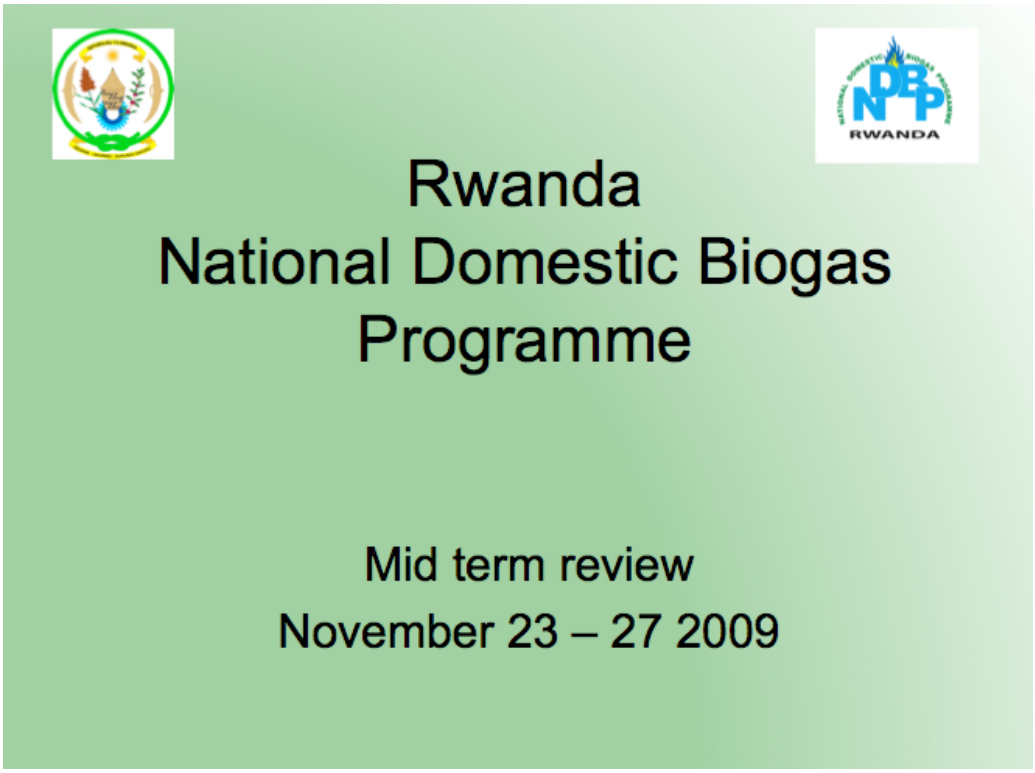

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Table of Content

Summary Observations:

1. The mission reviewed a biogas programme with highly committed and skilled programme staff which is imbedded in a conducive policy environment and guided by a dedicated Government.
2. The main components of the NBDP programme (promotion/marketing, quality control and training) are well designed, developed and executed.
3. The programme is, however, significantly lagging behind its output targets. The main issues marring scaling-up, as per the mission's view, include:
   a. The very high investment costs of the biogas installation;
   b. The delay in fielding the biogas loan product (mitigating to some extent the above mentioned high up-front investment for the household, and;
   c. The delay in gearing the programme towards a truly dissemination and market focused organization

Summary Recommendation:

4. The Government of Rwanda, Ministry of Infrastructure, to take the opportunity of the establishment of the Board for Energy and Water to position the NDBP as a swift and fairly autonomous output-oriented organization ("biogas utility")
5. The NDBP management1, for a short period at the beginning of every month, suspend all other activities, and directs all its staff and resources to deliver the monthly required bank applications to achieve the number of applications for that month. Once the number is reached, in 4 to 5 days, staff will return to their normal duties.
6. To sustain the commercial dissemination of the program, management is urged to look into reduction of the investment costs and related monthly loan repayments of the biogas installation. This can be done in two ways:
   a. reduce the production costs of biogas installation. Details are given in Annex C
   b. work with the Bank and if necessary outside financial advisors to design a loan repayment scheme which will reduce the monthly loan repayments, by extending the loan fromor a period of 36 month to 60 month. Details are given in Annex D

[1] The mission noted the concerns of the team with this recommendation. However the mission strongly believes that if this action is not taken and the project continues to operate as usual, these numbers, crucial to complete the otherwise successful, program, will not be achieved. The argument that nearly all the staff is already engaged in promotion activities, strengthen the need for the implementation of this recommendation, as all these promotion activities have not led to a significant increase in the number of clients.

I. Findings and Recommendations:

1. The Rwanda Domestic Biogas program is one of the best designed biogas programs in Africa and the first of its kind receiving support by SNV on the continent. The program has developed strong characteristics, without which a rapid roll-out of the program would not be possible. The following are the observations and recommendations of a review team consisting of Andreas Michel (GTZ), Felix ter Heegde (SNV) and Antonie de Wilde (Independent Evaluator).
2. The review team visited the Ministry of Infrastructure, the SNV office, the GTZ office, the Banque Populaire du Rwanda S.A. The team also visited a branch office of the Banque Populaire in Gicumbi as well as a number of installations. A complete list of the persons and organizations met with during the mission is provided as Annex B. The mission would like to thank the Minister, the Hon' Dr. Albert Butare, the Permanent Secretary MININFRA, Mrs. Marie-Claire Mukasine, the NDBP program coordinator, Mr. Augustin Hategeka, and the local representatives of GTZ Gerard Hendriksen and SNV, Jean de Matha Ouedraogo without whose hospitality and support this mission would not have succeeded.
3. During the live of the project, which officially started in February 2007 with the signing of a tripartite MOU between MININFRA, GTZ and SNV, 390 installations have been installed as per the table below, 16 loans disbursed to farmers and € 543,000 (subsidy and programme support component) has been disbursed, as of September 30 2007, from the EnDev funds managed by GTZ. In addition GTZ and SNV have provided advice and technical assistance.

