Climate Investment Funds

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KENYA MENENGAI GEOTHERMAL PROJECT:
EXTERNAL PEER REVIEW REPORT AND RESPONSES

AFRICAN DEVELOPMENT BANK

KENYA MENENGAI GEOTHERMAL PROJECT

SREP Appraisal Document: External Peer Review Comments and Responses

External Peer Reviewer:

Martin Njoroge Mwangi

Comments by and Responses to the External Peer Reviewer

Comment	Reference	Response
There is a target of producing 27.8 million tons of steam annually. I could not find how the figure was determined in the Appendices or Annexes.	Logframe	The steam required to generated 400 MW is 7.6 tonnes/hour/MW * 24 hours * 365 days * 95% plant factor * 400 MW = 25.3 million tonnes of steam per year. For power generation, 10% excess power is allowed: 25.3 *1.10 = 27.8 million tonnes of steam per year. A footnote has been added to the logframe.
The risk of delays in the construction of the transmission line to evacuate the generated power is an important one. The suggestion that GDC will jointly undertake a feasibility study with KETRACO is not enough. A firm decision should be made early as to who will undertake the financing and construction of the line and its related substations (See further comment No. 33 below).	Logframe	On the mitigation against the risk that the transmission line is not available, it has been added in the sustainability section that the feasibility studies for the line will be included in the scope of the feasibility study being financed under the project (component E).
The risk of implementation delays and related cost overrun of 4 months and 20months respectively appears not to make sense. Is there any reference to these numbers particularly the 20 months in the appendices?	Logframe	It is an implementation delays and related cost overrun of 6 months.
The risk of the Menengai resource by an independent preliminary heat resource estimate of 400MW does not agree with the comments of C.1.9 which estimate 200MWa at 90% probability. It is my view that the reference to the Monte Carlo volumetric assessment with the current available information from the recently completed 4 wells may be misleading and put some doubt on the performance of the Menengai field and should be left out until the wells have fully heated up and tested. The fact that the first exploration well has discovered a very hot reservoir with steam output of equivalent to 7MW is very promising result for this project.	Logframe	This has been clarified as follows: ‘ An independent preliminary heat resource assessment estimates that at this early stage of drilling, it is already proven that there is a 90% probability that the resource will be sufficient for 200 MW and these numbers will increase as drilling goes on.’

In the Project Summary, under Project implementation schedule, is the wellhead to be procured under this project to utilize the wells drilled by the rigs to be procured in this project or other wells already drilled?	Project Summary	There are already 2 rigs on site. Two others are expected by the first quarter of 2012. The ones being procured under the Bank financing will only be on site by the second quarter of 2013. The wellhead to be financed by the Bank is meant to provide power to the rigs, instead of using expensive and polluting fuel. As soon as the wellhead is procured, it will be used to power the rigs on site
In item 1.2.1, on page 1, the latest LCPDP is dated March 2011 and the date should be included to make it more specific.	item 1.2.1	Done
In item 1.2.2, it would be useful to indicate the reference of the figures used. It is also important when referring to tariff to distinguish whether it is retail (consumer) tariff or generation tariff.	item 1.2.2	Changed to: ' average retail tariff of USD 16.36 cents per kWh for domestic customers, 17.95 for small industrial customers and 11.61 for commercial and industrial customers' as per LCPDP
In Item 1.2.4, Menengai's estimated potential is 1650MW while it is given as 1500MW in C.1.3 on page 37.	Item 1.2.4 and Annex C.1.3	1,650 MW is the correct figure. Corrected in the annex C.1.3.
In item 2 under Project Description on page 3, the statement of "…development of steam field …" should be substituted with "Steam gathering system.." which is used in Item D of table 2.1.1. The reason for this is it is always not clear that steam field development means steam gathering system because typically, steam field development refers to steam production drilling and steam gathering system construction.	Item 2	We are actually talking about the development of steam field, which indeed includes the steam production drilling and steam gathering system construction.
In item 2.2.1, it is suggested to include Eburru as one of the several fields with detailed studies.	Item 2.2.1	This has not been mentioned by GDC and it does not appear to be a field in the priority list of GDC.
In item 2.2.2 Table 2.2, under the Olkaria field, it is not correct to give the reason for rejection as the field being located in the	Item 2.2.2 Table 2.2	The fact that the filed is located in a conservation and recreational area was considered in the ESIA as a reason for

