Scientific and Technical Advisory Panel

The Scientific and Technical Advisory Panel, administered by UNEP, advises the Global Environment Facility
(Version 5)

STAP Scientific and Technical screening of the Project Identification Form (PIF)

Date of screening: May 06, 2016
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Consultant(s):

I. PIF Information *(Copied from the PIF)*

FULL SIZE PROJECT	GEF TRUST FUND
GEF PROJECT ID:	9040
PROJECT DURATION:	5
COUNTRIES:	Comoros
PROJECT TITLE:	Sustainable Development of Comoros Islands by Promoting the Geothermal Energy Sources
GEF AGENCIES:	UNDP
OTHER EXECUTING PARTNERS:	Ministry of Production
GEF FOCAL AREA:	Climate Change

II. STAP Advisory Response *(see table below for explanation)*

Based on this PIF screening, STAP's advisory response to the GEF Secretariat and GEF Agency(ies):
Minor issues to be considered during project design

III. Further guidance from STAP

The project aims to support the Union of Comoros by establishing policy, regulatory, legislative and financial de-risking instruments for renewable energy development ($1.5 mil of GEF funding) and assess the geothermal renewable energy resource by supporting the exploratory and drilling phase on one of the 3 main islands ($3.5 mln of GEF funding). With a total population of Comoros of around 800,000, the total project investment (GEF financing and co-financing) of $53.4 M amounts to around $65/capita. Almost half the population have access to electricity, mostly diesel-fired, the rest do not.

An 18MW heavy fuel oil-fired power plant is planned to add to the total current generation capacity of 22 MW. The issues of high energy losses through transmission and fraud are not considered here but need addressing.

The potential GHG emissions avoided as presented in the proposal seems to assume existing thermal plant would be displaced. In reality, any built new RE electricity generated is likely to be used to meet growing demand rather than to displace existing diesel-plant generation. When assessing the mitigation costs of $/t CO2 avoided, the CO2 emissions coming from geothermal resource extraction must be taken into account as they can reach 10-50g/kWh depending on the ground source conditions. The argument in the proposal should therefore justify that geothermal plant would avoid future emissions if new oil-fired or diesel-fired plant were developed instead

There is no doubt new electricity generation is needed to meet growing demand in the Union of Comoros. It appears that an abundance of renewable energy exists on the islands. An IRENA country assessment and other studies suggest high potential for developing solar, geothermal and hydro resources, while wind energy appears to have medium potential (although this could be explored further through additional wind regime data collection). This geothermal proposal in itself is worthy of support and would normally receive STAP consent. However, STAP raises concerns that the use of GEF resources to support more solar PV

systems being developed could be justified before further exploration and development of geothermal sources, or other possible RE options.

The statement "Geothermal offers the only real near-term solution" is questioned. It Is agreed that the potential for mini-hydro appears limited and wind is constrained if the mean annual wind speed is only around 5m/s as stated â€“ though this seems low for an island and investment in wind monitoring masts would be warranted to accurately assess the wind resource. However, the solar resource at 6kWh/m2/day is very good and solar PV systems could be quickly developed compared with geothermal that will take at least 5 years before any electricity is generated. The project proposal states that there is one micro-solar PV plant of 1 MW running in Anjouan providing electricity to six villages (IRENA, 2012). There are probably useful lessons that could be learned from that â€“ including capacity factors.

The African Development Bank's "Energy Sector Support Project" in 2013 (http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Comoros%20-%20Energy%20Sector%20Support%20Project%20-%20Appraisal%20Report.pdf) includes solar PV but to a very limited degree. Since 2013, PV costs have declined significantly. The EU's "National Energy Strategy Action Plan" includes funding 6 solar PV mini-grids in Moheli but no reference is provided and a copy of the Plan could not be found.

The question that has to be asked is whether the investment for geothermal exploration, plus around $50M in plant construction costs to total $81.3M, would be a better value proposition for the GEF and co-funders than a similar level of investment made in solar PV. The current proposal does not assess this comparison nor adequately justify funding geothermal above solar PV.

There are successful examples supporting solar PV in SIDS, some of these projects having received GEF funding in the past (for example, see: http://www.irena.org/DocumentDownloads/Publications/IRENA_Renewable_Energy_for_Islands_2014.pdf). GEF Project 9355 supporting solar PV in the South Pacific Island of Tonga is another example of what might be possible. There, the proposed installation of a total of 1.3 MW solar PV on nine islands has a total construction cost of around US$9M which equates to around $7/W. For the three Comoros islands generation costs are likely to be a little lower since the claimed solar radiation level of 6kWh/m2/day is around 20% higher than that for Tonga.

Assuming a cost of $6/W installed for PV, if the total $81.3M investment cost proposed for this 10 MW geothermal exploration project was instead used to support solar PV, around 14MWp of PV could be installed. Assuming a conservative capacity factor of 20% this would generate around 24 GWh per year. (It is assumed that the 3600 GWh total solar generation potential quoted in the proposal is the total technical potential though it is not clear what assumptions were used to calculate this). Given the planned future geothermal development based on the projected exploration outcomes is for 10MW, that equates to around $8/W, but with an assumed capacity factor of 70% (this is not quoted in the proposal), this would generate around 60 GWh/yr.

