MISSION REPORT – Rwanda – January 2009

Country: Rwanda
Project titles and numbers:
Private Sector Participation in Micro-Hydro Power Supply for Rural Development (PSP Hydro) - PN 1956.3021.5
And
Support of the National Domestic Biogas Programme (NDBP) - PN 1957.3008.0

Duration of current phases:
PSP Hydro: 05/2006 – 12/2011
NDBP: 02/2007 – 12/2009

Lead executing agency:
GTZ-IS

Mission team:
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17.01.2009 – 24.01.2009

Date:
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Abbreviations:

BP:	Banque Populaire
CDF:	Common Development Fund
EnDev:	Energising Development
GTZ:	Deutsche Gesellschaft für technische Zusammenarbeit (“German technical cooperation”)
IPP:	Independent Power Producer
MHP:	Micro Hydro Power
NDBP:	Support of the National Domestic Biogas Programme
NEDA:	National Energy Development Agency
PD:	Project Developer
PPA:	Power Purchase Agreement
PSP Hydro:	Private Sector Participation in Micro-Hydro Power Supply for Rural Development
RURA:	Rwanda Utilities Regulatory Agency
SWAP:	Sector Wide Approach
VCP:	Venture Capital Provider
WB:	World Bank

Contents

1 Summary

In January 2009 a project progress visit to analyse the status quo and to project an outlook into 2009 and beyond for the PSP Hydro project ("Private Sector Participation in Micro-Hydro Power Supply for Rural Development (PSP Hydro) and the NDBP project (Support of the National Domestic Biogas Programme) was performed.
Both projects are implemented in the frame of the dutch-german cooperation Energising Development (EnDev).
Progress in both projects is seriously behind schedule. The NDBP suffers from the delayed formation of a credit line for the biogas digester customers. The credit line is essential for most customers to overcome the barrier of high initial investment costs. Only a limited number of customers could be identified that could cover the first investment even without a credit. During the period of the mission a total of 186 household biogas digesters were operational (including 101 digesters of the Ministries pilot phase) while another 150 digesters were in progress (either under construction or in the initial digester feeding process). NDBP has managed to train 9 construction companies. The programmes promotional campaigns and marketing activities for household biogas digesters created a notable demand, increasing the pressure to finalize the credit line.

Within the PSP Hydro project it was expected at the time of the mission that the first MHP plants (Sogemr, Repro and Enny) would be commissioned between May and July 2009. The GTR project has been stopped while the RES project is projected to be handed over to a new owner and manager, probably with the district administration taking a leading role. The process how is however still unclear.
Repro and Enny have overcome the major obstacles in the preparation phase. Technical equipment has been order, Power Purchase Agreements (PPA) with Electrogaz have been signed and tariffs with the future customers have been agreed on. However commissioning will only take place in the 4th quarter of 2009.
The experience in the first phase of PSP Hydro has shown that the applied financing mechanism bears room for improvement to increase the performance and success of each hydro power producer. For the next phase in the program a call for expression of interest resulted in seven interested parties who want to develop MHP sites under new conditions. It is planned to reduce GTZ's subsidy from currently 50% to app. 10%-30% and to bring in more private equity, most likely through involving a venture capital provider (VCP). An increase of the project developer's performance in terms of quality and speed in the managerial and administrative field is expected.

Though both projects are behind schedule the mission team rates the development in both projects carefully positive and expects both of them to achieve the anticipated results in the near future. An extension of both projects into the second phase of Energising Development is recommended.

Future opportunities arise next to the prolongation of the current projects (including the engagement of venture capitalists in the PSP Hydro program) in institutional biogas, and possibly in a low cost lighting component. Next to that it is considered worth while to investigate the opportunity to cooperate with the Common Development Fund.

2 Situation analysis and framework conditions

2.1 Poverty situation and energy situation especially in rural areas

2.1.1 Energy for electricity generation

The energy consumption of Rwanda‘s 8.5 Million inhabitants of 34 kWh per capita is one of the lowest in the world. Less than 6% of the population is connected to the grid, in rural areas less than 1%. 85% of the energy is generated by the means of biomass, mainly firewood. If the consumption remains stable, the country will be completely deforested within the next 15 years. Due to the low purchasing power (more than 60 % of country’s population live below the absolute poverty line), more than 90% of the households use firewood or charcoal for cooking with traditional ovens with an efficiency rate of 15-20%. 65% of the electricity is generated by hydropower, the remaining by diesel generators. 50% of the energy is imported from the CEPGL association (SINELAC and SNEL) as well as a small amount from Uganda. The fuel for 3 diesel generation stations (100.000 t/year) contributes to 60-80% of the import expenditures. The power supply grid has an extension of about 2000 km. In 2004 technical losses amounted to 15%. As during the genocide in 1994 the power generation and supply infrastructure was destroyed in large part, the government resolved to implement a rehabilitation and expansion programme in 2002. The monopoly of the energy and water supplier, Electrogaz, Electricity and water services will be under a new state body, the Rwanda Energy and Water Board in which Electrogaz will be integrated in it. The structure and the final decision to make it are not defined yet.. The energy policy of 2004 is in line with environmental standards and envisages demand coverage by harnessing hydro power, methane gas from Lake Kivu, wind power, solar power and geothermal energy. Until 2010, the generation capacity is planned to increase from 40 MW (including imports) to 125 MW. In March 2005, the contract for the “Urgent Electricity Rehabilitation Project“ with a volume of 31 Million USD was signed with the World Bank. Results are showing. During this mission World Bank representative claims that grid losses have gone down to acceptable percentages and grid stability is sufficient.

After the genocide in 1994, Rwanda has been undergoing a reconstruction in all sectors. The economic sectors with a dynamic potential (e.g. agribusiness, tourism, information and communication technology) require an improved energy infrastructure which is not in place in most of the regions. While large companies rely on expensive diesel generators, most of the SMEs in rural areas have no electricity supply, which limits expansion and hampers productivity. At the same time, large parts of the social infrastructure cannot provide efficient services due to a lack of energy. Rural electrification does not reach most regions. There are only few providers of decentralised energy systems in the country.

