

Terms of Reference (ToR)

Drilling of shallow groundwater wells at 20 locations in Amhara and Oromia

1. Background

Commissioned by the German Ministry of Economic Cooperation and Development (BMZ), the GIZ project Green People's Energy for Africa aims to improve the conditions for decentralized energy supply in nine countries of Sub-Saharan Africa, amongst them Ethiopia. Since the inception of its country project in Ethiopia in December 2019, Green People's Energy Ethiopia (hereinafter: GBE) collaborates closely with the Ethiopian Ministry of Water, Irrigation and Energy (MoWIE) and a variety of public and private sector stakeholders.

The main output areas of the Ethiopian country project of GBE are as follows:

1. Supporting local initiatives to uptake and use of renewable energy (RE) technologies thereby improving their impacts on the livelihoods of the off-grid community
2. Increasing vocational training capacities for solar PV
3. Promote use of solar PV energy for enhancing social services and production
4. Support decentralized, local energy supply and service provision initiatives

As part of output area 3 - promotion of solar PV energy for enhancing social services and productive use, GBE intends to introduce 20 solar powered irrigation systems (SPIS) in Amhara and Oromia regions. Under this project, small holder farmers typically with farm field sizes of 2000-3000m² (ca. 0.25ha) shall be supported with SPIS technology on cost sharing basis. The project is implemented in collaboration with another GIZ project, the Green Innovation Center (GIC) which works on agricultural value chain development. GBE therefore targets beneficiaries of GIC – local farmers in different regions including Amhara and Oromia. This is to ensure synergy and efficiency but also to follow up with the intervention and maximize its impact thus warranting sustainability.

This ToR concerns the development of shallow water well for the application of SPIS in Alefa Basi and Amude kebeles of Amahara and Oromia regions, respectively. GBE hereby seeks to hire a suitable contractor to drill shallow boreholes.

Objectives

The objective of this assignment is to engage a suitable contractor to drill/bore 20 (twenty) boreholes to depths of 20m that will be used as sources of irrigation water in Alefa Basi kebele in Bure Zuria woreda of Amhara region/West Gojam zone and in Amude kebele in Doddota woreda of Oromia region/Arsi zone. The 20 boreholes shall be divided equally between the two kebeles (i.e., 10 in Alefa Basi and the other 10 in Amude). After the drilling, the boreholes will be used for the installation of solar powered irrigation systems that will be pumping water from the boreholes and used to irrigate small scale farms owned by different farmers in the two kebeles.

2. Description of works

a. Location

The following table lists the location of the sites where the drilling is to be done. Once contract is awarded, the GPS coordinates for all sites will be provided to the contractors.

Table 1 Locations of well construction and current water well depth

#	Region/ zone/ woreda	Kebele	Site code	Altitude, (m)
1	Amhara/ West Gojam/ Bure Zuria	Alefa Basi	AM-AL-1	1998.5
2			AM-AL-2	1994.75
3			AM-AL-3	1998
4			AM-AL-4	1998.42
5			AM-AL-5	1994.4
6			AM-AL-6	1995
7			AM-AL-7	1997.03
8			AM-AL-8	2000
9			AM-AL-9	2000.46
10			AM-AL-10	2002.86
11	Oromia/ Arsi/ Doddota	Amude	OR-AM-1	1597
12			OR-AM-2	1597
13			OR-AM-3	1596
14			OR-AM-4	1598
15			OR-AM-5	1600
16			OR-AM-6	1600
17			OR-AM-7	1600
18			OR-AM-8	1603
19			OR-AM-9	1598
20			OR-AM-10	1597

b. General system design

- The boreholes shall allow for the insertion of submersible pumps that will be solar powered and installed in later phase of the project (not part of the present ToR).
- The diameter of the boreholes shall be 10inch.
- A gravel pack will be installed in the annular space of the shallow well and the outer portion of the casings to a minimum height of 2m above the static water level to compensate for settlement during development.
- On completion of testing each borehole the well head shall be constructed as per specification and be secured with 6mm thick steel plate welded or screwed on the top of the surface or production casing.

c. General aspects of the works to be done (details in the annexes)

- The contractor shall demonstrate high quality of works and service
- The technical design and implementation of the well works must be according to this ToR and respective Annexes supplied with the ToR.
- The contractor must clearly indicate in the bid the specifications (material, diameter, height, thickness, etc) of any material being used for the borehole drilling and installation according to this ToR.

3. Responsibilities of the contractor

- The Contractor shall perform the works in accordance with the contract documents.
- The Contractor shall be fully responsible for all materials delivered and works executed by the Contractor as well as for safety precautions in connection with the works.
- The Contractor shall be responsible for all acts and omissions of the sub-contractors, of any of the Contractors' agents or employees or of any others performing any of the works under this ToR.
- The Contractor will be responsible to provide and transport to site all materials required for all the works and the installation. If materials delivered are found technically faulty or damaged before the installation, the contractor is responsible.
- The contractor guarantees against poor workmanship and poor quality of materials of the works under this ToR for **six (6) months** (defects liability period) after the completion and preliminary handing over. Such shall be clearly indicated in the technical offer of the Contractor.

4. Responsibilities of GIZ GBE

- GBE shall make available data, design, documentation and information required by the Contractor and available to it for carrying out the works under this ToR.

