Study on the Energy Sector in Ethiopia

(This is an English version translated by the Embassy of Japan in Ethiopia based on an original report written in Japanese)

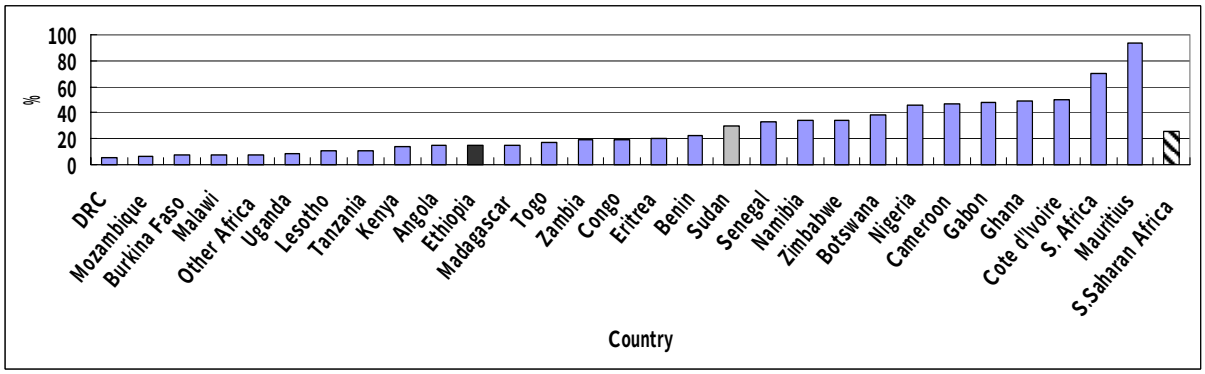
September, 2008

Embassy of Japan in Ethiopia

1. Introduction

The long-term goal of the five year development strategy, PASDEP (Plan for Accelerated and Sustained Development to End Poverty), is for Ethiopia to become a middle income country in 20-30 years. Since Ethiopia is not an oil producing country, it should achieve this target by strong industrial development.

A stable supply of enough energy is a must for industrialization. However, the access to energy in Ethiopia is relatively low, as little as 16 % (2005), while the average access rate of Sub-Sahara Africa is 26% (figure 1). The access to energy is gradually improving to reach 20% in 2007 by the efforts of the EEPCo (Ethiopian Electric Power Corporation) and the GoE (Government of Ethiopia) constructing new power plants and expanding the national grid, although it is still lower than the Sub-Sahara African average. In addition, some say that this figure is not reflecting the number of the population who are actually using electricity. The official number, 16%, is calculated by the population living in the electrified area (which means the area the national grid reaches) but many of the poor do not have money to pay the cost for distribution lines from the national grid to their houses and they are left without electricity. The real access rate of the population that is actually using electricity is said to be much lower, about 6 %[1].



Source: OECD/IEA, World Energy Outlook 2006, ANNEX B[2]

Figure 1 Access to Electricity, Sub-Saharan Africa（2005）

In addition to the low access rate to electricity, another problem in the energy sector is that Ethiopia is too dependent on hydro power, which causes brownouts during the dry season/drought.

[1] WB, Project Appraisal Document for a Second Electricity Access Rural Expansion Project

[2] http://www.worldenergyoutlook.org/docs/weo2006/Electricity.pdf

On the other hand, Ethiopia is facing new difficulties, such as a food shortage caused by the lack of rain during the small rainy season in 2008, the oil price surge hitting all over the world, and hyper inflation which has reached 40%. Ethiopia has been recording two digit economic growth for the last five years but it is anticipated that it would slow down due to these new challenges. Further enhancement of the energy sector is a must in order to maintain the economic growth and become a middle-income country in 20-30 years through industrialization, considering the difficult macro-economic situation.

Although Ethiopia is not well blessed with natural resources according to current knowledge, it has rich water resources such as the Nile River. Therefore, Ethiopia is aggressively developing hydropower plants, as it is relatively cost effective, not only to fulfill the domestic needs but also to export surplus electricity to the surrounding countries. The export from Ethiopia in general has been growing, but imports are increasing more rapidly than exports because of the increasing demand for both industrial inputs and daily commodities, caused by the recent economic growth. Also, the recent oil price surge increases the government's expenditure – the expected additional payment would be 1 bil US $ in the coming year, according to the IMF -- and worsening the account balance of the government. Therefore, export of surplus electricity is an effective countermeasure to earn foreign currency and improve the account.

Therefore, strengthening the energy supply is the key for the economic growth and macro-economic stability.