2.1.2 Energy for cooking purposes

In Rwanda, firewood and charcoal are practically the sole providers of cooking energy in the rural areas. Firewood covers 90.4 % of the demand and charcoal 7.4 %, the remaining 2.2 % being mainly covered by agricultural residues. Even for the urban households firewood (52 %) and charcoal (39.5 %) are by far the main sources of energy used, other sources being gas and kerosene (2002 population and housing census). This dependency on firewood and charcoal creates an unsustainable situation as the demand (1.93 kg/capita/day, MININFRA, 2005) largely surpasses the production (0.46 kg/capita/day, MININFRA, 2005). The Government of Rwanda is trying to curb the rate of deforestation amongst others by banning the felling of trees without a permit. This rule applies to all trees including the ones in privately owned production forest. However, it is doubtful whether this measure will help without the availability of energy alternatives and fuel efficient woodstoves.

Households in rural Rwanda depend for more than 90 % on fuelwood to meet their domestic energy needs. For many of these households it becomes increasingly difficult to satisfy their daily domestic energy requirements, due to the high population pressure and stringent legislation designed to reduce (fuel)wood consumption. Collection of traditional fuels devours time, in particular for women and children, which could have been spent otherwise at school or in productive activities. By burning these fuels, particularly women and small children are exposed to smoke and prone to respiratory illnesses and eye ailments. Often, the same households are facing also the consequences of lack of hygiene and proper sanitation, resulting in water borne diseases affecting mainly women and children. At many places, the collection of traditional fuels damages the environment on which the people heavily rely.

2.2 Institutional set up and actors in the energy sector

In Rwanda electricity is produced and supplied by state utility Electrogaz. Small, independent power producers (IPP) are not yet playing an important role in the overall power production of the country. However, the number of IPPs is slowly increasing also due to the activities of the PSP Hydro project.
Firewood is getting scares in the country. Private wood plantation for production of firewood and charcoal create a relevant supply channel for Rwandan households and institution relying on these fuels.
Formation of the National Energy Development Agency (NEDA) is still on hold. Recently it seems to become more likely that NEDA will get started soon, but it is still not clear in which form (Agency or Board) that will happen. Also if NEDA will have to deal only with energy or if water and other topics will be included seems to be undecided.
The Rwanda Utilities Regulatory Agency (RURA) should be in the position to facilitate the tariff negotiations between Electrogaz and IPPs. In the case of the Hydro projects RURA did not come up to these expectations. The tariffs had been set by Minister Butare.

2.2.1 Public institutions

See 2.2

2.2.2 Electricity companies

See 2.2

2.2.3 Banks and finance organizations

On the request of the Netherlands Embassy in Kigali the Dutch Rabobank participates in Banque Populaire (BP) and supports its management and restructuring. Rabobank however does not bring in finance. The -also Dutch- FMO Development Bank is however interested in funding the NDBP credit line at BP. The appraisal process is however lengthy and delaying the roll out of the credit line and hence the biogas program.

BDR: Rwandan development bank according to the project might be interested as an alternative financier of the credit line, as might the Dutch Triodos bank. However this will require a fully new appraisal process delaying the roll out even more.

With Grofin and REIC two Venture Capital Providers (VCPs) are operating in Rwanda. Both of them are not involved in projects in the energy field so far while most of their projects are located in and around Kigali. For both the volumes per project are below 1mio $ with an equity share of app. 10% of the VCP. Their expected payback periods range between 3-6 years. Besides their investment in equity both take care of financial closure via obtaining loans for their projects too.
REIC and GROFIN in principle are interested to start projects with the Hydro PDs. However further negotiations and clarifications are needed. A consultant will be sent by GTZ to accelerate proceedings and negotiations with VCP, PD and GTZ.

2.3 Policy framework

The Rwandan Government wants to develop the energy sector as a priority. A sector wide approach (SWAP) for energy was developed late 2008 with world bank (WB) assistance. Based on the SWAP GoR together with World Bank as lead donor develop an investment prospectus for on grid electrification to be agreed upon before mid 2009. Focus in the SWAP is on electricity, increase production and grid densification. Biomass does not play a major role in the investment prospectus, not does off grid electricity. However, in the Biomass field the Government is developing a Biomass Energy Strategy (BEST) for which the baseline data collection is ongoing.

2.4 Key problems hampering access to modern energy services in rural areas

Institutional knowledge and capacity slow down the speed of creating more access to modern energy in rural areas. Additional lack of initial investments can be identified as an obstacle to introduce modern energy services and technologies.
Connection fees to the existing Electrogaz grid are too high for most potential electricity users as they include the price for the metering equipment, too.
The formation of an operational energy agency, eg NEDA and a active regulatory authority would be beneficial for progress in this field.

2.4.1 Obstacles for grid based rural electrification

- Lack of power production capacity
- High connection fees

2.4.2 Obstacles for off grid energy technologies and services

- Initial Investment costs
- Availablibity of devices
- Little awareness about option

3 Analysis and Assessment of the EnDev activities

3.1 Rural electrification through Micro Hydro Power Plants

3.1.1 Market situation

A real private hydropower sector in Rwanda does not really exist, except for the efforts being put in by the EnDev PSP Hydro project. Government (MinInfra) aims to put as fast as possible and as many as possible hydro schemes on the ground supported by donors and development partners (e.g. UNIDO). In practice these sites are being built fully financed by the government and transferred to communities after commissioning. Foreign organizations/companies are responsible for construction and commissioning. The number of sites being built so far is limited. This might change because of the EU-Energy Facility project which was won by MinInfra and which aims to implement 4 MW in Micro Hydro schemes (€ 10mio€) in the coming 4 years. The project will be implemented by BTC. As a consequence of this situation that the national capacity to design, build, operate and manage hydro power projects is limited too, making the build-up of a commercial sector quite challenging. Nevertheless MinInfra however is open for any initiative that brings extra power

to the country. The Hydro power atlas of Rwanda as produced by MinInfra shows 300 suitable sites, all still open for –also private- development (all sites below 200 kW have not been allocated).

3.1.2 Activities of other stakeholders

As mentioned, other stakeholders are fully working through a public sector approach, building and financing by government/donors and after commissioning handing the schemes over to the local population (or Electrogaz??). BTC is active, UNIDO too. A private sector approach is only being implemented by EnDev.

Nevertheless, MinInfra (Kirenga) very much appreciates the project and its concept, even though in the beginning the ministry was not too keen on the PSP Hydro approach. The risk of financial errors was considered very large, as it actually proved to be. Kirenga suggested that a closer eye on the financial operations of the PD's (day-to-day monitoring) would have been advisable, from GTZ but even more from a closer involvement of the district governments (since they also represent the customers)

Kirenga further mentioned a booming productive use development at the Nyamotsi site after the hydro came into operation. In the end the capacity of the plant became a bottleneck. During the mission this was not further explored but it is recommended to the project to verfiy this in anticipation of productive use developments at the PSP Hydro sites.