Period	Number of plants	Financing modality
2007, pilot period	101 GGC 2047 model fixed dome plants	Financed by Mininfra with technical support of SNV
2008 – current	212 GGC 2047 model fixed dome plants	Financed by GTZ/Endev and Mininfra with technical support of SNV
2008, pilot	77 Chinese pre fabricated fiber glass fixed dome biogas plants	Financed by Mininfra

4. The program has conducted promotion campaigns, training programs and developed institutional relations with several organizations and institutions. While the review team has some minor suggestions to further improve these activities, which are detailed later, the teams overall assessment of this work is that it is carried out in a thorough and professional manner.
5. The mission recognizes the significant commitment made by the Rwanda Government, to sustain this effort. Scarce budget resources have been applied to ensure the programs success (NDBP pilot phase, 25% contribution to the subsidy component of the NDBP, Chinese fiber glass digester pilot).

6. A number of unfortunate circumstances, in particularly the delay in getting a credit program started have had significant impact and only 390 of the planned 3450 units have now been commissioned. (11%)
7. As it is the mission's task to review the progress up to now and make recommendations for the second part of the project, the mission respectfully offers the following observations.

Policy Environment

8. The project enjoys strong political backing. The Minister for Energy personally monitors the progress of the program, and intervenes where necessary.
9. The Government makes a significant contribution to the programme. It provides 25% of the subsidy to consumers, and has financed research and development costs such as the purchase and installation of 100 polyester biogas installations imported from China.

II. Linkages with Other Ministries and Government Programs

10. The program is guided by a Steering Committee consisting of representatives from the Ministry of Agriculture, Ministry of Local Government, Banque Populaire, NGOs, learning institutes,. The meetings are held sporadically and the frequency of meetings, particularly in light of potential linkages with the Ministry of Agriculture and the Ministry of Health, but also to position the Steering Committee as a firm monitoring body, should be increased to at least three times annually.

11. A recent promising development is that several district mayors have entered delivery of domestic biogas installations in their annual performance agreements with the President. For the next year, a total of 1170 biogas installations are in these programs.

IIA. Linkages with Other Institutions and NGOs

12. The program has an ongoing relation with KIST, which was contracted to build the first batches of biogas installations. More recently, the Program has also developed relations with organizations which will assist in the dissemination of the biogas units as part of their own programs. National Women's Council, Heifer International Rwanda, the Lutheran World Federation and the East African Dairy Development Board are among the organizations with which the programme has entered into partnership to assist in the dissemination of the biogas units.

III. Contribution to National Priorities

13. The Government has a strong commitment to sustainable development and has implemented laws to restrict free grazing of cattle, cutting of trees and use of wood for fuel. The Government, through a number of programmes, aims to increase the quality of agricultural land through provision of organic fertilizers.
14. As the NBDP contributes strongly to the above, the mission recommends NDBP to intensify cooperation with these programmes.

IV. Funding Arrangements (Procedures, Budget Utilization, Use of Funds)

15. The programme works on the basis of a tripartite Memorandum of Understanding between the Ministry of Infrastructure (MININFRA), SNV and GTZ. A further arrangement, the "Energising Development Partnership Project, Support to the National Domestic Biogas Programme (NDBP)", provides details of the support GTZ receives from the German – Dutch Partnership Program "Energizing Development".
16. The mission took place at a time that the project, for the first time, had run out of money, both from the GoR and from the GTZ. This resulted in a lowering of moral among staff, and had direct impact on the progress of the program as the NBDF program was not longer able to make commitments to farmers who had applied for subsidy . loans and/or inquired about receiving support of the program.
17. By the end of the mission the GTZ representatives were in a position to re-assure the NBDP that the interruption of the flow of funding was based on the relatively late decision of all involved sides to prepare a new interim agreement instead of entering into a new financing agreement under EnDev2 and the bureaucratic delays within the GTZ and MINECOFIN due to high pressure of time. Other potentially significant delays due to the absence of renewed agreements between GTZ and the GoR covering the energy projects regarding the program could be prevented through the Netherlands Embassy, which from January 1, onwards will take over the political responsibility for the project.
18. Pending completion of the formalities, to prevent NDBP facing fund shortages early 2010, the mission recommends the programme to submit the disbursement request for the first half of 2010 as soon as possible

V. Institutional Arrangements Management and Organization:

19. The current project phase can be characterized as one between a technology supply phase and a market demand phase. While the original project concept was

necessarily focused on technology push, the shift to create and respond to"market demand" will necessitate some changes in design and strategy.

20. One of the implications of this shift can be compared with provision of electricity. This typically is done not in a line ministry but rather in a utility with it's own procurement procedures and its own manual of operations. Serving 15,000 (or even 50,000 as per request of the President of the Republic) domestic biogas units and a significant number of institutional biogas systems will require a separate entity: "Rwanda Farm Gas S.A." Like Electrogaz S.A., it is recommended that Rwanda Farm Gas get's its own budget line item in the National budget, to gradually wean such utility away from donor finance and into the country's normal operations of basic service delivery (as oppose to operations under a line ministry).
21. **Organization:** The Ministry of Infrastructure is in the middle of a reorganization and the mission strongly supports the Ministry's plan, recently approved by parliament, to create a Board for Energy and Water, which would have a number of executing agencies including Electrogaz and, what might be called, "Rwanda Farm Gas". To ensure swift service delivery, it is recommended that Rwanda Farm Gas draws up its own Manual of Operations. It is suggested that next to normal operating procedures, the manual would also describe in more detail the management procedures such as weekly meetings in which both budget and expenditures, as well as planned number of units and actual commissioned units are reported. It is further recommended that, based on annual plans and budgets and monthly reports, the NDBP obtains financial autonomy from the Ministry within the rules and regulations of the Board.
22. **Management Information System and Communications**: It is strongly recommended that NDBP/ Rwanda Gas will maintain a solid Management Information System, which provides, in one central location and through easy screenshots, such information as number of plants commissioned, number of biogas loans sanctioned, number of trainings given, number of students attended, mason trained, masons certified, promotions activities, date of aired radio spots, date of aired TV spots, efficiency of promotion as expressed by number of new applications received after promotion has aired, and or promotion activities have been administered.
23. **Complaints and Customer Satisfaction:** Within the MIS, complaint documentation and analysis system should be introduced to register increasing quality and resulting in higher user satisfaction. Additional training and marketing material can then be adjusted and promotion and marketing cost reduced.
24. It is recommended that NDBP already starts with the design of such an MIS and incorporates the current reports on individual activities into the system.

VI. Promotion

25. The NBDP has a strong promotion program. Material for radio and television has been well prepared. Documentation, booklets, T-shirts and hats, are available to hand out in workshops and training seminars.