Japan can mobilize the newly created fund, called the 'Cool Earth Partnership', to support the energy sector development in Ethiopia, while the most-often applied measure, Yen Loans, cannot be utilized for Ethiopia due to the assessment result on debt sustainability undertaken by the IFM. The Cool Earth Partnership, a 10 bil US $ fund, was established by Prime Minister Fukuda in January 2008 prior to the TICAD IV and the Toyako Summit in May and July 2008, respectively. The fund is meant to be utilized for measures to mitigate world-wide affects of climate change. Clean energy is one of the most appropriate sectors to apply this fund, particularly when there is no chance to apply Yen Loans.

Considering the importance of the sector and its suitability as a subject of Japanese government's support, the Embassy of Japan has conducted this survey to gain the overview of the sector, following the Series of Studies on Industries in Ethiopia[3]. This study is not academic but meant for information sharing initially among the Japanese government agencies and Japanese private sector to explore the possibilities of Japanese ODA supports and private investments.

[3] Available at: http://www.et.emb-japan.go.jp/oda_e.htm

2. Situation of the Energy Sector in Ethiopia

National Strategy/ Policy

The PASDEP sets its target in the energy sector to increase the access rate from 16% (2005/06) to 50% (2009/10) by the augmentation of energy generation from 791MW to 2,218MW and the expansion of the grid to 13,054km. The improvement of efficiency of the existing energy resources is another target. The energy loss is to be reduced from the current level of 19.5 % to the international average, 13.5%, during the same period of time. The total cost is estimated to be 51 bil birr (equivalent to 5.3 bil US $) for five years which is almost equal to the annual national budget. This is a very ambitious plan and therefore, the government is aggressively mobilizing new resources such as financing from the Chinese in addition to the conventional resources, such as the World Bank (WB).

The Power Sector Development Program is the national program to embody the targets of the PASDEP and as part of this, the Universal Electricity Access Program (UEAP) was prepared particularly to electrify the most rural areas. The total cost of the UEAP is estimated as 8.8 bil birr (equivalent to 920 mil US $) and the WB is financing part of it.

To make the strategy and policies more consistent, the EEPCo (Ethiopian Electric Power Corporation) is now preparing an integrated plan, the Highlight on Power Sector Development of Ethiopia (2008-2018).

Generation, Transmission and Selling

Only 10% of the total energy consumption in Ethiopia is supplied by electric power and the rest is from primitive resources, such as wood fuel and dung. The total capacity of electric generation of the country is about 730 MW, 86% of which is from hydropower, 13% diesel and 1% geothermal.

As mentioned above, the official access rate of the country in 2007 is about 20%. However, this figure is based on the population living in the electrified area and the number of the population who is actually using electricity is said to be about 6%.

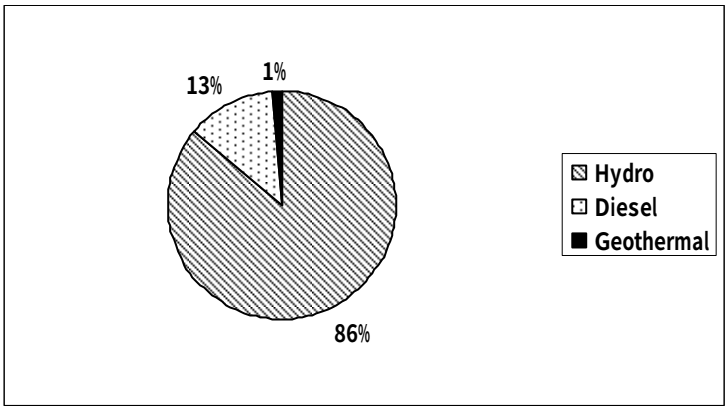


Figure 2 Type of Electric Power Generation in Ethiopia

There are two systems of transmission of electricity; one is called ICS (Inter-Connected System) and the other SCS (Self-Contained System). The former is the transmission system through the national grid, which is connecting 8 hydropower plants (662.60MW), 12 diesel power plants (113.44MW) and one geothermal plant (7.3MW) to 1,643 villages and towns at the moment.

The latter is for remote areas that the national grid does not reach. It connects small scale power plants (hydropower, solar energy, and wind energy plants) to the surrounding households off-grid.