The draft "energy sector prospectus" (based on the SWAP that agrees on targets and main development lines only) for Rwanda is expected mid February and focuses on tripling the electricity access rate in Rwanda by the end of 2012. World Bank is assisting GoR in the process. Components of the prospectus are grid (economic roll out), micro hydro (according the atlas) and PV. Total costs summarize to USD 200-250 million (not necessarily all new funding). Input is expected from GoR (10 MUSD/year), Electrogaz (little), connection fees (app 70 MUSD), World Bank (70 MUSD) and other donors (NL, EnDev, EU, Belgium).

Concern is the implementation capacity as investment pace in the electricity sector will (have to) grow from 10-15 M€ to 70-80 M€ per year. The potential seems –partially- available (Electrogaz in the last years managed to increase the pace from 2.000 to 20.000 connections per year), but is probably insufficient. Also RURA, supposed to steer the tariff process is very low on capacity. Off grid strategy is lacking so far, but will be one of the elements of the prospectus. There is a strong need however for a lead partner in the off-grid strategy and the management thereof.

World Bank is also (and has been for a while) preparing a GEF TA project (implementation expected from mid 2009). 7.3 MUSD of which 2.8 ESMAP. The GEF project is to include the off grid strategy.

In the prospectus there is hardly any large scale generation. According to World Bank this investment pipeline is already active: large and small hydro's, the Kivu pilot, the large Kivu implementation, etc. Also Biomass is not included in the SWAP/prospectus. The BEST is very good, but World Bank advises that someone should adopt it and bring it to the prospectus level.

WB has been working on sector rehabilitation programs in Rwanda since 2004, resulting in a stable grid without too many losses.

3.1.3 EnDev activities

Project developers

The PSP Hydro concept proved quite challenging and consumed much more time and support from the GTZ project officer than expected beforehand. Of the six "original" project developers, later partially replaced by 2 new organizations, at the time of the mission only three projects were moving forward with the perspective of commissioning somewhere mid 2009. A fourth project is currently transferring ownership with however still insecure prospects. A fifth was recently cancelled. This paragraph describes the status of the projects as found during the mission.

RES
The RES project faces serious problems. Unable to reach financial closure RES has consumed only subsidy but no equity contribution. When this became clear the project has addressed this with RES and after RES failed to resolve or even react properly the matter was discussed with MinInfra. After an intervention from Minister Butare RES will now be relieved of the project and responsibility is to be transferred to the local government. However at the time of the mission it was still unclear how this process will take place. It is therefore hard to estimate if and when the hydro plant at the RES site will materialize. Progress on the ground so far is that only the intake of the plant is completed. There seem to be no PPA or tariff agreements with households to be connected.

ENNY
The Enny project seems to proceed comfortably now. Financial closure is reached, engineering completed, expropriation finalized in January. (Ossberger) Turbine will arrive in February; civil works will be completed before July. After that commissioning will be done. Enny's administration is according to the project of sufficient standard now.

Enny has a more or less clear grid plan. Key customer is a big (90 staff) tea factory, 9 km's away from the hydro plant. On the transmission line to the tea factory 4 transformers will be placed connecting 300 households. In a second phase of connections Enny aims to reach a connection density of 30% (the Electrogaz rule of thumb). Enny does not feed into Electrogaz' grid. Target is to connect 972 households and 18 productive use and social infrastructure customers. Connection fees will be between 9.000 (poor HH) and 200.000 RWF (SI). ENNY partially will provide credit for connection fees to its consumers from the tariff payments. Also the tariff will be differentiated in small-medium-large consumers. (Households will pay app. 10% below Electrogaz tariffs, i.e. 110 RWF). Also ENNY found prepaid meters of about 50 USD (in China) which seem to be appropriate for the purpose.

There is an administrative delay in the RURA environmental permit. This was obtained but has to be renewed every year. For the second year it is still pending. This is the case with all project developers. However, since this process is largely steered by MinInfra (as it was in the original permit) this is not seen as a problem.

SOGEMR
SOGEMR encountered some difficulties in the last months. Its manager got arrested putting the project on hold. Offices and power house are constructed but nothing else. Meanwhile however a new manager has been appointed by the hospital which is a main client to the hydro plant and co-investor. The new manager seems well qualified and is restarting rapidly. Financial closure is however not yet reached. The turbine (Ossberger, 438 kW) is already on site (on a lease contract, therefore making costs!), engineering will be ready by February, turbine installation is planned for March, civil works completion by June, and transmission works and expected commissioning in July.

Connection fees are expected 50.000 RWF, tariff at 100 RWF/kWh. Only Surplus electricity is to be sold to Electrogaz (at 70 RWF). At the core of the project is as mentioned a hospital. Next to that SOGEMR plans to issue bonds to villagers for 20.000 RWF to create ownership and to provide a source of revenue (about 4.000 RWF per bond per year)

SOGMR is planning for a second (and beyond that more, in the 1-2 MW range) hydro projects in Rwanda. Is negotiating with a US non-profit fund and is looking around for turbine manufacturers since Ossbergers delivery time is up to 2 years. SOGEMR has some contacts in China and Indonesia but is worried about the after sales.

REPRO.
This project was added to the PSP Hydro program from the latest call for proposals early 2008 and is moving ahead rapidly. The project, a rehabilitation project, was visited during the mission. Financial closure is reached. Ossberger will rehabilitate the turbine in March and will supply a new generator. Civil works (extensive) are for the majority completed and look good. Grid interconnection plans are ready, household/village connection is under discussion with the consumer organization. Transmission works are planned for April '09. According to the project developer at first the houses near the installation will be connected (additional to grid interconnection). Estimate is to raise connection rate from 143 to 301 HH in a first wave. After that appr 30% of the households within reach of the grid are expected to be connected. Tariffs and connection fees are still under negotiation, but presently Electrogaz clients in the village pay also for transmission losses, i.e. 130 + 70 (losses) RWF/kWh, and suffer from up to 4 day blackouts

GTR
The GTR project was cancelled because of lack of progress, with backing of MinInfra. The budget will be included in a new call for proposals early 2009.