26. From promotion to marketing: making the shift from technology push to demand driven, also implies a shift from promotion to marketing. The mission recommends that the program starts to in cooperate, what in other technology commercialization programmes has been the key to success, focusing not only on the virtues of the technology, but also on the daily cash savings this investment will provide to the clients.

27. The second recommendation regarding promotion/marketing is a focus on selecting the most efficient tools to achieve the programmes objectives. For the coming phase that would be the collection of information about the number of sales achieved after each marketing event. The orders that came in after a TV spot, the orders registered after a radio program or a village promotion program. This will allow the programme to analysis the cost effectives of each marketing methods.

28. In addition, it is strongly recommended that the new biogas-loan facility is prominently included in the promotion messages (as all bank branches have been trained in this Nov/Dec and are ready to disburse loans), focusing on monthly repayment amount (RWF 12,000 per month for 36 months, or a lower month over a period of 60 month, as proposed in this report), after discussing the details with BPR) rather than interest rate (13% pa).

29. **Website as promotion tool**: It is recommended that the program establishes its own website, where next to program information and e.g. application forms the day to day program performance is reported. It is suggested to regularly (daily, but at least weekly) update the following project data: Number of applications received, time between application and Bank approval, time between approval and project clearance, time between approval and disbursement of the first tranche, time between first and second disbursement, number of masons trained, number of loans and biogas units commissioned and a quality index on the services delivered. (as example see: http://www.energy.gov.lk and http://www.energyservices.lk)

30. The website would also have important project information such as date and place of next training, application form for training attendance etc.

31. In preparation to publishing management information on the Rwanda Farm Gas website as described above, it is recommended that project management send a one page summary (monthly news bulletin) with the above variables by email to all parties including GTZ headquarters, GTZ office in Rwanda, Netherlands Government representatives in Rwanda and the Hague, World Bank, African Development Bank, BTC and other bilateral agencies working on the energy sector in Rwanda.

VII. Construction and After Sales Services

32. **Construction Costs and affordability**: In the process of mastering a new technology, it is important that researchers and staff understand the relation between reliability, safety of operation and costs. In a technology push phase, reliability and understanding safety issues with the technology are generally more important than cost. In a market demand phase, however, lowering cost, while

maintaining reliability and safety standards are more important. In the current Bill of Quantity, reliability and convenience of construction have understandably been more important than cost. The review team identified a large number of small cost savings which can, in composite, reduce the cost of the digester significantly. From RWF 780,080 to RWF 582,050.

33. **Increasing assets while saving on household expenditures.** Experience with commercialization of new technologies has shown the impact of the perception of realized savings on consumer behavior. Technologies that are perceived to provide savings are more rapidly acquired than technologies that are acquired for other purposes. The scope and time for the review mission did not allow for adequate review of this dimension of the project. However the mission recommends that project management considers the following options:
34. **Reduction in the Bill of Quantities**. Annex C shows the proposed amendments, which would bring the estimated cost for a $6m^3$ down with 25% from RWF 780,080 to RWF 582,050
35. **Adding a 4 m^3 unit** to the list of options will reduce investment further to RWF 466,550, allowing families with lesser needs and poorer to utilize the technology. It is suggested that the subsidy component for the smaller units is maintained at the same level of RWF 300,000. As it is assumed that smaller units will be bought by poorer people, this would have the effect that more subsidy would be directed to poorer families.
36. As it is assumed that smaller units will be bought by poorer people, this would have the effect that more subsidy would be directed to poorer families.
37. **Adding a repayment option of five years (60 month).** The mission was informed that current financial regulations do not allow the Bank to provide loans with a term of more than 36 months. For that reason it is proposed that either the project or a suitable third party institution, such as FMO, IFC, TrioDos, KfW, can buy the loan at the three year point as is described in Annex D
38. **Emphasize the utilization of digester slurry** in horticultural activities. International experience has shown that digester slurry when properly applied has significant costs savings (and yield increases) over the utilization of natural and artificial fertilizer in horticultural activities of the farmer. Thus hours saved by not having to gather fire wood, is often translated in time spent in the garden, resulting in higher yields.
39. **R&D for cheaper digester design**, applying different materials, and different designs.

VIII. Quality Control.

40. The After Sales Services program has not yet been tested. Reviewing the plan for quality control, the current program design is excellent for a technology supply program, but given the labor intensity of the proposed method of regular visits to the clients, will become rather expensive. The mission recommends, that the

project reviews different methods of quality control and after sales services such an independent 24/7 helpline and participant monitoring described in Annex E.

41. **C**omplaint Line: Analogue to the information line, the team might want to consider to open a complaint and help line where clients can call. For example when they encounter difficulties with gas built-up, not working cookers etc., but also in case the contractor does not respond to their calls.

IX. Operation and Maintenance

42. The program material that the team reviewed was -as with the other program components of excellent quality. The team has the following suggestions:

43. Posters: In many programs, operation manuals are put aside, get lost and when the information is required at a crucial moment, the manual can't be found. Other programs successfully added crucial parts of the manual in the form of posters which clients can hang on the wall to their programs. It is suggested that NBDP considers the use of posters as operational manuals.

44. One important element of the program, which can significantly benefit the clients is the use of slurry in horticultural applications. The cash income resulting from this, has significant contributed to clients' interest in purchasing a biogas unit. The program needs to start to collect evidence from the digesters that have been in operation for over one year to learn from farmers' practices and impressions. Also need to carry out a more official research to confirm the farmer's impressions.

X. Training

45. Overall training material was of excellent quality.

46. **Masons and Companies:** The program has now trained approximately 130 mason working in 36 companies. While this is less than planned, it also shows that the project avoided to train masons in access of the applications received and intended to increase numbers once the market starts to develop. On the other hand, the projected rapid acceleration of the program will require a significant increase in the number of trained masons.

47. **Recommendation**: the mission encourages the program to increase the training of individual masons. Experience in other countries has shown that training individual masons will increase competition for projects and will contribute to a lowering of the construction costs due to competition.

48. Reviewing the planned increase in number of units commissioned, the team noticed that the number of trained masons will not be enough to satisfy that demand. In line with the increase numbers, the NBDP might review the training of masons and speed this up significantly.