Table 1 Electricity Supply

No.	Name	Installed Capacity (MW)	Dependable Cap. (MW)	Average (GWh/year)
Hydropower				
1	Koka	42.2	38.4	110.0
2	Awash II	32.0	32.0	165.0
3	Awash III	32.0	32.0	165.0
4	Finchaa	134.0	128.0	640.0
5	Melka Wakena	153.0	152.0	543.0
6	Tis Abay I	11.4	11.4	85.2
7	Tis Abay II	73.0	68.0	282.0
8	Gilbel Gibe I	192.0	184.0	847.0
	Total	**670.6**	**646.6**	**2,836.7**
Geothermal				
1	Aluto-Langano	7.3	7.3	49
	Total	**7.3**	**7.3**	**49**
Diesel				
1	Kality	10.0	10.0	128.8
2	Awash 7 kilo	30.0	30.0	51.5
3	Dire Dawa	40.0	40.0	233.0
	Total	**80.0**	**80.0**	**413.3**
	Total	**757.9**	**733.9**	**3,299.0**

Source: World Bank, PAD for Ethiopia/Nile Basin Initiative Power Export Project (2007)

The selling price of electricity is suppressed to 0.6 birr/kw (equivalent to 0.06 US $, 0.15-0.20 US $/kw in Japan) with subsidies. This is a government policy to ensure access to energy of the poor. However, the reality is that the most of the poor do not have/have the least access to electricity and therefore the rich are the ones who are taking advantage of the subsidies. It is suggested that the rich who utilize more electricity should bear more of the costs by progressive tariffs, which would still ensure the access of the poor whose utilization of electricity is minimal. This also contributes to the increment of finance of the EEPCo, which is necessary to expand the service to achieve the ambitious targets of the PASDEP.

Diversification of Energy Resource

As mentioned above, about 86% of electricity generation is supplied by hydropower. This is rational considering the facts that Ethiopia is rich in water resources and hydropower is relatively cheap. However, as can be seen in the figure 3, the rainfall in Ethiopia varies considerably from year to year and therefore, over dependence on hydropower makes the

energy supply very unstable. Needless to say, the instability of the energy supply brings about negative impacts on industry and the economy.

The EEPCo also recognizes the importance of the diversification of energy resources to ensures stable energy supply and is trying to develop various kinds of power plants.

Source: EPPCo, The Wind Energy Projects in Ethiopia, Oct 2006

Figure 3 Annual Rainfall

IPP (Independent Power Producer)

Reykjavik Energy Investment (REI), which is an Icelandic energy firm, has signed an MoU on the implementation of a feasibility study for the Tendaho Geothermal Energy Plant, which is near the border with Djibouti. Details, such as the ownership and selling price of electricity, are going to be discussed later. This would be the very first case of IPP in this country, if all goes well.

The EEPCo is encouraging the private sector to invest in the energy sector and relevant proclamations were enacted in 2005 and 2007.

3. Hydropower

Actual Situation and Further Construction Plans

As mentioned above, eight hydropower plants are in operation, which are providing about 650MW, 85% of the total energy supply. The EEPCo plans to establish an additional 14 plants (table 2) and 4 out of 14 are already under construction (no.1-4 of the table 2). If all goes according to the plan, the generation capacity will increase from 730MW to 2,000MW in three years and to 3,000MW in 2012 when the Gilbel Gibe III Power Plant is completed.

Table 2　Plan of Hydropower Plant Construction

No	Name	Capacity (MW)	Budget (mil €)	Resource		Contructor	Project Period	Others
				GoE (mil €)	Others (mil €)			
1	Construction of Gilgel-Gibe II	420	56	22	33 (Italian Gov、EDB)	Salini (Italy)	Oct-09	
2	Tekeze Stations	300	73		EEPCO	Wambo Engineering Corporation CWGC (China)	Sep-08	Shortage of Finance
3	Beles Station	460	199		EEPCO	Salini (Italy)	Oct-09	
4	Gilgel Gibe III	1,800	1,445		ADB, JP Morgan, Italian Gov	Salini (Italy)	2012/13	Shortage of Finance
5	Fincha Amerti Neshe Hydro Power Plant	100	130	EEPCO	Exim Bank of China (TBD)	GEZHOUBA WAater & Power Group of China (China)	Nov-10	
6	Halelle Warabessa Hydro Power Plant	422	470	EEPCO	TBD			USA･EPPCo JV
7	Tekeze II Hydro Power Plant	450	450	EEPCO	TBD			
8	Gibe IV Hydro Power Plant	1,900	1,900	EEPCO	TBD			
9	Genale III Hydro Power Plant	258	235	EEPCO	TBD			
10	Genale IV Hydro Power Plant	256	296	EEPCO	TBD			
11	Geba I &II Hydro Power Plant	366	384	EEPCO	TBD			
12	Kara Dobe Hydro Power Plant	1,600	1,548	EEPCO	TBD			WB under consideration
13	Border Hydro Power Plant	1,200	1,118	EEPCO	TBD			
14	Mendia Hydro Power Plant	2,000	1,920	EEPCO	TBD			WB under consideration
	合計	11,532						