Next to information on the progress as described above, in a meeting with all the "remaining" PSP Hydro project developers (SOGEMR, REPRO and ENNY) some general comments were received.

- The up front studies could have been done more carefully. One of the learning points from the project developers was that material costs are generally much higher than estimated because of the relatively small volumes that a project purchases. It was suggested to approach suppliers jointly.
- More regular joint meetings with the project developers would be welcomed, to share experiences and to identify possible joint or common actions.
- Business plan calculations generally miss power supply from Electrogaz if the turbines are idle but customers still need service.
- VAT rules and regulations and their impact on the project and financial planning were insufficiently clear to the projects
- The annual renewal of the RURA environmental permits should be more properly addressed.

But, in spite of the problems encountered all three of the project developers present are interested in building a second project.

Support agencies

CAPMER
Originally contracted to support the project developers in business development, administrative and financial organization CAPMER appeared either not capable or unwilling to perform its tasks in the project. After several discussions CAPMER's contract was annulled. Arguments over this annulment are still under discussion. A private auditing

company, TM Auditors, have taken over Capmer's role in assisting the project developers. TM was responsible for auditing the project developers earlier in 2008.

Electrogaz
The national utility Electrogaz (all assets under the ownership of MinInfra) supports the project developers were requested in technical issues. It is however unclear how much support actually is given, or requested for by the project developers. Where project developers claim insufficient response to their needs and requests Electrogaz stated that there were no problems with the visiting frequency. During the site visit to REPRO it also appeared from the project's logbook that Electrogaz' engineers indeed visit the project very regularly. So in some cases Electrogaz support seems sufficient. In order to improve its support Electrogaz will prepare work plans with the individual project developers early February. Support is expected to improve.

From its experience in the project Electrogaz advised the project developers to improve the engineering capacity of the PD's by hiring their own engineers.

Electrogaz is furthermore keen on any new projects, welcomes each kWh on its grids since the larger generation projects will materialize in 5 years from now at the soonest. Electrogaz would like to get the maintenance contract for all MinInfra and BTC sites.

3.1.4 Technical aspects of the promoted energy services

No special observations during the mission.

3.1.5 Financial and socio-economic aspects of the promoted energy service

Regarding PPA's Electrogaz remarked that actually RURA would have to facilitate the negotiations between the project developers and Electrogaz. In practice however Minister Butare sets the price. During the mission there was some confusion about the PPA's. At first all the PPA's seemed to be based on the payback time of the projects, i.e. for Report and GTZ PPA's of 9 years seemed to be closed. However, later during the mission during an interview with Electrogaz it appeared that the validity of the PPA's is only one year.

Household tariff discussions are not being held with the individual households but with sector governments, except for the Repro project where there is contact with the parish. In general tariffs are as follows:

Electrogaz tariff is 112 RWF + VAT = app 130 RWF
Average project developers tariff's (households) = 100 RWF + VAT
PPA Electrogaz = 60 RWF + VAT

Usually Electrogaz reaches 30% connection rate (at 200 US$ connection costs). It would be interesting to see if the lower rates form the project developers will lead to higher connection rates. In case connection fees are prohibitive some of the project developers picture a cross subsidy of the connection fees over the tariff payments. Most project developers opt for pre-paid meters. Intelligent fuses and flat rate are not under consideration.

So far the PSP Hydro project proved to be very hands on for the EnDev project officer. Assisting project developers in their business plans, advising on finance and technology, checking receipts, etc proved to be much more cumbersome than expected. Business support by CAPMER proved insufficient and monitoring of the project developers to a level in which all problems become sufficiently clear and intransparencies are avoided is practically impossible in the present design of the project. Besides, a 50% subsidy on each scheme (which in practice in most cases is much less because the original investment studies done

by the project developers underestimated the costs whereas the subsidy amount is fixed) does not lead to a sustainable commercial market.

To relieve international expert involvement, structure closer monitoring and more commercialize the program an (at least for EnDev) innovative concept was designed. This new concept involves close cooperation with a or more venture capitalists (VC) who take a share in the equity of the hydro projects, and provide financial closure through combining this with the necessary bank loans. 2 VC's were already identified. During the mission both VCs were visited for discussing the ideas and to get a better picture of their operation.

Grofin is a relatively young VC in Rwanda. It draws from a fund in Nairobi of 125 Million USD. Grofin Rwanda has an investment volume of approximately 3,5 million dollars, which at first glance seems a bit weak for taking up a number of 1.000.000 USD projects. The largest projects now are about 800.000 USD. Minimum project size is about 30.000 RWF (farmers). Grofins projects for now seem to be located in or close to Kigali. Grofin is interested in financing hydro's in Rwanda with a complete equity/loan package where a 10% (equity) contribution is made by EnDev. The equity contribution has to be repaid by the project developer at a given time. Grofins normal involvement in a project is maximum 6 years, but the EnDev contribution (or the return that is made with it which could flow to Grofin) possibly makes it interesting for Grofin to extend it to 8 years. Grofin is not per se interested in managing any "revolving fund" that might form from the equity buyout by the project developers[1]. EnDev was however explicitly asked to do the technical part of the project appraisal, monitoring and support of the projects. Grofin will support the business side. It was agreed that GTZ will send a financial expert to further develop options and prepare draft legal documents with Grofin.

Next to Grofin, REIC was visited during the mission. It appears that REIC is, apart from its institutional setting which is more government related, can provide similar services as Grofin. It has more or less the same experience and fund size, and expressed its interest to work with EnDev too. EnDev's financial expert will therefore work with REIC as well.

The new VC approach was discussed by the program officer with Minister Butare, who supports the concept because it brings a complete financing package.

3.2 Biogas systems for domestic cooking application

3.2.1 Market Situation

Prior to the project there was no market for domestic biogas in Rwanda. It is the aim of the project to develop such a market, based on commercial principles. The program appraisal study as performed by SNV shows ample market potential at Rwandan farmers with at least two cows provided financial support in the form of buy down subsidies and/or micro credits. Details on market potential can be found in the appraisal study <reference>

3.2.2 Activities of other stakeholders

Besides the NDBP there are no other active stakeholders on domestic biogas in Rwanda. In the past CITT/CIST deployed some activities, also in the field of institutional biogas installations, but meanwhile a large part of the CITT/CIST activities (and personnel) seem to have been integrated in the NDBP. Within the NDBP there was a considerable pressure to implement a pilot with (100) Chinese fibre glass digesters which caused some delay on the SNV/masonry type. An evaluation of the performance of these fibre glass digesters is not

[1] One of the ideas is to provide 10% EnDev subsidy to the project developers, through the VC's, from a revolving fund. However, equity buy out will not occur for at least 5 years in the projects. Will the fund be idle for that period?

done yet but first experiences show that the relative advantages expected from these digesters (low costs, fast and easy assembly) do not substantially materialize under Rwandan conditions.