proximity of a conservation and recreational area. The correct reason is the second one given as it has a limited resource and it should be added that it is currently being developed by KenGen and Orpower4 to its maximum limit. It has been demonstrated in Olkaria that geothermal can be developed in the conservation area by implementing a properly formulated environmental management plan. This experience from Olkaria is certainly going to be used in the development of Menengai.		rejection because if GDC has the choice to develop a field located in conservation and recreational area and another one which is not located in such area , they will choose the one which is not located in the conservation and recreational area. The fact that KenGen and Orpower4 are developing the field to its maximum limit has been added.
In Item 2.4.4, the Kenya Government is committed to providing an additional US$ 185 million. When are these extra funds going to be provided? Is that contribution part of the government funding to the Project cost given as UA189 million in Table 2.4?	Item 2.4.4	GoK commitment is UA 189 million.
'The land was bought at a cost price of 250,000.00 KSH per acre'. From whom?		From private owners.
In Item 2.5.1, Appendix 4 should be changed to Appendix IV. There is no mention of Nakuru town being a beneficiary of the Project. I suggest that a Google map indicating the project site and areas to benefit could be useful probably as an Appendix or Annex.	Item 2.5.1	Appendix changed. Nakuru is quite a distance from the project site. The town will benefit in terms of more power being available in the national grid. Due to distance, it is not given that people from Nakuru will benefit significantly in terms of job creation and other social benefits. The project has focused on the nearest communities and as mentioned before, the nearest residence is more than 5 km.
In item 2.7.2, the hiring of project management consultant in addition to transaction advisor should be included. The formation of a PIT under the institutional framework should also be mentioned. Both the Project management consultant and PIT are key components to address risk in delays and cost overrun of the project.	Item 2.7.2	This has been reflected in the risks section.

In item 2.7.3, in the first line, should be added "and Olkaria I units 4 and 5" in order to account for the total 280MW under development. This is because Olkaria IV alone will not provide the 280MW. In addition, one useful lesson from Olkaria is the current successful management of 5 rigs operating simultaneously. Since GDC is involved in the drilling management at Olkaria, this experience will be very useful in Menengai as well.	Item 2.7.3	Done.
In item 3.1.1. I find the reference to average tariff of about USc 16.00/kWh irrelevant while comparing generation tariff. The USc 16.00/kWh is the consumer or retail tariff (see comment No. 4 above). It would have been useful to compare generation tariff of various types of generation inclusive of capex, opex and fuel costs.	Item 3.1.1	Agreed and removed.
Item 3.1.3 refers to expected new power plant cost of USc 12.4/kWh for variable O&M and fuel while peak energy is valued at USc 20/kWh which included both the O&M and capital expenditure costs at peaking capacity. It is misleading to compare figures this way as they don't refer to similar conditions.. In other words it is more useful to compare different types of generation including capital, O&M costs and fuel costs. This way it is possible to clearly see that geothermal type of generation offers the cheapest option both at peak and base load conditions.	Item 3.1.3	In fact, the assumption of USc 20/kWh used here refers only to O&M costs and fuel costs of the peaking units and does not include capital costs. I agree with the comment and we can make the correction in the text, mentioning that this figure is O&M costs and fuel costs only. This will make the two figure comparable. Separately from this comment, the benefit of a base-load unit during the peak times is not only limited to savings of O&M costs and fuel costs (which tend to be high for the peak units). On top of that, there is a benefit of provision of additional capacity at the peak times, when this capacity is actually needed most. That is why the document talked about savings of both running costs and capital costs at the peak times. Thus the figure of USc 20/kWh is sourced from LCPDP and used in the analysis, the additional capacity cost savings, might be worth additional 2-3 USc/kWh, according to the same set of