Source: Based on Interviews with EPPCo, WB, and IDC

As can be seen in table 2, four out of ten plans which are not yet under construction have some likelihood of being financed; Fincha Amerti Neshe Plant, which a Chinese company is considering financing, Kara Dobe Plant and Mendia Plant, which the WB is showing an interest in, and Halelle Warabessa Plant, which would be financed by a joint venture of an American company and EEPCo.

If all these plans are realized, the generation capacity would reach 7,850MW, which is ten-fold of the current capacity. The EEPCo envisages that the domestic demand will increase four-fold by 2016, which the anticipated supply capacity far exceeds. The surplus electricity is supposed to be exported to neighboring countries, such as Sudan, Kenya and Egypt, to gain foreign currency.

However, the digging of a 27km tunnel for Gilbel Gibe II is delayed due to an unexpected high-pressure mud layer.

Also, the construction of both the Tekeze and Gilbel Give III Power Plants is delayed because of a shortage of funds. Additional financing is needed, particularly for the latter.

Japanese Involvement

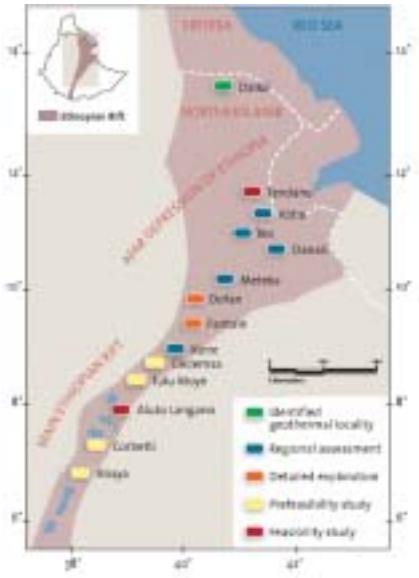
Hydropower is the main energy source in Ethiopia and further development is needed. However, considering the fact that many other development partners are already supporting

hydropower plant development and that the diversification of energy sources is a crucial issue, Japan can exploit its limited resources better if it supports other kinds of plants.

4. Geothermal Energy

Potential of Geothermal Energy

According to EEPCo, geothermal energy development is second in priority to hydropower. Feasibility studies have been carried out since 1969 and the total capacity of the geothermal energy of Ethiopia is estimated to be 700-1,000MW. However, the initial investment for a geothermal energy plant is huge and also the risk is relatively high (the excavation of expensive wells frequently fails). Therefore, no big plant has been built for more than 10 years after the first pilot plant at Alto-Langano was established.



Source: Meseret Teklemariam, Geothermal Exploration and Development in Ethiopia

Figure 4 Potential Areas

The identified potential areas for geothermal energy plants are; i) lakeside areas, such as Alto-Langano, Corbetti and Abaya, ii) South Afar area, such as Tulu-Moye, Gedemsa, and Dofan, and iii) North Afar area, such as Tendaho and Dallol.

Pilot Plant at Alto-Langano

The pilot plant at Alto-Langano is located at 200 km south of Addis Ababa and started to operate in 1998. Two generation units supply 7.28MW in total, about 3.5MW for each. There are two types of generator; one is a high-temperature vapor type that revolves the turbine directly (6,000 revolve/min) and another is a media (pentene) heated by middle-temperature vapor that revolves the turbine (1,500 revolve/min). The life-duration of a generator is normally 25-30 years with good maintenance but both the generators at the Alto-Langano pilot plant are now out of order. The reason is not clear but it is assumed that capacity building for maintenance should be strengthened because a geothermal energy plant requires skillful maintenance. A plan to build a third generation unit with 30MW has been suspended for a long time due to the difficulty of raising funds.

ARGeo (African Rift Valley Geothermal Development Facility)

ARGeo (African Rift Valley Geothermal Development Facility) was established by six members, i.e. Djibouti, Eritrea, Ethiopia, Kenya, Tanzania and Uganda, with support from UNEP, Iceland, Italy, USA and France in order to promote investment, share information and mitigate risks in geothermal energy development. It runs the Risk Mitigation Fund,

which functions as a kind of insurance to cover the losses when test boring, which costs a lot, fails. The fund applies to foreign investors as well.