XI. Credit Programme

49. After significant delays, an agreement between the Ministry of Infrastructure and the Banque Populaire de Rwanda S.A (BPR) for the provision and management of subsidy and credit support within the National Domestic Biogas Programme was signed. Although the credit facility started only 2 months ago (and initially was only available from one branch office), the Bank expressed disappointment over the number of applications received (30) so far, in light of the expectation that was built up before the agreement was signed. In the review of the arrangements between NDBP and Banque Populaire (BPR), the mission likes to clarify that BPR expects that the NDBP will take potential borrowers under their program to the Bank.

50. **Recommendation: make generation of loan application a program priority**: In light of the significant delay of number of units commissioned, and the lower than expected applications after the credit program was in place, the mission recommends that the Project gives the highest priority to the generation of firm applications for biogas construction and/or biogas loans. Based on the numbers produced, the programme will not succeed, and therefore will not do justice to the otherwise successful activities, if a business as usual approach is maintained. The mission can not urge programme management strong enough to act on the proposed recommendation. It is recommended that in the first two weeks of December all field staff and HQ staff are mobilized to assist in taking applications to the Bank. It is further recommended that a target for the next calendar year is agreed upon, say 1500. (Please note this is lower than currently planned). It is further recommended that all staff for small periods of time is assigned the task of bringing in and processing applications from the first of the month till the day that the quota for that month is reached. (By an even allocation and taking a rejection rate of 25% of applications by the Bank into account, the project has to assure 166 applications per month throughout the year are accepted by the Bank to ensure that 1500 units are actually commissioned in 2010). Only after the target of 166 is reached for that month, the staff should continue with their normal operations. In addition, the programme should explore ways to increase their promotional leverage by partnering with other organizations with rural outreach. Achieving these numbers should now become a central focus of management. Senior management would be expected to take daily account og the numbers, and call upon project and if necessary other development partners if in the coming three months, the projected numbers are not achieved.

51. It is further recommended that the program develops a reward system for staff bringing in applications. These rewards can be monetized, but can also be given such recognition (best performer of the month), and in kind by awarding participation in overseas training programs, etc.

XII. Subsidy Provision

52. The program changed substantially its subsidy provision (based on the 2006 proposals). Initially the subsidy was estimated at $300 of the total investment costs of $859 (equivalent of 35%). However, with the increase in construction costs, it was raised to RWF 300,000 which is about 38% of the investment costs of the installation.

53. Based on experience in other renewable energy programs, including biogas programs, changing the subsidy in a program is highly correlated with the failure of programs. If the subsidy is decreased potential clients are waiting in the expectation that the Government will increase the subsidy in due time (often around elections). If the subsidy than doesn't materialize the client is disappointed and often loses interest to buy the bio gasifer. If the subsidy goes up, clients are often waiting for the next increase. In both scenarios client and program loose in both programs.

54. The mission does recognized that the Rwanda programme does face a difficulty here. The subsidy was re-establish after an examination of the costs of building the gasifier. The mission now reviewed these costs, and after consulting with practicioners in other countries is convinced that the costs can be reduced significantly, while maintaining the same quality. However that would make the established subsidy one of the highest in the world.

55. The mission recommends that in the coming three months the team tests the assessment of the mission regarding the cost of construction. Once the team has based on the inputs given by the mission , established that the costs are indeed significantly lower, it is recommended that the team and the Government, if deemed necessary with the assistance of an outside advisor, carefully examines the subsidy and devices a strategy that will indeed reduce the subsidy, but will minimize the negative effects that have been observed in other programs as a result of the change in subsidy.

XIII. Research and Development Activities

56. The past years saw well designed research programmes such as the test of the Chinese fiberglass biodigesters.

57. The mission recommends that R&D in the coming months is focused on ways and means to reduce the costs of the current GGC 2047 model biodigester. For example given the high costs of cement, the project might built some digesters where the walls and floor are made from a mixture of cement and lime, while only the dome itself is made from cement. Details regarding proposed changes that can be made in the Bill of Quantity are shown in Annex C.

58. **Energy Packages**:

    a. Biogas together with Solar pV. The various surveys as well as reports from the project field staff indicates farmers are willing to invest in the provision of good light. In many countries, good light has been an important driver for the implementation of energy programs, as good light facilitates the availability of longer study hours for the children. Several

donors are struggling to find channels to establish commercially sustainable Solar pV programs[2]. In addition, provision of light through small Solar pV systems will simplify necessary fittings in the biogas installation and thus reduce costs significantly while improving reliability. The mission suggests that the project investigates the possibility to offer household energy packages consisting of biogas application for cooking and Solar PV household systems for lighting and charging of mobile phones.

b. Biogas and improved firewood stove, fireless cookers and promotion of cooking techniques: The biogas production in the biogas digesters seems not to be enough for cooking of beans. Households still use firewood for this cooking task. Improved Cook Stoves (ICS) could reduce the amount of fuel for this. Additional fuel could be saved if "Fireless Cookers " (Retained Heat Boxes) and cooking techniques are introduced. Applying these steps could reduce the time for beans to be on a stove to approx. 30%.

c. Combining biogas with the dissemination of simple pressure cookers may reduce energy requirement to the extent that also for smaller plants the generated biogas will be sufficient for most of the household's needs. Another advantage can be achieved with introduction ICS and techniques as these are at low costs and will be affordable also for household that can not pay far a biogas digesters. Thus, with this cheaper measure a bigger parts of the population could be reached easily leading to higher reduction of fuel wood consumption in Rwanda.

XIV. Institutional Arrangements, Procedures and Project Staffing

59. MININFRA, GTZ and SNV signed a tripartite memorandum of understanding. All agreed on the project, and to work together. However the agreement does not clarify if each party has its own responsibility or that the three parties, together take the responsibility for meeting the projects targets. Such a situation is causing frictions and tensions, which when openly discussed can provide for more efficient and reduced tension in project implementation. Often Governments want to assure that they have the lead, and are not dominated by expatriates. Expatriates might feel that the Government is not carrying out its responsibilities effectively. The review mission was surprised to find that while the parties work together, the concern regarding the low numbers of installations commissioned had not been more explicitly discussed and dealt with. The most commonly heard excuse was the lack of credit to the households but since September 2009, this is no longer the case. Also the Minister of State has on a number of occasions intervened but this has not really changed the situation in the field.

