business practices in the Third World have already been questioned by many experts. The balance between energy security and food security is sensitive in Africa. By continuing to grow food for fuel, China might further propagate its negative image of a country that is looking after profits at any expense. Similarly, as countries in the Southeast Asia develop

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more land for biofuel production they loose land that would otherwise be used for harvesting food. In various partner countries, political leaders have lamented the production of precious crops for exports to China. In the Philippines for instance, this discussion led to the 2007 Biofuels Act, saying that backing biofuels could adversely affect the country's ability to produce its own food.[61] China has thus to guarantee its investments are balanced.

As previously stated Chinese investments boost economies and provide a product that is in high demand, and provide jobs to workers in under developed regions. However the jobs that are being provided, need to be looked at closely. "While the projects increase the income of a few plantation smallholders, it also had a large negative impact by turning many villagers in the project area into poorly paid wage labourers."[62] The difference in the wage gap creates "envy and discord" inside communities disrupting the social structure. This is aggravated by political corruption, which is rampant in most of China's biofuel supplying countries. Indonesia's plantation and forestry sectors are infested with corruption, collusion, and nepotism, according to the Indonesian government's own official investigations.[63] For example, in Borneo and Papua New Guinea land that was lived on by native tribes for generations has been "allocated" by the governments and given to oil palm plantation.[64] Homes of indigenous inhabitants are being bulldozed to make way for biofuel plantations, often without any legal constraint because of the lack of land ownership rights.[65] These people were either dispersed or became underpaid workers in the palm plantations. In Ghana a company illegally seized 38,000 hectares of land for biofuels production and only backed down when civil society made it a major public issue. In Ethiopia, 10,000 hectares were cleared in a natural reserve.[66]

China is developing into one of the largest investors in foreign bio fuel projects. Its companies have made forays in numerous countries in the South. The foreign investments are relatively recent, and often it is too soon to determine the exact impact on local society. Yet, the main concern stated in this section is that bio fuel projects in fail developing countries often produce negative social and environmental issues because of the interplay of aggressive corporate strategies, local political negligence and corruption, the lack of a legal framework, and fragile agricultural and ecological

systems. China's practices thus far have not proven to be reassuring. Whereas there is no evidence that the Chinese government is aware of the risks or attempts to monitor the behaviour of its companies; there are already few examples that the latter are capitalizing on the weak governance of their partner countries to reap profits. However, the success of China's foreign bio fuel programs to a large extent depends on its long-term sustainability. Most palm oil crops require years to grow to full production capacity. To maintain the plantations for long stretches of time it is important that palm plantations not meet resistance from the surrounding society. Problematic practices in the alternative energy sector could add to China's image of an international free rider that coaxes developing countries in unequal deals.

## 5. Conclusion

Biofuel will only fulfil a minor part of China's clean energy needs, but given the vast scale of its needs, even this small aspect of Beijing's energy policies will have a substantial impact domestically and abroad. New regulations and incentives have awakened a lot of corporate interest, and just in a few years time, the People's Republic became one of the largest investors in bio fuel production. This observation confirms the assumption that as China develops, it will aim at more qualitative growth, and gradually conceive tighter regulations to curb environmental and social externalities. Referring to the initial question - Who is paying for it? - it is obvious that without massive state support bio fuel production would not have known such a rapid expansion. Chinese society is not only bearing the costs in by funnelling part of its taxes in bio fuel projects; there is also evidence that they pay a significant indirect price: higher food prices, reallocation of land, etc. But China is also *externalizing the externalities* to other states by supporting its companies to reach out to essentially less developed countries without providing and enforcing transparent guidelines. China's experience with bio fuels shows thus that the objective to deal with the environmental externalities, now increasingly perceived as a threat to China's long-term stability, are leading to secondary externalities that will also inevitably result into new hurdles for the People's Republic development.



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