IPP (Independent Power Producer)

The first case of an IPP project by the Iceland company is ongoing at Tendaho as mentioned above and the EEPCo is keen to invite more private investors into the sector. The tariff of electricity in Ethiopia is 0.6 birr/kw (equivalent to 0.06 US $/kw) at the moment, which is much cheaper than the average international price (which is why export of surplus electricity is feasible), but the EEPCo is very willing to have a stable supply so that it is open to flexible negotiations on the conditions, including the tariff.

Japanese Involvement

Ethiopia encompasses a part of the Great Rift Valley, where there are many potential areas for geothermal energy development. Despite the high potential geologically and high expectation from the EEPCo and GoE, the huge initial investment costs and the requirement of highly skilled workers have been impeding the exploitation of the resource for a long term.

Considering the EEPCo's recent enthusiasm to promote private investment, this may be the right area for the Japanese private sector to consider investment. The Risk Mitigation Fund of ARGeo can also work as an incentive for the Japanese private sector to invest in this area. Also, the Japanese Government can consider mobilizing the Cool Earth Partnership Fund or other funding mechanisms.

5. Wind Power

Potential of Wind Power

The EEPCo has been gathering data on wind power for more than a year and half at four sites, i.e. Mekele, Nazaret, Gondar, and Afar, with support from GTZ, and is going to start data collection at another spot in the west of the country. As can be seen in figure 6, winds blow stronger during the dry season. Therefore, wind energy could be an ideal complement to hydropower.

Mekele Wind Firm

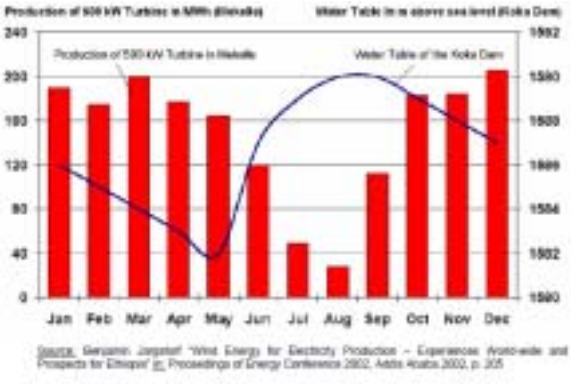
A Chinese company has won the tender for a wind firm in Mekele. The Chinese firm had tied money from a Chinese bank, which was almost 80% of the total cost. This is crucial for GoE/EEPCo who have to find finance for projects, which is not an easy task. Untied ODA is a trend in the world, but it should be reconsidered in the situation of new development partners such as China who are emerging with new methodology and logic.

Japanese Involvement

Wind energy has potential and is one of the areas which the GoE/EEPCo prioritizes. Also,

considering the complementary characteristics of wind power to hydropower, wind power is an area where Japan can contribute. The utilization of the Climate Change Mechanism Fund and Yen Loans (when the ban is lifted) can be mobilized and also private sector investment with IPP is highly possible.

Source: EPPCo, The Wind Energy Projects in Ethiopia
Figure 5 Potential Areas for Wind Energy Firms



Source: EPPCo, The Wind Energy Projects in Ethiopia
Figure 6 Wind and Hydro Power Generation (Annual)

6. Solar Energy

There are two types of solar energy generation; i) to convert photovoltaic energy directly to electricity, and ii) to heat water by solar light and revolve a turbine by vapor.

Rural Electrification

The technology to convert photovoltaic energy directly to electricity is so expensive that it is more suitable as an auxiliary power source at home/office on a small scale rather than as a large scale commercial enterprise. However, in Ethiopia, the development of the main power supply is not yet sufficient. Therefore, auxiliary power promotion with solar panels is not the first priority. On the other hand, this could be ideal for rural electrification where the national grids do not reach. Therefore, many NGOs and others are utilizing this type of solar energy generation in remote areas.

For example, GTZ International is implementing a project of electrification of schools and health centers (to keep fridges working to maintain vaccines) in the north-east. Several other NGOs are working in the field, but considering the geographical size of Ethiopia, it is not enough to electrify the whole country. Therefore, Japan also could support rural electrification with solar panels by utilizing the Grassroots Fund. Also, coorperation with other projects, e.g. school and health center building, will make the support more effective.

Also, since Japanese solar panels are of a high quality and cost competitiveness and the market in Ethiopia is substantially large, Japanese makers have an opportunity to enter the market with Japanese products.