60. As the role of GTZ and SNV may change starting from January 2009, a review of the tripartite agreement may be necessary. It is recommended that the three parties include issues on management, and address directly or indirectly such

[2] Such as IFC's Lighting Africa program

questions as who will be responsible if the project does not achieve its targeted outputs, and on a positive note, who will take credit if the project succeeds. Assuming that this is a joint achievement, the review mission suggests that the organizations involved also take joint responsibility. With an improved MIS system and weekly reporting on a few "key-scores" reached, that delays or achievements can be openly discussed and joint action taken to improve the agreed scores.

61. The restructuring of the Energy sector through establishing an Energy and Water Board, with "Rwanda Farm Gas" wits own CEO and management structure reporting to the Board will also greatly enhance the effective management and cooperation in the program

62. Clarity on the role of GTZ, possibly resulting in changes in the role of SNV in this project, should be discussed and resolved as early as possible. The project has the momentum to deliver and roll out, maybe not all the 15,000 units planned originally but at least half or more of that number. It is especially at such times in the life of a project that the whole team can rely on tested and experienced smooth working relationships, able to quickly resolve problems, to keep the momentum or even accelerate the roll-out. The proposed changes will have monetary consequences, and might require small adjustments in the current allocation of funds. The mission noticed that the three parties have started these discussions in a mature and professional manner, and urge them to finalize the proposed changes as soon as possible.

XV. Coordination at the Implementing Level

63. Fortnightly management meetings, with participation of all the staff of the three organizations involved have been reasonable effective. However, as in a typical technology development, technology mastering phase, activities and expenditures where discussed in the absence of budgets and achievement plans. It is strongly recommended that management, embracing the new phase of market demand, embraces a more corporate management approach, focusing on expenditures against budget, and activities against plans.

64. An important new stakeholder, the Banque Popular has now entered the program. It is extremely important that program management keeps in close contact with Bank Management. While the Bank has a well developed MIS, the review mission recommends, that the project takes up the challenge to match the performance of its management system with that of the Bank. The best way to test this is to compare on a weekly or fortnightly basis the number of loan applications received by the Bank and provided through the activities of the project (including applications delivered through the linkages with NGOs).

65. Partners are satisfied by the quality and quantity of the Advisory Services provided by SNV-Rwanda. However, both GTZ and the Ministry encourage the SNV-biogas advisors to consider residing (more) in the programmes' offices. As this will likely enhance the "feel" the SNV advisors will have with all details of the programme, the mission takes this "encouragement" over as a recommendation to SNV.

XVI. Next Steps:

66. Demand for funds in development is high, and demand for funds for renewable energy is even higher. This competition has led to establishment of performance benchmarks, and Governments and Enterprises around the world have adapted benchmarks to make decisions on their continued support for a particular program. The current cost per digester (taking total project cost into account is and divided by the number of digesters to be installed) is very high , due to the low number of installed units. . With the expected increase in numbers, this price should come down to €415. However this is still a very high figure for EnDev supported programs,
67. For the program to keep attracting Government and donor support it is important to now rapidly increase the number of commissioned units.
68. For that reason it is important that the project maintains in close communication with the stakeholders, and report on a weekly/monthly basis on the key number for this project phase: units commissioned. If these numbers keep lagging behind expectations, the mission has learnt that the donor parties would want to call for a new evaluation in July 2009 (after the first bi-annual report is published) with the aim to re-direct at least part of the remaining funds to the micro-hydro or other energy components of the collaboration in the energy sector.
69. The magic (minimum) number that would trigger reduction of financial commitment of the donor is subject to agreement by the Government and the donors. As a starting point for the discussion a number of 600 by the end of 2010 is suggested. However, similarly if the number is much higher, the parties need to meet urgently to discuss ways and means to sustain the rapid increase in the numbers, as the current available financing will only provide for approximately 6,000 units till the end of 2011.

Annex A: Terms of Reference

National Domestic Biogas Programme (NDBP)

1. Context

The pilot phase of the National Domestic Biogas Program in Rwanda started in mid July 2007 with the training of technicians and mason and the construction of 101 digesters funded through the Ministry of Infrastructure and with support of the SNV. Finances from GTZ/EnDev became available in January 2008 and the first staff members started their assignment for the project that month. Therefore the project has been in operation for about 21 months.

A Mid-term review (MTR) will be conducted for the National Domestic Biogas Programme (NDBP) in Rwanda. The MTR is a process of reflection in which all actors involved in the development measure take part and which is accompanied by at least one external appraiser, acting as a team leader.

The objective of the MTR is to assess the performance of the NDBP since the start of the program, identify and review the most important bottlenecks encountered and provide recommendations for the planning and steering of domestic biogas interventions in Rwanda by providing suggestions for the future.

2. Issues to be analyzed

The MTR and the appraisers working on the MTR will analyse the following issues:

2.1 Framework conditions

2.1.1 Policy environment

- Inter-ministerial arrangements
- Link to GoR policies and strategies
- Contribution to national priorities

2.1.2 Funding arrangements (assess procedures, budget utilization, use of funds)

2.1.3 Institutional arrangements (assess involvement of major parties to contribute to the expected outputs, partnerships for service delivery, NBSC)

2.1.4 Organizational setup MININFRA/NDBP (assess the appropriateness of programme implementation and management arrangement strategies, including organisational structure, staffing (quantity, quality, and adequacy), monitoring arrangements)

2.2 Assessment of the NDBP operation, monitoring and progress (quality and timeliness of input by relevant actor)

2.2.1 Promotion (communication with the final client population)
2.2.2 Construction and after sales services
2.2.3 Operation and maintenance
2.2.4 Training at all levels; technicians/ entrepreneurs, bank staff and users
2.2.5 Quality control systems and their application
2.2.6 Credit provision to farmers
2.2.7 Subsidy provision
2.2.8 Research and Development activities (toilet connections, slurry use)
2.2.9 Institutional arrangements, procedures and project staffing
2.2.10 Coordination at implementation level (including planning and reporting)

The review team will assess the overall project progress against the project targets, identify the bottlenecks and indicate opportunities for improvements where possible.