3.2.3 EnDev activities

The NDBP team within Mininfra is now 12 persons, including technicians. According to the team 238 digesters have been constructed or are under construction in the pilot phase (50% is still starting up operations). Later info from the projects' Database: 190 under negotiation (data list completed, committed without loan scheme), 95 contracts signed and under construction, 91 contracts signed and finished. Up till December 2008 subsidies were paid for 92 digesters. After a number of workshops in 5 of the 30 the districts district representatives approached farmers for their interest. This resulted in a "waiting list" of 1.300 farmers who showed their interest to buy a digester provided the credit line materializes. Looking back this might just have caused the delay in the program since everybody now waits for the credit, leading to turnover difficulties at the mason companies.

Training activities
Following a May 2007 training course for masons at CIST, the NDBP now cooperates with Tumba College of Technology (TCT) in the implementation of a ToT (Training of Trainers) course to centralize training activities in the program. Participants in the course are from a/o technical schools (in order to create training-hubs at the provincial level), CIST, NDBP, and an agricultural school. Additional to the ToT course, the TCT/NDBP cooperation aims for direct trainings for masons and supervisors, and for refresher courses that also serve as a feedback opportunity from the field. TCT seems reasonably equipped for that task. A Nepalese SNV advisor assists TCT in building its capacity on biogas. More basic institutional and technical support (a/o micro hydro) is given by JICA.

R&D activities
Fibre glass domes and lowering of costs of stoves through local production (some experimenting at TCT was observed), but no structural activities so far.

The mission had some discussion with SNV on the tasks presently located within the Mininfra, which ideally should be located outside, QM, Technical issues, financing. One of the reasons would be that once trained people within the ministry are liable to easy change jobs. It seems that NEDA (who's goal it was/will be to separate policy and implementation and to give more autonomy to the implementation offices) is back on the agenda. However, in what form still is unclear. As an agency, a board, only for energy, energy and water, or broad infrastructure? Procedures will in general (ToR available at Gerard Hendriksen) remain the same as in the ministry, but hopefully the chain of command will become shorter. A decision about NEDA will probably not be made soon however.

The steering committee for the NDBP (8-12 people from ministries, NGO's and R&D) doesn't function as planned. Is doesn't convene, has been delegated to lower echelons, and is only one of so many. General opinion seems to be that there is however no need for a closer involvement of a steering committee. This might be right. Contacts with other Ministries and districts seem to be sufficiently established.

In the financing the Banque Populair stands ready, especially in the combination with Rabobank who is engaged in the institutional strengthening of BP on the request of the Dutch Embassy. BP has already engaged in promotion activities. The waiting is for the internal procedures of FMO who provides the financial means for the credits. Timeline

expected (optimistic) is FMO ready for board approval by Feb. 1st, mid February approval given, negotiation BP-FMO 4 weeks, so contract signing mid March[2].

NDBP coordinator Augustin refers to the delay of the credit facility as the major bottleneck. According to him the potential of HH without the credit system would be app 15.000 (of app 200.000 total potential with 2 cows according to the SNV study). While waiting on the credit system Augustin/the NDBP team will start with increasing the outreach of the program to all provinces in the country by sensitization activities, training of masons and demonstrations.
Augustin further refers to the tedious internal procedures at Mininfra that the program has to go through as well. He expresses the hope that the new permanent secretary (due in February) will give more flexibility (while waiting for some more distance from the ministry through the establishment of a NEDA).

The question was raised what will happen when the credit line is available. Will the market suddenly boom? And if so, will the producers become the bottleneck?

There is certainly no lack of ambition. MinInfra is put under pressure to increase the NDBP's targets from 15.000 to 100.000. District mayors are pressed to make biogas installations part of their performance plans. Next to that the Minister for Education recently announced in a speech that all boarding scholls in Rwanda should own a (institutional) biogas installation within the next three months. Even if this is unrealistic, it still does illustrate the pressure from government side to perform.

3.2.4 Technical aspects

Quality control is done by Mininfra's field staff, both during construction and commissioning. Any technical complaints after commissioning will be resolved by the field staff together with the responsible mason. In future, when the market grows, it will no longer be possible to maintain this system. NDBP/Mininfra now opt for the system where they accredit contractors and perform random quality audits.

3.2.5 Financial and socio-economic aspects

The already active masons/construction companies complained about the low profit margin. The maximum price was set by the ministry (because it is still a nascent market some regulation is required) but remained fixed while prices for cement rose substantially (costs for a digester went up from 850 to 1150 US$ or 650.000 RWF). A solution was found in permitting a negotiating margin between the constructor and the client.

It seems that the contractors are thinking of joining in an association. NDBP is not sure about the effect. On one hand it improves the exchange of experience and information, on the other hand it might potentially block the process.

Clients are very satisfied with the digesters. No or few technical problems were encountered. "Even men turned to cooking". Benefits mentioned (by the team):

- saving on firewood collection time
- lighting
- multitasking (next to cooking other activities can be performed)
- it raises the families standing
- health/smoke issues

[2] Per april 7th the internal process at FMO is still pending

Experiences

Biogas household
A visit was brought to a recently commissioned biogas digester. So far the owner (a widow) proved to be very content. She used the biogas stove for 5 days a week. The other 2 days she cooked beans for which the amount of biogas is insufficient (proper insulation of the cooking pot after bringing the beans up to temperature might be a technical solution to that). Benefits mentioned were the easy on and off switching, the absence of the need to be at the stove continuously, no smoke/clean kitchen. As she was owner of a wood lot the argument of lower costs for firewood did not apply but she managed to sell wood that she did not need to use for her own cooking. There had been one attempt to use the slurry as fertilizer but it failed.