The cost of $0.10 â€“ 15 / kWh generated is projected in the proposal, but on top of the exploration and plant construction costs for the geothermal project are the road access, water supply etc. and the distribution costs needed for the lines and poles to carry electricity from the single geothermal site to the existing grid. This grid is poorly maintained so will also probably need to be upgraded to carry the additional load adding further to the total cost. Users of the additional electricity would be the residents, schools, hospitals and businesses on only the one island as it is assumed no undersea cables are envisaged in the proposal.

By way of comparison, solar PV generation costs would likely be within a similar cost range per kWh under this level of solar radiation based on current costs but further analysis would be required to confirm this. Solar PV technologies can be more widely distributed across all three islands of the union of Comoros and either employed as mini-grids or individual solar homes to avoid high investments in distribution infrastructure. In other words, a $81.3M investment in solar PV would enable electricity to be generated and distributed on all three main islands of the Comoros and might therefore benefit a greater proportion of the total population currently without electricity access than would geothermal energy. The above is a hypothetical scenario assuming that financing comparable to the geothermal proposal could be mobilized ($81.3M). It is provided to illustrate the comparable, if not higher cost-effectiveness of PV energy generation versus geothermal generation.

Furthermore, while there is a number of specific risks faced by PV projects such as, for example, construction risks, risks affecting the viability of project development, financial risks of insufficient access to investment and operating capital, technology risks and risks of variable changes in electricity generation due

to lack of sunshine, many of these risks are easily addressed and accounted for. PV energy generation technologies are proven and considerable experience, including in the region, is available.

Unlike PV, in addition to technology and operational risks, geothermal energy generation faces a range of substantial environmental risks that would be difficult to control in the condition of SIDS. Geothermal power plants can have impacts on both water quality and consumption. In many instances, not all water removed from the reservoir for cooling is re-injected because some is lost as steam. Water is also consumed during the drilling operations. Produced toxic sludge should be properly disposed of, and STAP is concerned with limited capacity for hazardous waste management. Land-use issues may arise depending on the properties of the resource reservoir, the amount of power capacity, the type of energy conversion system, the type of cooling system, the arrangement of wells and piping systems, and the substation and auxiliary building needs. If geothermal sites are located in remote and sensitive ecological areas this should also be considered in project planning. Because of water abstraction, there is an increased risk of land subsidence. Furthermore as mentioned in the proposal, the location of sites is in geologically active "hot spots" with elevated earthquake risks. There is evidence that hydrothermal plants can lead to an even greater earthquake frequency [National Renewable Energy Laboratory (NREL). 2012. Renewable Electricity Futures Study]. Transparent communication with local communities may be necessary if sites are located close to settlements.

Balancing the uncertainty of the geothermal resource and the time needed for exploration and plant construction against the urgent need to provide secure electricity supply that solar PV could provide could involve greater analysis. It appears it may be too late for geothermal to substitute for the heavy fuel oil-fired plant already under construction. However, an argument could be made that solar PV could provide an economically viable alternative with lower greenhouse gas emissions, be developed in the short term, have much lower business and environmental and social risks and hence avoid future GHG emissions from the oil-fired plant over its lifetime of several decades. Meanwhile, the proposed geothermal assessment and exploration could be undertaken in parallel, or as a future project as more funding becomes available, so that together solar PV and geothermal can then meet the increased electricity demand with low carbon emissions per MWh.

Therefore, STAP's recommendation is for a life cycle cost/benefit analysis to be undertaken to ensure that geothermal energy generation does indeed provide the best economic, environmental and social value for the investment since the GEF investment of a similar amount in solar PV systems could be a more attractive proposition that could be delivered in the shorter term. Perhaps this has already been done in the EU Energy Strategy Action Plan, but if so, it was not mentioned in the proposal.

STAP advisory response	*Brief explanation of advisory response and action proposed*
1. Concur	In cases where STAP is satisfied with the scientific and technical quality of the proposal, a simple "Concur" response will be provided; the STAP may flag specific issues that should be pursued rigorously as the proposal is developed into a full project document. At any time during the development of the project, the proponent is invited to approach STAP to consult on the design prior to submission for CEO endorsement.
2. Minor issues to be considered during project design	STAP has identified specific scientific /technical suggestions or opportunities that should be discussed with the project proponent as early as possible during development of the project brief. The proponent may wish to: (i) Open a dialogue with STAP regarding the technical and/or scientific issues raised. (ii) Set a review point at an early stage during project development, and possibly agreeing to terms of reference for an independent expert to be appointed to conduct this review. The proponent should provide a report of the action agreed and taken, at the time of submission of the full project brief for CEO endorsement.
3. Major issues to be considered during project	STAP proposes significant improvements or has concerns on the grounds of specified major scientific/technical methodological issues, barriers, or omissions in the project concept. If STAP provides this advisory response, a full explanation would also be provided. The proponent is strongly encouraged to:

design	(i) Open a dialogue with STAP regarding the technical and/or scientific issues raised; (ii) Set a review point at an early stage during project development including an independent expert as required. The GEF Secretariat may, based on this screening outcome, delay the proposal and refer the proposal back to the proponents with STAP's concerns. The proponent should provide a report of the action agreed and taken, at the time of submission of the full project brief for CEO endorsement.