2.3 Other important issues related to the development measure

2.3.1 Capacity development provided by GTZ and SNV (assess cooperation and contribution to outputs)
2.3.2 Cross-cutting themes including gender and environment issues
2.3.3 Sustainability and potential for up-scaling once approach is demonstrated successful
2.3.4 cost efficiency of the NDBP

2.4. Lessons learned and recommendations[3]

With regard to each issue, the mission will draw specific conclusions and make recommendations for
further necessary action by MININFRA, GTZ and SNV/Rwanda, in order to ensure progress and sustainability of programme achievements. This includes:

- identification of lessons learned in the programme to date (strengths, weaknesses, opportunities and threats), suggesting reasons for particular successes and failures and proposed changes;
- identification of programme (re) design needs in order to increase its effectiveness in reaching its targets. This includes proposals for improvement to programme activities, budget allocations and inputs (including consideration of adjusting the targets), organisational/institutional set-up (update the existing tripartite arrangement) and implementation plan.

3. Team composition

[3] The MTR team has the full mandate to make any reasonable recommendation to change the design and implementation of the programme that may aid the effectiveness and sustainability of the programme.

A team comprised of three experts one GTZ head office, one from SNV head office and one expert representing the Government. The team will work with experts of the MININFRA/NDBP team in Rwanda to carry out the review. The work will be coordinated by an independent consultant who will also responsible for the time schedule, the report preparation and the presentation of the results. The coordinator will be agreed upon by the three parties and be contracted through GTZ. Section 5 provides details on the responsibilities of the team leader**.**

The team leader/coordinator and the other members from the GTZ and SNV head offices should have extensive exposure and experience with program formulation and reviews, particularly in the context of renewable energy management programmes, stakeholder consultations and preferably have an understanding of the socio-economic conditions of Rwanda.

4. Services provided by the review team

Within the scope of the MTR, the review team renders the following services:

- studies and assesses all relevant documents (reference list is included at the end of the ToR);
- travels to Rwanda for a period of about 1 week (for the coordinator and the GTZ & SNV experts from the head offices);
- consultation with SNV/Rwanda country director and biogas focal point, GTZ representative, MININFRA representative and NDBP coordinator;
- meets SNV Rwanda advisors, GTZ advisor, MININFRA and NDBP staff;
- meets other relevant stakeholders associated with the programme (BPR, Heifer, EADD, biogas construction companies, biogas families);
- field visits;
- uses appropriate evaluation methods to verify and develop the interim findings together with other actors involved in the MTR;
- prepares a draft MTR report for feedback, to be incorporated in the final document. An outline of the report with the areas to be covered will be agreed at the start of the review mission.
- presents the preliminary findings and recommendations of the review team to the stakeholders (SNV, GTZ, MININFRA and others) in a wrap up meeting for comments and feedback;

The review team present the findings and recommendations in a workshop to the concerned stakeholders and assist in identifying the opportunities for the future collaboration between the three parties (MININFRA/GTZ/SNV). These will be included in the final r

5: Responsibilities of the Team leader

The responsibilities of the team are governed by the tasks outlined above. The team leader will be responsible for:

- developing a schedule to conduct MTR and drawing up a list of stakeholders to be consulted;
- developing the outline for the MTR report;
- allocating specific tasks and responsibilities

- preparing the draft and final report based on the inputs provided by the other team members. presenting and discussing the recommendations as agreed by the team.
- providing 3 printed copies of the final report (not exceeding 30 pages, excluding annexes, written in English) along with a softcopy containing all material in Word and Excel.

The team leader is responsible for the final report and ensures that all parts of this ToR are covered. Should there be any disagreement between the team members, the findings and recommendations by the Team leader should ensure that these views are reflected in the final document.

6. Time inputs and draft schedule

For the activities mentioned above, the following time requirements have been estimated:

- Preparation and literature review: 2 days
- Implementation phase: max 7 days (including travel)
- Report writing (team leader/coordinator) : 5 days

Proposed draft Time schedule

Activity/ Month	**Sep-38**	**Sep-39**	**Sep-40**	**Oct-41**	**Oct-42**	**Oct-43**	**Oct-44**	**Nov-45**	**Nov-46**	**Nov-47**	**Nov-48**	**Dec-49**	**Dec-50**
ToR approval by all parties	x												
Identification of SNV and GTZ team members			x										
Recruitment of external appraiser by GTZ					x								
Recruitment of Rwandan appraiser by GTZ					x								
Field work											x		
Draft of MTR report												x	
Final version of MTR report													x

Please note that SNV is organising a biogas workshop from 9 – 13 Nov in Nepal and this will be attended by some of the NDBP staff and most SNV experts and therefore conflicts with the MTR in Rwanda.

7. Costs and other support

GTZ will support the costs of the external consultant/teamleader. SNV/Rwanda and NDBP will provide logistics support and office space during the MTR. The NDBP will ensure availability of its staff to assist the MTR team as necessary and will ensure

that the required advisors and/or management including ministries and other relevant organisations are available to provide necessary input.

8. Supporting documents and materials

NDBP will prepare a status report as per end of Sept 09 providing details of the project that will be of interest to the MTR.

An assessment of the performance of the fibre glass and the masonry digesters will be carried out in Sept/Oct through a national consultant (under contract) and the (draft) report will be made available to the mission

An official Audit of the project accounts is under preparation and it is expected that this will be available to the MTR mission.

In addition the following background materials are readily available to the MTR:

- Feasibility study (Sept.2005);
- MININFRA-SNV MoU signed (*Nov. 2005)*;
- Endorsed implementation plan for a National Programme on Domestic Biogas in Rwanda (*September 2006*);
- tripartite MoU (MININFRA/SNV/GTZ) signed (*Feb. 2007);*
- Biogas baseline survey (Sept 07);
- annual plans and reports,
- FMO (credit fund) – BPR (credit/subsidy provision) agreement;
- BPR – NDBP agreement;
- NDBP-SNV assignment agreements;
- client satisfaction reports.

Annex B: People Met

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Annex C: Preliminary Assessment of Cost Reductions and Cash Flow.

a. The current Bill of Quantities quotes for a range of bulk and hardware higher quantities then the original BoQs for GGC 2047 design installations in other African countries. While it is acknowledged that country-specific conditions will translate in adjustments in the BoQ, part of the higher quantities for Rwanda seem to indicate a measure of "over-design". In view of the high investment costs, this "over-design" may not be desirable. Reductions have been proposed while noting that they need field-verification.

b. A significant share of the target population will keep between two and three heads of cattle, translating an amount of dung available between, say, 20 to 40 kg per day. For these customers, a $4m^3$ installations will provide benefits at the same level as $6m^3$ installations but at considerably lower investment.

c. For the assessment of the investment costs, four situations have been taken into consideration:
   - I: the current BoQ for a $6m^3$ installation;
   - II: the BoQ for a $6m^3$ installation using the original GGC 2047 quantities;
   - III: the BoQ for a $6m^3$ installation using original GGC 2047 quantities whereby lime is substituting part of the cement, fitting lay-out is improved and labour costs have been reduced, and;
   - IV: the BoQ for a $4m^3$ installation based on the GGC 2047 model, using lime, improved fittings and adjusted labour costs.

d. The overview shows that cost reductions for a typical $6m^3$ installation of up to 30% should be possible. Including a $4m^3$ installations would, for households with up to 3 mature, zero-grazed cows, reduce investment with 40%.