Mid-Scale Energy Firm

The second way to revolve turbines with vapor heated by solar light can be applied for a mid-scale energy firm. This potential is not yet explored enough, although Ethiopia has a huge solar energy potential (figure 7). Sakai-city (Osaka, Japan), Kansai Denryoku and Sharp have just announced a new plan to develop a mega solar energy firm jointly. This would be the biggest solar energy firm in Japan. The technology Japan possesses can be also shared with Ethiopia to develop a larger scale solar energy firm.

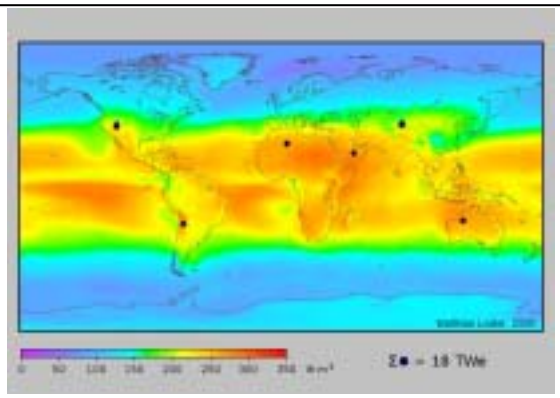


Figure 7 Solar Energy Distribution Map

7. Electricity Loss

The electricity loss in Ethiopia is about 20%, which is much higher than the international average, 12-13%. Most of the loss happens during distribution from the national grid to end users. The WB is financing projects to promote efficiency and automation of distribution.

8. CDM (Clean Development Mechanism)

CDM does not improve the energy situation directly but it can be a good incentive to attract private investors now that the CO_2 market is expanding all over the world and the price of CO_2 is increasing. Also, the promotion of renewable energy and the reduction of emissions of greenhouse gases was one of the main commitments of the Japanese Government at TICAD IV and the Toyako Summit. Therefore, I would like to have a quick look at the CDM situation in Ethiopia.

However, since hydropower, which does not emit CO_2, is the main energy resource in Ethiopia, CER (Certified Emission Reduction) is relatively low compared to the countries where fossil electric power generation is the mainstream power source.

Institutional Arrangements

Ethiopia has signed the Kyoto Protocol and the EPA (Environmental Protection Authority) under the MoME (Ministry of Mine and Energy) was designated as the DNA (Designated National Authority), which is an official agency dealing with all CDM projects in the country, to follow up the Kyoto Protocol. DNA only deals with administrative work and the Steering Committee consisting of MoME, MoARD (Ministry of Agriculture and Rural Development) and EEPCo is responsible for the substantial issues.

EPA has just prepared a regulation on sustainability and environmental assessment, which will come into force soon.

One CDM project, the details of which are described below, is going to be approved soon and according to MoME, it will take stronger initiative and will lead EPA to promote CDM projects further.

Humbo Reforestation Project

The very first CDM project in Ethiopia is going to be approved and implemented soon at Humbo Woreda located 350km south of Addis Ababa. The implementation body is Humbo Woreda, supported technically by World Vision Ethiopia and World Vision Austria and financially by the WB. CER (Certified Emission Reduction) will be sold on the international market and the income will be utilized to refinance the project. The PDD (Project Design Document) is available on the web-page of UNFCCC (United Nations Framework Convention on Climate Change).

Other CDM Projects

16 project plans have been submitted to EPA (table 3). These projects are seeking buyers (the one who buys a project will gain the CER right and can sell it on the international market). The details of the projects are available from EPA.

Table 3 CDM Project Plan List

No.	Name of Project	Implementation Body
1	Ethanol (biofuel) production project in the Ethiopian sugar industry	Ethiopian Sugar Development Agency
2	Production and marketing of biofuel	Atirf Alternative energy Plc
3	Integrated A/R & Biofuel project in some woredas of BGNRS, SNNPRS, and ARS	Ethan Biofuel Ltd.
4	Methane Gas capture from effluents and solid waste	Ethan Biofuel Ltd.
5	Establishment of distillery plant to produce fuel ethanol & biogas from cane molasses to substitute fossil fuel	Metahara Sugar Factory
6	Ethiopian Millennium initiative of Household energy efficiency. Dissemination of efficient household light bulbs project	Ethan Biofuel Ltd.
7	Rehabilitation of degraded land through bamboo planting	Ministry of Agriculture and Rural Development
8	Choke Mountain Afforestation & Reforestation Project	Ethio Horn Plc
9	Hakim Gara Reforestation Project	Harar Brewery
10	A proposal to demonstrate how to operate a highly beneficial clean cooking stove	Makobu Enterprises Plc/Guia Association
11	Meta Abo Brewery Watershed Development	Meta Abo Brewery/OBAaRD
12	Conservation Agriculture	SG-2000 & Makobu enterprises Plc
13	Carbon Sequestration and Better Energy Utilization	Bhair Dar University & Amhara EPA
14	Carbon Sequestration by 10 Woredas (districts) farming communities of Tigray, Oromiya and Amhara Regions	ISD
15	Converting Methane into renewable energy through biogas digester in Mekele University	ISD
16	Humbo Reforestation Project	World Vision /Humbo community