Institutional biogas, boarding school
The boarding school had app 800 students (girls) and had two digesters, one for the toilets and one for the cattle-manure. The school possessed 19 cows, and some pigs. Best experiences were with the manure digester. The digester fed by the toilets knew some problems in yield and stability, however not that serious. The biogas accounted for a significant amount of the energy consumption of the school**.** The rest is firewood. The installations were built by CIST in 2007. The school principal seemed content about the performance. A problem was however encountered in maintenance. It proved hard for the school to find someone to make repairs or to give them advice in case of technical problems.

4 Outcomes, project impact and EnDev criteria

All analysis and calculations in the following chapter have been prepared based on the information available during the mission in January 2009.

PSP Hydro has disbursed about 56% of its current budget of 3 Mio €. With the current planning it is unclear if the remaining budget will be spent until December 2009. NDBP has disbursed only 36% of its current budget of 2.2 Mio €. The volume of future disbursements depends on the staring of the credit line for the biogas users. With the delayed start of the credit line the use of the total budget is in question.

The table below shows that PSP Hydro and NDBP are still far away to reach the planned targets. However, the installation of the first biogas digesters has happened already and potential customers have lined up waiting for the credit line to materialize. With the 2 Micro Hydropower plants that will be commissioned during the forthcoming months it is expected to achieve a share of the anticipated number of beneficiaries in 2009.

Energy for households	2.405	0	0	-	-	-
Energy for cooking	-	-	-	11.000	3.000	840
Energy for social infrastructure	61.818	0	0	-	-	-
Energy for productive use,	30.232	0	0	-	-	-
Total	94.455	0	0	11.000	3.000	840
Budget	3.000.000 €	1.800.000 €	1.694.000 €	2.000.000 €	600.000 €	714.000 €

4.1 Rural electrification through Micro Hydro Power Plants

Procedures and structures to establish IPPs in the micro hydro sector have been developed and supported by PSP Hydro. Even if the first fruits will only be harvested mid 2009 PSP hydro has contributed significantly to sow the seed of private investment and ownership in MHP projects in Rwanda.

4.1.1 Outcome

As per date of the mission no countable number of people have been supplied with a modern access to energy through the PSP hydro project. First outcomes are expected July 2009. By then the MHP plants of Enny and Repro will be commissioned and start producing electricity.

4.1.2 Project Impact as contribution to MDGs

Once the MHP plants will be in operation they will contribute to the following MDGs:

MDG 1: eradicate extreme poverty and hunger
The MHP electricity enables users to make savings on expenses as expenses for electricity are expected to be lower than on candles and kerosene/gasoline.

MDG 4, 5 and 6: health related
The MHP electricity will strongly reduce indoor air pollution of kerosene/gasoline smoke and candles. It will also improve safety around the house.

MDG 7: ensure environmental sustainability
The MHP electricity intervention line contributes to the environmental sustainability through reduced use of kerosene/gasoline and small batteries (for radios for instance). Additionally there is an increased awareness of the importance of a proper catchment area management and reforestation to secure long term water resources.

Another anticipated impact of the MHP electricity is the improved access to information and communication devices such as mobile phones and radio.

4.1.3 Fulfilment of EnDev Criteria

a) Cost efficiency:

No detailed data are available to calculate the cost efficiency of the planned installation. At the end of 2009 not all household will be connected which will cause high (EnDev) connection costs for the few that will be connected by then. The costs are expected to decrease for the new phase with more households getting connected.

b) Sustainability:

Sogemr and Repro are planning to sell surplus electricity to Electrogaz at a fixed rate of 60 RWF/kWh. The tariff for customers will be at 100RWF+VAT, which is slightly lower than Electrogaz customer tariff. Enny will only sell to direct customers at rate below Electrogaz rate.

The planned tariffs should be sufficient to run and maintain the system. Uncertainty remains on the payment moral of the customers as well as on the management of the IPP.

However, the projects receive a subsidy of close to 50% of the total investment. The sustainability of this approach for starting new projects relies on the subsidy. To achieve a Hydro *sector* that will be sustainable the subsidy component needs to be reduced drastically.

c) Scaling-up potential:

Many suitable sites (app. 300) for micro hydropower have been identified and can be found in a national hydro power atlas. The main barrier for the use of this potential is lack of

capacities in the micro hydro sector. The positive response to a 2nd call for expression of interest shows that a number of private investors is willing. With PSP hydro support the capacities in the finance sector will be build up. The chances for additional hydropower plants are high.

d) Additionality and newly provided access:

The micro and mini hydropower plants of the present project would not have been constructed if PSP hydro would not provide the necessary resources and advice. Two of the new plants will become economical feasible due to feeding into the national grid. Nevertheless the project reports that households directly connected by the project would not have been connected otherwise within any length of time.

e) Accountability:

The planned hydropower installations are financed by private investment, a credit and a subsidy through EnDev. Thus, the results will be 100% accountable for EnDev.

f) Intensity and complementarity of cooperation:

The activities of PSP Hydro in the hydropower field are complementary to the activities of the government of Rwanda. The interest is in hydropower project of high quality, which are expected to be supported and developed through the PSP Hydro activities.

4.2 Biogas systems for domestic cooking application

NDBP has set the technical basis for a role out of domestic biogas systems in Rwanda. The projects operational success is only slowed down at the doorsteps of the internal procedures in the banking sector.

4.2.1 Outcome

NDBP has trained 9 companies in construction of domestic biogas digesters. Including the governments pilot phase now 186 digesters are operational and another 150 digesters are in progress (either construction or feeding stage). App. 1000 potential customers have shown their interest in the biogas digester once the credit line will be in place. So far 840 people use the benefits of the new digesters to satisfy most of their cooking needs. Additional to a stove each plant powers a gas lamp with its gas. This enables the users to have cleaner and brighter light during evening and night hours without hazardous fumes.
Through NDBPs marketing campaign awareness of biogas digesters has been created successfully which resulted in construction of digesters without credits and an increasing demand for the subsidies and credits.

4.2.2 Project Impact as contribution to MDGs

MDG 1: Eradicate extreme poverty and hunger

Biogas digesters reduce expenses for cooking fuels in households purchasing biomass fuels from the market.
Through the use of biogas the pressure on the scares biomass resources is reduced. Even poor households that will not be able to own their own biogas plant will benefit from the new digesters as competition for the remaining biomass will be lowered. Operation of the biogas plant often might also be outsourced by the owner, creating new employment opportunities in the community and so lowering poverty through job creation.