Summary plant costing implications

	I	II	III	IV
Building materials	175,000	112,500	112,500	93,750
Cement	198,000	154,000	132,500	106,000
Hardware	178,800	150,300	144,600	135,100
Labour & sundry	229,000	192,500	155,000	134,000
Totals	**780,800**	**609,300**	**544,600**	**468,850**
Cost reduction		*22%*	*30%*	*40%*

e. As a consequence from the cost reductions, loan amounts can be reduced, reducing monthly repayments with up to 58% for the $6m^3$ installation and 67% for the $4m^3$ installation.

f. Extension of the loan repayment period from 34 months to 58 will further improve the cash-flow performance of the installation significantly, reducing monthly repayments with up to 70% for the $6m^3$ installations and 76% for the $4m^3$ installation.

g. Within the current design, further cost reductions could be obtained by:
   - For some areas, consider construction in cement blocks or cement-stabilized bricks.
   - Spherical dual radius compensation chamber to reducing slab area.

Summary plant loan implications

	I	II	II	IV
Investment rounded	800,000	610,000	550,000	475,000
Subsidy	300,000	300,000	300,000	300,000
Hh investment	**500,000**	**310,000**	**250,000**	**175,000**
Hh down-payment	200,000	160,000	125,000	75,000
Investment subsidy	300,000	300,000	300,000	300,000
BPR loan	300,000	150,000	125,000	100,000
Repayment	**PMT 34**	**PMT 58**		
Installments	34	58		*months*
Interest	1.87%	1.87%		*/month*
	I	**II**	**II**	**IV**
PMT 34	**12,000**	**6,000**	**5,000**	**4,000**
PMT 58	**8,515**	**4,257**	**3,548**	**2,838**
Cost reduction	*PMT 34*	*50%*	*58%*	*67%*
	PMT 58	*65%*	*70%*	*76%*

- Looking critically into costs of imported appliances; comparing pricing with similar products used in Cambodia shows
- Application of cement-stabilized bricks may deserve particular attention as this would open the opportunity of construction of "modified Camartec" or "Dheenbandu" types of installations, further reducing the requirement of (very expensive) cement.

h. Testing planned for early next year with Camartec – Tanzania may reveal new, pre-fabricated designs suitable for African conditions.

Costs of imported (Chinese) appliances *(US$)*

	Cambodia	Rwanda
Lamp	2.80	26.00
Stove	12.00	35.00
Pressure gauge	2.00	12.00
Sulpher filter	2.40	40.00

A detailed overview of the BoQ comparison is provided here under.