Source: EPA

LFG (Land Fill Gas) Energy Plant

LFG, which utilizes the emitted gases from land fill to generate electricity, can be a CDM project. The land fill in Addis Ababa is not treated properly and emits a terrible smell. LFG does not generate huge amounts of electricity but can contribute to the electrification of the neighboring houses and the improvement of the surrounding environment.

However, the Austrian Government and GTZ International are already working on the effective utilization of the land fill and there is not that much room left for Japan to

participate.

On the other hand, the amount of garbage in Addis Ababa has been increasing as the economy grows. The French Government is going to support the creation of two new land fill sites in the suburbs of Addis Ababa, but considering the size of the city, further development of land fill sites may be needed in the near future. Since an LFG energy plant can be built at relatively low cost, about 1 mil US $ although it ranges depending on the size, Japan could support it with its Grants.

9. Biofuel Development

Biofuel is not directly related to electricity issues but considering the current situation that 90% of energy consumption is supplied by wood or dung, biofuel can be an alternative to improve energy efficiency. Also, the export of biofuel could be an important source of foreign currency for Ethiopia, where there is currently no significant fossil fuel production. This is important for Ethiopia particularly at the moment when the oil price surge is hitting the country's balance sheet. MoME and other government agencies are starting to promote biofuel development now and therefore I would like to touch this topic as a complementary energy source.

Policy

The Ethiopian Government plans to allocate 2,300ha for biofuel production counting on a big EU market as well as domestic demand. However, even Brazil, which is the most advanced country in biofuel development and which possesses 8 times more land than Ethiopia, has developed less than 2,300ha for biofuel so far. Therefore, the number might not be realistic but it shows the enthusiasm of the government.

Biodiesel

Biodiesel is made of Jetropha and Castor Oil. Since harvesting of these fruits cannot be mechanized, it requires a lot of manpower. The production cost can be minimized in Ethiopia, which possesses a plentiful workforce at a reasonable price. In addition to the labor cost, the land is leased by the government for a very low price, which also reduces the cost.

On the other hand, the transportation cost is an issue. Harar, which is the highest potential area for biodiesel production, and the second candidate site, Welo, is relatively near to the Djibouti port, but the rest of the candidate sites are more than 1,000km from the port and the transportation cost would be substantial. One of the solutions is to sell the products on the domestic market near the production sites.

Castor Oil is in higher demand not only for biodiesel but also for medicines, lubricants and cosmetics. Therefore, it would be relatively expensive for biodiesel (1,500 US $/ t), while Jetropha costs only 1,000 US $/t, which gives it a higher potential as material for

biofuel.

50% of the weight of a Castor fruit can be processed to crude oil, compared to only 33-38% in case of the Jetropha. The productivity improvement of Jetropha is ongoing.

Bio-ethanol

Bio-ethanol can be made of sugar cane. 8mln Litter of ethanol is currently produced annually from sugar cane in Ethiopia and bio-ethanol has been starting to be mixed with petrol at the rate of 5% since October 2008. According to MoME, the usage area and the ratio will be gradually expanded.

Ethanol is more efficient than wood and dung, so it is good to promote ethanol usage at home as a short term measure. Some are already using bio-ethanol for cooking at home. Also, a joint venture of American and Ethiopian companies is producing a cooking stove using ethanol, which may gradually increase the domestic demands.

Investment

An Israeli company has started to cultivate Jetropha and Castor Oil and some crude oil from Castor fruits was exported to Germany for the first time this year as a trial. Exports are planned to increase up to a couple of thousands tons within this year (2008). Contract farming is partially utilized, which generates cash income resources for small farmers.

Another 35 investors have shown interest and some of them have already obtained land.

Development Partners

On the contrary, skepticism against biofuel development is prevailing among development partners. This is because the world-wide food price surge, which is endangering food security in the world, is partially caused by biofuel development and they believe that a country like Ethiopia where food security is not ensured should produce edible products rather than biofuel.