		source data. For reasons of being conservative in the estimation, only USc 20/kWh is currently being used in the analysis, which can be considered as a realistic assumption.
In item 3.2.3, It is not enough to say that "…the equipment will have neutral, non-reflective colors that blend with the natural vegetation". A statement should be made that it will be a requirement that all the equipment and buildings being employed or erected in the project will meet color criteria suitable to blend with the environment. Both GDC and the contractor and will have to follow this code in order to reduce visual impact. It is also important that the use of environmentally friendly designs and operational procedures have successfully been employed in Olkaria within Hell's Gate National Park for a considerable time now with very good success.	Item 3.2.3	The buildings (camp) already existing in the area are white but are not sore to the eye based on the fact that they are in a low area. However the color of the fence around the camp has blended well with the environment. Equipment has been highlighted due to the fact that they are massive and tall (tanks and rigs) and can be seen from a distance depending on where in the crater they are drilling. Regarding procedures and code, GDC has an approved health and safety policy that includes environmental issues. In addition there is the project's ESMP to take care of any environmental issues. GDC has inherited or employed a lot of people who worked in Olkaria and therefore the good practices of Olkaria have already been included in most activities at GDC.
Environmental awareness training suggested is good but should include GDC employees, contractors and visitors.	Item 3.2.3	The training already includes employees and contractors. Visitors as per the health and safety policy will receive a short induction and are not allowed to wonder around the development unaccompanied.
The cost of implementing both social and environmental impacts is estimated at KES 99 million some of which will be used to procure 100 acres of land from 22 owners. The environmental summary posted on the AfDB website refers to KES 139 million. It would have been useful to clarify by tabulating the ESMP activities indicating cost estimates and the implementing authority.	Item 3.2.3	That is because 40 million has already been paid to the land owners.
In item 3.2.4, details of CO_2 emission reduction could be included in the foot note. The information provided simply states that the	Item 3.2.4	This has been added in Annex C.2.

figure is given by assuming a grid factor of 0.6 tons of CO2e/MWh. This is not detailed enough to give the emission reduction figure of 1.9million tones per year. The method uses Olkaria II unit 3 emission reduction based on the fact that Olkaria II steam has 0.3%w/w of non- condensable gases (NCG). CO_2 is 88.45% in NCG at Olkaria. The steam consumption rate for Olkaria II unit 3 is 2.087kg/s/MWe. Therefore CO_2 in emitted is 2.087 x .3% x 88.45% x 60 x 60 = 19.9362762 kg/MWhr. Assuming that the power station will operate at 90% load factor, total CO2 emitted in 1 yr for the 400MW power plant(s) will be (8760 x 90% x 19.9362762 x 400)/1000 = **62,871.04062**tCO2/yr. Then determine the CO2 emitted by the Kenyan grid for the equivalent 400MW. Energy generated by 400MW geothermal plant in one year is 8760 x 90% x 400= 3,153,600 MWhr. The base emission is 3,153,600 x .6396 (Kenya grid factor) = **2,017,042.56** tCO2e/yr. Therefore the emission reduction due to generating 400MW of geothermal at 90% load capacity = 2,017,042.56-62,871.04062 = **1,954,171.52** tCO2e/yr. This calculation could be provided in the appendix for reference instead of the footnote.		
Item 3.2.6. Is the 30% women employment ratio referring to GDC permanent employees or rural community or both?	Item 3.2.6	It refers to all GDC employees, including permanent, temporary, etc.
Item 3.2.8. Are the 912 skilled and 300 unskilled GDC permanent employees or temporary employees engaged during various field developments? It would be good to give estimates of GDC permanent employees and temporary employment during steam gathering construction covered in this project vis-a –vis those perhaps employed by IPPs during powr station construction and operation.	Item 3.2.8	Both permanent and temporary, including contractors hired by GDC.
In item 3.2.10, perhaps the inclusion of EMSP table provided in the appendices would have been useful as mentioned in	Item 3.2.10	No, the ESIA and ESMP should not be included in the project appraisal report as per the Bank rules. Parts of those