			I NDBP 6m³ March 2009			II NDBP - 6m³ original quantities quant			III NDBP - 6m³ orignial quantities & lime substitution & improved fitting			IV NDBP - 4m³ orignial quantities & lime substitution & improved fitting		
SN	Items	Unit	Qty NDBP	Unit Cost NDBP	Total Cost NDBP	Qty NDBP	Unit Cost NDBP	Total Cost NDBP	Qty NDBP	Unit Cost NDBP	Total Cost NDBP	Qty NDBP	Unit Cost NDBP	Total Cost NDBP
1	**Building materials**			FRW	FRW		FRW	FRW		FRW	FRW		FRW	FRW
1.1	Stones	m³	6.0	12,500	75,000	4.00	12,500	50,000	4.00	12,500	50,000	3.5	12,500	43,750
1.2	Gravel 20mm diameter maximum	m³	2.0	20,000	40,000	1.25	20,000	25,000	1.25	20,000	25,000	1.0	20,000	20,000
1.3	Clean coarse sand	m³	2.0	15,000	30,000	1.50	15,000	22,500	1.50	15,000	22,500	1.25	15,000	18,750
1.4	Clean fine sand	m³	2.0	15,000	30,000	1.00	15,000	15,000	1.00	15,000	15,000	0.75	15,000	11,250
	Sub total 1				***175,000***			***112,500***			***112,500***			***93,750***
2	**Cement**													
2.1	Portland Cement	bags	18.0	11,000	198,000	14.0	11,000	154,000	10.0	11,000	110,000	8.0	11,000	88,000
2.2	Lime	bags							5.0	4,500	22,500	4.0	4,500	18,000
	Sub total 2				***198,000***			***154,000***			***132,500***			***106,000***
3	**Hardware materials**													
2.1	Acrylic emulsion paint	kg	2.0	2,000	4,000	2.0	2,000	4,000	2.0	2,000	4,000	1.0	2,000	2,000
2.2	Gas Turret pipe with 1 1/4-1/2 reducer	pcs	1.0	7,000	7,000									
2.2a	Gas Turret pipe with 1 1/4-1/2 reduction elbow or T					1.0	7,000	7,000	1.0	7,000	7,000	1.0	7,000	7,000
2.3	Steel rods 8mm	pcs	4.0	7,500	30,000	4.0	7,500	30,000	4.0	7,500	30,000	3.0	7,500	22,500
2.4	Binding wire	kg	0.5	2,000	1,000	0.5	2,000	1,000	0.5	2,000	1,000	0.5	2,000	1,000
2.5	Galvanized wire	kg	0.5	2,000	1,000	0.5	2,000	1,000	0.5	2,000	1,000	0.5	2,000	1,000
2.6	PVC pipe 110 mm, PN 4	pcs	1.0	12,000	12,000	1.0	12,000	12,000	1.0	12,000	12,000	1.0	12,000	12,000
2.7	PVC pipes 20 mm, PN 16	pcs	7.0	2,500	17,500	7.0	2,500	17,500	7.0	2,500	17,500	7.0	2,500	17,500
2.8	PVC elbow 20mm	pcs	7.0	500	3,500	7.0	500	3,500	7.0	500	3,500	7.0	500	3,500
2.9	PVC tee 20 mm	pcs	4.0	500	2,000	4.0	500	2,000	4.0	500	2,000	4.0	500	2,000
2.10	PVC socket 20 mm	pcs	4.0	500	2,000	4.0	500	2,000	4.0	500	2,000	4.0	500	2,000
2.11	PVC Adapter nipple 1/2	pcs	4.0	500	2,000	4.0	500	2,000	4.0	500	2,000	4.0	500	2,000
2.12	PVC Adapter socket 1/2	pcs	1.0	500	500	1.0	500	500	1.0	500	500	1.0	500	500
2.13	Tangit Glue	kg	0.25	8,000	2,000	0.25	8,000	2,000	0.25	8,000	2,000	0.25	8,000	2,000
2.14	Galvanized Nipple 1/2"	pcs	5.0	500	2,500	2	500	1,000	1	500	500	1.0	500	500
2.15	Galvanized Union	pcs	1.0	700	700	0	700	-	0	700	-	0.0	700	-
2.16	Galvanised Plug 1/2"	pcs	1.0	500	500	0	500	-	0	500	-	0.0	500	-
2.17	Gas hose pipe	m	2.50	2,000	5,000	2.00	2,000	4,000	2.00	2,000	4,000	2.00	2,000	4,000
2.18	Hosepipe Nipple	pcs	4.0	2,000	8,000	2	2,000	4,000	2	2,000	4,000	2.0	2,000	4,000
2.19	Hosepipe clamp	pcs	6.0	600	3,600	4	600	2,400	4	600	2,400	4.0	600	2,400
2.20	Gas valve 1/2"	pcs	4	3,500	14,000	4	3,500	14,000	0	3,500	-	0	3,500	-
2.20a	Gas valve 1/2" male-female with union	pcs							1	5,000	5,000	1	5,000	5,000
2.20b	Ball valve PVC	pcs							2	1,000	2,000	2	1,000	2,000
2.20c	Water trap with screw and washer	pcs							1	3,000	3,000	1	3,000	3,000
2.21	Biogas lamp	pcs	1	15,000	15,000	1	15,000	15,000	1	15,000	15,000	1	15,000	15,000
2.22	Biogas stove	pcs	1	20,000	20,000	1	20,000	20,000	1	20,000	20,000	1	20,000	20,000
2.23	Pressure gauge	pcs	1	7,000	7,000	0	7,000	-	0	7,000	-	0	7,000	-
2.24	Teflon tapes	pcs	3	300	900	2	300	600	2	300	600	2	300	600
2.25	Galavanised elbow	pcs	2	500	1,000	1	500	500	1	500	500	1	500	500
2.26	Wood screws	pcs	10	30	300	10	30	300	10	30	300	10	30	300
2.27	Screw holders 8 mm	pcs	10	30	300	10	30	300	10	30	300	10	30	300
2.28	Wall clamps 1/2"	pcs	5	500	2,500	5	500	2,500	5	500	2,500	5	500	2,500
2.29	Desulphication device	pcs	1	13,000	13,000	0	13,000	-	0	13,000	-	0	13,000	-
	Sub total 3				***178,800***			***149,100***			***144,600***			***135,100***
4	**Labour and unexpected cost**													
4.1	Skilled labour	person-day	15	3,500	52,500	10	3,500	35,000	10	3,500	35,000	9	3,500	31,500
4.2	Unskilled labour	person-day	36	1,500	54,000	25	1,500	37,500	25	1,500	37,500	20	1,500	30,000
4.3	Work Supervision	lumpsum	1	15,000	15,000	1	15,000	15,000	1	7,500	7,500	1	7,500	7,500
4.4	After-sales services	lumpsum	3	5,000	15,000	3	5,000	15,000	3	5,000	15,000	3	5,000	15,000
4.5	Transport supervision	days	3	2,500	7,500	2	2,500	5,000	2	2,500	5,000	2	2,500	5,000
4.6	Transport of special materials	lumpsum	1	15,000	15,000	1	15,000	15,000	1	5,000	5,000	1	5,000	5,000
4.7	Gross margin for company including 1 year guarranty	lumpsum			70,000			70,000			50,000			40,000
	Sub total 4				***229,000***			***192,500***			***155,000***			***134,000***
	Total cost of a 6 m³ digester				**780,800**			**608,100**			**544,600**			**468,850**
	RWF in Euro	**810**												
	Total cost of a 6 m³ digester in Euro				**964**			**751**			**672**			**579**
	Potential cost reduction							22%			30%			40%

Annex D: Financial Intermediation to Extend Loan term

It is suggested that the most efficient way of providing the requisite support to Banque Populaire 's credit exposure and alleviating any liquidity constraints, would be by way of a risk equalization payment by the new lender to Banque Popular. This would, together with regular loan service payments by the borrower, mimic the behavior of a three year loan in terms of both credit risk and liquidity for Banque Popular.

During the first three years, Banque Populaire would take the credit risk and absorb any loan losses. If the borrower did not default during this period, Banque Popular would effectively be fully paid out after three years by the combination of borrower's loan payments and the risk equalization payment, even though the borrower would be due to make loan payments for a further two years.

During these last two years, the NEW LENDER would bear the full credit risk of the remaining loan and BANQUE POPULAIRE would, as lender of record, be administering the loan as agent for the NEW LENDER. A legal agreement would ensure that Banque Populaire safeguarded the NEW LENDER's rights, including foreclosing on any available security, as though the loan were its own.

Annex E : Participant Monitoring

Instead of the project's technical officers visiting each installation, the project would develop training material to be given to the farmers/ client. This can be a simple cartoon based manual, with drawings and pictures of digester elements which should be inspected, for household without access to electricity, or an interactive video training which can be played on a DVD. The manual will instruct borrowers to fill out a short survey monthly or quarterly, reporting their technical, economic, and social experiences resulting from access to modern energy services. This would include estimates for the number of hours the technology is used, and speed and availability of repair services, but also observations on social issues, such as an increase in learning hours for school children. The project might want to consider rewarding participating borrowers by paying part of a monthly installment. The feedback from the surveys will help to fine-tune the project interventions for improved effectiveness, will spot technicians and firms which do not provide the after sales services, and or the availability of spare parts and will monitor the environmental, economic, and social impact of the project on the beneficiaries.