However, theoretically the Ethiopian government forbids the production of biofuel on land where food crops are cultivated and encourages the utilization of marginal lands. It is necessary to carefully watch the affect of biofuel development on food production, but considering the merits of biofuel production, it cannot be so simple that development partners refuse any involvement in the sector. Rather, development partners' support is needed to promote the adequate biofuel development with the necessary environmental/social protection.

Japanese Involvement

The Japanese private sector is interested in Jetropha and Castor development, not only from an investment view point but also for purchasing the products. Also, facilities for oil refining do not exist yet in Ethiopia, although refining can add value substantially. This is

another area where the Japanese private sector can invest or which government ODA can support.

On the other hand, development of legal regulation of the sector is now being established and the MoME has just prepared 'the Biofuel Development and Utilization Strategy of Ethiopia', the English translation of which is not yet completed. The establishment of legal regulation of the sector is one area where Japan can provide technical support, particularly in environmental protection.

10. Conclusion

Rationalization of Japanese Involvement in the Sector

As repeatedly mentioned above, a large enough and a stable supply of electricity is a must for industrial development and economic growth. Since the Japanese Government has been supporting the effort of the Ethiopian government to maintain/accelerate economic growth in many ways, support to the energy sector would be in line with the basic Japanese assistance policy for Ethiopia.

Although Japan cannot provide Yen Loans to Ethiopia at the moment, considering the results of the debt sustainability assessment done by IMF, the Cool Earth Partnership Fund could be mobilized for funding.

Also, to ensure the supply needed for growth, the Ethiopian government has started to promote private sector investment in the energy sector in addition to their own huge investment so far. IPP promotion is the new trend the Ethiopian government has started to promote. This will open the space for the Japanese private sector to invest in the Ethiopian energy sector. The flexibility the EEPCo is showing regarding the conditions, such as tariffs, is also a good indication to encourage Japanese private investment.

In addition to all the above, support to the energy sector also serves macroeconomic stability. Ethiopia is facing new macroeconomic difficulties, i.e. drought, oil price surge and hyper-inflation, after maintaining high growth for the last five years. Particularly, the oil price surge is a serious issue for Ethiopia because it is a 100% oil importing country. According to the IMF, the Ethiopian Government has to bear an additional 1 bil US $ to cover the oil price increase for the coming year. This is almost equal to the country's income from exports. Shortage of foreign currency in Ethiopia is serious and worsens the situation.

To maintain economic growth, scaling up of development partners' support is needed. The IMF recommended that assumption of the oil bills with foreign currency is the most effective development partners' support, and support to investment in infrastructure would be the second recommendation. Since the huge domestic borrowing by EEPCo serves to increase inflation, support by foreign currency to the sector could be a particularly good solution to inflation for the short-term. Also, it would contribute to the mid/long-term

growth, which serves sustainable growth.

Suitable Areas for Japanese Involvement

This study has revealed that geothermal and wind energy development are suitable areas for the Japanese government's support and the Japanese private sector's investment, considering the potential of both areas as well as the importance of diversification of energy resources. There still exist a need to develop more hydropower plants, but many other development partners are already actively supporting the sector and at the moment the diversification of energy resources is a more effective way to solve the energy shortage during the dry season/drought.

Also, a mid-scale solar energy firm could be a new frontier where Japan could exploit its competitive advantage in technology, while smaller scale rural electrification with solar panels could be supported by small ODA grants. Since many NGOs are already utilizing solar panels for rural electrification, Japanese producers could also enter the existing solar panel market with high quality Japanese products.

The CDM is well institutionalized in Ethiopia and can be a good incentive for private investors, although CER is relatively low because fossil electric power generation is not used that much. LFG energy generation is also one area which Japanese grants could support as a CDM project, the need for which may increase in the near future as the Ethiopian economy grows rapidly.

Biofuel is another area where the Japanese private sector could show an interest, not only through investment but also by purchasing the products. As Ethiopia is at the initial stage of biofuel development, technical support for the establishment of relative legal instruments is also needed.

The development of the energy sector is an area where the private sector and public sector should cooperate, since it should be for-profit to be sustainable, as well as serving the public interest as basic infrastructure. The Embassy of Japan in Ethiopia will continue to seek the areas where both Japanese public and private sectors can contribute to the development of the energy sector in Ethiopia, which is crucial for the country's economic growth and stability, through information gathering and sharing with the relevant Ethiopian government agencies, private sector and potential Japanese investors.

As mentioned at the beginning, this study is not meant to be an academic survey as the contents are mostly based on interviews. However, I hope this will provide a quick overview of the energy sector in Ethiopia for decision makers in both public and private sectors and will lead to real action and real investments in the near future.

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