MDG 4,5 and 6: Health related

Reduced indoor air pollution through use of a cleaner fuel for cooking and lighting will result in less respiratory and eye infections.
Through the higher safety properties of a biogas stove compared to a traditional biomass stove, fewer accidents will occur. Combined with the cleaner indoor air reduced child mortality will be achieved.

The slurry coming out of the digesters could probably be used as a high quality fertilizer, increasing the results when harvesting and so benefitting in a better nutrition.
It is expected that the hygienic situation and the sanitation environment of the households can be improved by connection also toilet to the digester.

MDG 7: Ensure environmental sustainability
Using Biogas for cooking on a large scale will reduce demand for biomass fuels and therewith decrease pressure on Rwanda's biomass resources. With decreasing biomass consumption, the organic matter in the soil will increase.

4.2.3 Fulfilment of EnDev Criteria

a) Cost efficiency:

With costs of app. 850€ per person reached cost efficiency within NDBP has to be described as poor. The target value for the 1st phase of NDBP with 200 € / person is still far. Currently it is doubtful if this can be achieved by the end of 2009.

With an extension of the programme, provided the credit line will be available, cost efficiency will improve significantly and the high investment of the first phase will pay back.

b) Sustainability:

Construction companies are qualified and ready to role out biogas digesters; customers are aware and interested in the technology. However, the lacking credit line is the major obstacle for the programme to start on full scale.

NDBP provides a subsidy which supports customers to cover the initial investment. Increased number of contracts will improve the economic viability for the construction companies and lower the product price, thus reducing the relevance of the subsidy.

The unforeseen changes of material prices had an influence during the 1st phase as the price for cement raised significant and caused a higher price per digester. Future increase of material costs might have a negative impact on the product, too.

c) Scaling-up potential:

Demand for biogas digesters and interest to invest has been announced by app. 1000 households. Once the credit line is in place the construction companies won't be able to fulfil this demand and more training of construction companies will happen. NDBP is preparing for this. Cooperation with national training institutes ensures the availability of trained companies in each district of Rwanda.

d) Additionality and newly provided access:

Through NDBP households gain an access to an energy form that was not available for domestic use in Rwanda so far. The NDBP supports the formation and building up of the new domestic biogas sector.

e) Accountability:

The connected households are at 100% accountable for DGIS. No other financial support is involved than EnDev and the beneficiaries.

f) Intensity and complementarity of cooperation:

The EnDev component "Support to the National Domestic Biogas Programme" supports direct the initiative of the Rwandan Government. EnDev's activities are complementary to the government's interest and demand.

5 Observations and Recommendations

5.1 SWOT analysis of the project

5.1.1 SWOT analysis of PSP Hydro

Strenghts - 2-3 project developers (REPRO, SOGEMR and likely ENNY) seem strong enough to complete their projects *and* able and willing to build more. - Electrogaz is interested in supporting the process and has already some internal MHP capacity	***Weaknesses*** - MinInfra is short staffed, overall capacity is weak. - Private sector capacity on hydro in Rwanda is still limited - So far, assessed market potential was not a prerequisite for project acceptance - Monitoring of projects/developers was, in spite of massive input from program manager, insufficient to avoid administrative intransparencies and fraud - No plant has been commissioned yet – slow progress - High subsidy share of close to 50%
Opportunities - Facilitation (by the project) of more exchange of experiences between de project developers will lead to jointly tackling problems and sharing lessons learned - There seems to be 1 local turbine manufacturer (4,5 kW). Opportunity to develop local micro/pico schemes - MHP Atlas with app. 300 identified sites available	***Threats*** - Situation on RES is still unclear. Further delay is expected - Juridical implications from cancellation of GTR - Insufficient qualified potential to role out VC approach beyond 1st round - Further delays might cause zero-connections at phase end –risks for 2nd phase

5.1.2 SWOT analysis of NDBP

Strenghts - Construction companies are qualified - Promotion activies created demand - MinInfra supports process - 1st 190 digesters are successful in operation	***Weaknesses*** - MinInfra is short staffed, overall capacity is weak. - initial investment costs are too high
Opportunities - Interest from BRD to fund the Biogas credit line at BP. Minister Butare will talk to BRD soon - Synergies through settings up a program for institutional biogas	***Threats*** - delay in credit line might cause cash flow problems at masons who turn to other business - Biogas reputational damage from delay

5.2 Recommendations

PSP Hydro

It was recommended to send a financial specialist to Rwanda to discuss further with Grofin and REIC, to assess their capacity and to prepare the concept of the VC participation.

Clarification on further procedures (and support where necessary and appropriate) for transferring ownership from RES to local government as well as any financial repayments from GTR and RES should be obtained.

Closely monitor progress and EnDev outcomes of the 3 projects still under development in the present phase, to ensure commissioning mid 2009.

A system of closer monitoring and supervising of project developers in the PSP Hydro project has to be developed. Also MinInfra recommend this, and suggested even that project developers would use their own funding first before any subsidy would be paid, or to use a special double signature fund fort he full budget. The VC's will definitely play a large role, but technical supervision and connecting both monitoring systems needs to be defined.

Involve Grofin and REIC in the further preparation and implementation of the call for proposals for new projects following the January expression of interest, to get their input and commitment and to familiarize them better with the concept of micro hydro projects.

Facilitate a rapid development of new project resulting from the last expression of interest and push for start of project implementation in 2009.

Facilitate regular meeting with the project developers for exchange of experiences and to explore opportunities for cooperation (on e.g. joint purchase of equipment).

Involve MinInfra in selecting new personnel for the PSP Hydro project whenever appropriate.

EnDev's prime target is to connect as many households and institutions/companies as possible. Feeding into the grid is –to secure income and support the business case- acceptable, but should not be the prime objective. It is therefore reccommended to make "market potential" an intergal part of the (site) selection process and the project development right from the start of the business plan. Rather than grid feed-in a large productive use consumer (i.e. a tea factory) would be preferred.

NDBP

Keep in close contact to FMO in order to speed up the realization of the micro-credit facility as much as possible. Assist BP wherever possible (and whenever asked for)

Meanwhile keep momentum going and raise interest through increasing the number of demonstration plants and training of (trainers of) new masons in new districts, accepting the risk of slow materialization of credit scheme and subsequently not fully fulfilling expectations raised in the market.

Setting an internal deadline for investigating alternative financing of credit scheme, in case FMO proves to troublesome or even comes up with a negative decision.