comment No. 16 above.		documents are disclosed by the country and the Bank and are available on request.
Item 3.2.11 regarding the existence of PAP's, you cannot say there are no PAPs even though those affected are on the route to the actual site where wells and power stations will be construction. Even if they are en route they are affected by the project. In the last part of this paragraph, it is a bit confusing of whether the land was bought and paid for or the price was negotiated and agreed upon and part payment made before the registration was finalized. Which means that the final payment will be made after the land is transferred to GDC.	Item 3.2.11	The road impacting those people has already been implemented. Hence it is not included in this project's financing plan.
Item 4.1.2. In this paragraph, I would suggest that the last sentence include that .. " and is aggressively training staff in all the activities of geothermal development"	Item 4.1.2	Done.
Item 4.1.3, at the end of the second sentence should add "…geothermal project at the moment but this is expected to change when it starts receiving revenues from sale of steam and early generation from wellheads."	Item 4.1.3	Done.
Item 4.1.4. The relationship between PIT leader and the management consultant should be clearly defined. Will the management consultant be resident? An organization structure could assist in this. It is important that the roles and reporting structures of the PIT leader and the consultant be clear in order to avoid conflict which has been seen in many projects causing delays and cost overruns. It is also important to determine if the PIT members have other duties or they will be fully engaged in the project work. Dedicated PIT members are preferred so that they give their full attention to the project.	Item 4.1.4	This will be decided during the preparation of the terms of reference of the supervision consultant.
Item 4.1.5. The ESMP should clearly show project activities to be	Item 4.1.5	The contractor is required to compile a detailed ESMP and in

done by the steam gathering contractor and I am sure some of the activities will certainly be done by GDC staff. A table for ESMP would be therefore useful as suggested elsewhere.		any case. Moreover, the social and environmental impacts associated with steam gathering are already included in the current ESMP.
Item 4.3.2. Acronym PFM is not defined in the section of acronyms and abbreviations.	Item 4.3.2	Done.
Item 4.3.3. External oversight will be provided by the Government's Auditor General or through a private firm.	Item 4.3.3	The audit will be conducted by the Auditor General or his appointed firm using the bank's audit terms of reference.
Item 4.4.2 in the first line, I suggest inserting " IPPs to be competitively involved in" after "..risk will enable.." In the last sentence I suggest substituting the words " has also shown its" with " …is highly…".	Item 4.4.2	Done.
Item 4.4.3. It would have been useful to discuss the generation tariffs here and to distinguish between the generation tariff and consumer or retail tariffs. This comment has been made in comment No. 4 above.	Item 4.4.3	Addressed above.
Item 4.4.4. It would be useful to add that the power sector has experience in dealing with IPPs and negotiating PPAs.	Item 4.4.4	Done
Item 4.4.5. There is no link between Orpower4 and Ormat in this paragraph. This could be done by saying that Ormat owns Opower4.	Item 4.4.5	Done
Item 4.4.7. It is important to state in the first sentence that the interest shown is "to invest in power generation at Menengai".	Item 4.4.7	Done
Item 4.4.8. A decision has to be made early to decide who will finance the main transmission line out of Menengai and the related substations. Given that there could be several IPPs	Item 4.4.8	This will be decided after the feasibility study, financed by the project and which will include the transmission line component, is finalized.

operating in Menengai, it would be useful if the transmission line was funded and constructed by KETRACO. There have been instances where the power station developer has negotiated funds for transmission line and substations and supervised the construction. The project is then later transferred to the transmission line operator at a cost in order to avoid delays in commissioning the power station and loss of revenues. However, this is not the preferred method from IPP standpoint.		
Item 4.5.2 under **drilling risk**, I would suggest that training being undertaken by GDC and which is included in this project financing will also greatly assist in addressing this risk.	Item 4.5.2	Done
Operation and maintenance risk should include risk caused by chemical scaling from geothermal fluids, delays in drilling and connecting make-up wells or failure in reinjection system.	Item 4.5.2	Done
Implementation delays and cost overrun risk can be reduced by a carefully selected PIT assisted by the management consultant to be engaged. The management consultant may not be required throughout the project period particularly at the tail end of the project. This flexibility should be built in the procurement of the consultant.	Item 4.5.2	Done
Private sector /plant construction delay risk could also be addressed by careful selection of the IPP with previous experience elsewhere.	Item 4.5.2	Done
Transmission line construction delays risk should be addressed as discussed in comment No. 33 above.	Item 4.5.2	Done