Support MinInfra to develop and institutional biogas activities for financing under EnDev2 (see also under future opportunities) by preparing and implementing an expert (concept development) mission to Rwanda and starting with some (10) demonstration units to prepare the ground.

5.3 Future opportunities

The Netherlands Embassy (Maresa Oosterman) stressed to take duly notice of and align wherever possible with GoR plans while developing new activities under EnDev2 (as was the general advise from the evaluation of the EnDev1 program). Specific reference was made to the Sector Wide Approach (SWAP) that came out at the end of last year and the sector investment “prospectus” due in February, co-led by GoR and the WorldBank.

Whereas the sector investment prospectus seems to focus largely on on-grid solutions, there is definitely potential for EnDev2 off-grid activities. During the mission it was suggested that EnDev might take the lead in that sector. For TA there is/will be a secretariat under MinInfra (Eva Paul) coordinating 2 units; one for on-grid at Electrogaz, and one for off-grid at a future NEDA.

A new financing setup of PSP Hydro using venture capitalists was already mentioned. Provided successful, EnDev2 could top-up remaining funding from EnDev1 to expand the approach.

An interesting “instrument” could be provided by the Community Development Fund (CDF), see text box. The fund channels development money to the individual districts, earmarking of funds is possible, TA next to financial support for investments is welcome. Technically solar or biogas for SI, small community operated hydro’s (where private sector will not go), and even grid densification (provided it can be aligned with the on-grid sector prospectus) seem feasible. Advantage would be that EnDev could ride piggy back on existing structures, meanwhile strengthening them (linking CDF to MinInfra expertise, providing possibly long term energy advisor). It is advised to obtain more information on experience with working with CDF from the Netherlands Embassy.

The Community Development Fund started in the year 2000, and provides a way for GoR to channel development funds from both GoR and donors to the individual districts. Annually the Rwandan districts prepare through the district counsel their district development plans and annual action plans. Main source of funding is the CDF. The funds' budget is set annually and is divided among the disctricts according a/o population, poverty standard, size, lack of infrastructure.

Tasks of the CDF are
1) support/finance of local initiatives,
2) follow-up on the use of funds, and
3) work as an intermedeairy with donors.
For that CDF has its own technical pool of about 40 persons.

In general donor funds are 100% for investments, the CDF running costs are in the GoR budget. Earmarking of funds is possible, regional and sectoral.

Rural electrification is definitely a focus area; Solar (PV) in government institutions, mini/micro hydro (expensive, hard, only 1 under construction -38 kW-), and together with Electrogaz grid densification. Technically CDF leans on MinInfra. Operation models are either through a management contract with Electrogaz or community operated (for small isolated installations).

GoN has funded CDF 15 M€/3 years (14 M€ investments, 1 M€ capacity development)

Very concrete, and very much urged by GoR, is to widen the scope of the biogas activities to Institutional Digesters at schools. The Minister of Education announced in a speech earlier this year that all boarding schools in Rwanda should own a (institutional) biogas installation within the three months. Even if this is overambitious it does illustrate the pressure from government side to perform. It was agreed that preparation and concept development (inclusing a mission from an institutional expert) would be implemented under EnDev1, whereas full implementation could be part of EnDev2 (1/3 endev, 1/3 GoR, 1/3 school). Technical expertise within mininfra is available as the experts from CIST are now all within the ministry.

Another option for reaching the poorer households is through battery charging operations for LED powered lamps. Robert-Jan van der Plas was asked to prepare a draft for a project to use an existing microcredit system (Luego) for small entrepreneurs for battery charging stations.

Annex :

Terms of Reference for the Mission appraiser

Energising Development Rwanda

PSP (Private Sector Participation) Hydro Program

Support to the National Domestic Biogas Program

Terms of Reference

Progress Assessment Mission

January 2009

Background

The Federal Republic of Germany and the Kingdom of the Netherlands have jointly embarked on the global program “Energising Development” to provide up to 5 million people in developing countries worldwide with sustainable access to modern energy services. The program is implemented by GTZ in cooperation with SenterNovem.

To contribute to its goal the program supports two energy access programs in Rwanda, notably the PSP (Private Sector Participation) Hydro Program, started in 2006, and the support to the NDBP (National Domestic Biogas Program), started in 2007.

Currently the completion of phase one of the global Energising Development (EnDev) program by mid 2009 is in progress and the prolongation of the program with a second phase is in preparation.

The mission, comprising representatives of GTZ, GTZ-IS and SenterNovem, has the aim to assess the progress of the current Rwanda components of the program and to identify options for future programs under the programs second phase.

Objectives of the mission

The **objectives** of the mission are:

1. To assess the progress of the current EnDev-Rwanda components and identify any obstacles for successful implementation.
2. To identify the lessons learned from the current components so far.
3. To develop recommendations for further improvement of implementation and/or to overcome identified obstacles in the currently running program components
4. To identify and develop recommendations for future program components under the EnDev2 program.
5. To complete with the program teams the December 2008 monitoring documents of the program.

Deliverables

1. A **mission report** comprising:
   a. An assessment of the current state of affairs on PSP Hydro and NDBP.
   b. Identified obstacles and lessons learned.
   c. Recommendations for improving implementation
   d. Recommendations for future new program components
2. Completed **monitoring documents**

Main activities

Persons/institutions to visit

PSP Hydro

- PSP Hydro team
- MinInfra
- ElectroGaz
- CAPMER
- CAPMER-auditors
- PSP Hydro project developers
- MARGE
- GROFIN

NDBP

- NDBP team
- MinInfra
- SNV
- Banque Populaire
- RABO Bank
- KIST/CITT

General

- GTZ Country Director
- German Embassy
- Netherlands Embassy

Field visits

- PSP Hydro sites
- Biogas (domestic) clients, masonry and fibre glass
- Biogas installations masons/suppliers
- Institutional biogas installations

Mission members

The mission comprises representatives of GTZ (public and International Services –IS-) and SenterNovem. SenterNovem, agency of the Netherlands Ministry of Economic Affairs, implements Dutch policy on Sustainable Development and Innovation, and cooperates with GTZ Head Office in the implementation of the global EnDev program.

- Andreas Michel, GTZ-Energising Development. Energy Advisor, EnDev desk officer.
- Marcel Raats, SenterNovem. Senior Advisor, coordinator EnDev-SenterNovem.
- Ingmar Stelter, GTZ-IS, responsible project coordinator

Mission dates

The mission will visit Rwanda from 17-24 January 2009.