5. Time schedule

- The contractor is going to start the works at the end of the rainy season, anticipated on 01 November 2021.
- The overall work together with submission of report shall take place within a maximum of 60 (sixty) calendar days after the signing of contract by the contractor. Final date for completion of works cannot go beyond 30 December 2021.

6. Sample installations

The contractor shall complete one supply and installation of borehole as per this ToR at one farm site and let GIZ GBE or its appointed supervising consultant conduct inspection and quality-control. Only upon GIZ GBE's (or its consultant's) approval shall the contractor continue to the next works. If the performance of the contractor is not up to the expectations, GIZ GBE reserves the right to cancel the contract.

7. Others

GIZ GBE and its hired supervising engineer will inspect all materials before they are allowed for use, installation or application.

8. Remuneration

- Payment related issues and contractual agreement shall be concluded according to the prevailing GIZ rules regulations and guidelines.
- An advance payment can be provided ahead of the start of the works.
- A retention payment of 5% of the contract price will be withheld until the end of the defect's liability period (= defects and liability period after preliminary hand-over).

9. Management of Assignment

The Contractor shall be accountable to the assigned supervisor by the regional offices of GIZ Energy Programme Ethiopia and/or independent supervisor that may be assigned by GIZ GBE. The Contractor is further accountable to - and should keep informed the other GBE experts based in Addis Ababa including the Country Project Manager of GBE Ethiopia.

10. Bidding remarks

- All required material needs to be delivered on stock within 15 days of contract signing.
- Bidders have to submit their offers for all 20 farms (10 each in each kebele) according to the BoQ supplied with this ToR.
- Bidders have to submit a technical proposal, including their company profile, installation experience, CVs of proposed staff and other documents as stated in the respective annexes to GIZ.
- Under the tender for expression of interest, Bidders shall not submit financial offer. After evaluation result of the technical offer, qualified bidders only will be communicated for the financial proposal.

Annex I:
Technical specifications for borehole drilling

Description of Work

The work comprises the following:

- Inception and mobilization
- Drilling of 20 boreholes
- Supply and installation of screen and blind PVC pipe casings
- Packing of the annular space with clear and well-rounded river gravel
- Cleaning and development of the well
- Physiochemical and biological quality analysis
- Conducting pumping test and determination of safe well yield
- Well head construction
- Maintenance and defects liability
- Reporting

1. Inception and Mobilization

The contractor shall have an inception meeting with GIZ GBE and its supervising engineer right after signing the contract in order to clarify on the expectations about the works.

Subsequent mobilization shall consist of all necessary manpower, digging tools and construction materials to the sites and after completion of the work, demobilization shall consist of cleanup work and operations including but not limited to those necessary for the removal of personnel, equipment and incidentals from the project site.

2. Borehole drilling

a. Total Depth

The production well must be completed to 20m in depth. For site specific details refer to section 4.1 of the ToR and additional information to be provided after signing the contract.

b. Drilling method

The drilling shall be carried out with the appropriate drilling technique and diameter for the geology and required depth at each of the project locations. Since the geological formations are expected to be soft, following evidence from the earlier site assessment and the surroundings, appropriate drilling machine should be used. However, GIZ cannot guarantee this and hence it wouldn't assume any responsibility if such assumption proves wrong at any of the sites. However, if the case is to arise, GIZ and the contractor will try to agree on an alternative site or approach.

c. Drilling rate lithologic logging

The Contractor shall collect cuttings and record at every two meters. These cuttings are to be described and the contractor shall prepare the lithologic log, which shall be included in the final report. Geologic logging will be performed in the borehole immediately after completion of drilling.

d. Safety of construction crew

It is entirely the responsibility of the contractor for the safety of the construction crew on duty in any of the activities in the construction area including drilling the water wells. The contractor shall put in place appropriate measures including supply and use of safety

equipment and following appropriate procedures and all cautionary steps for the safe operation of tools and equipment and for the safety of personnel. GIZ GBE cannot assume any responsibility for any injury or death of any of the construction crew or others in and around the construction area and for the damage of any equipment, tools or materials that may be caused during the execution of the works under this ToR.

e. Plumpness of the Well

- The contractor shall provide that the loss of plumpness of the well's axis (if any), would allow a free lowering of the casing into the well.
- If not, and if the well cannot be fitted with any conventional pumping system, the well will be considered unexploitable and would therefore be unacceptable by the GIZ GBE.

3. Supply and Installation of PVC pipe casing

- **Blind and screen casings** shall be at 6" internal diameter (ID) and have a thickness of at least 6.4mm.
- **All casings** shall be strong and new and comply with standards such as DIN 4920, API or ASTM.
- **The screen casings** will be placed in zones with the highest hydraulic conductivity as determined by geological logging. The screens may be intercepted with blank casing placed in the less permeable zones of the aquifer. However, at least 80% of the total depth of the aquifer will have to be screened.
- **The screen casings** shall be manufactured of strong PVC and shall have a minimum of 10% open area. The slots shall widen inward to minimize clogging.
- If the contractor supplies **slotted screens** the slots must be factory slotted or made using standard slotting machines, vertical, 100mm in length, and equally spaced around the perimeter of the casing must be equally spaced. The slots should be clean and without cutting residues. Drilled holes or torch-cut slots are not permitted.
- The **screen slot size** shall be selected on the basis of a mechanical size analysis of either the natural water-bearing sediments or the filter pack material. The maximum allowable slot opening is 2.5mm.

4. Gravel Packing

- The gravel pack will be selected river, clean, composed of well-rounded grains and should have a uniformity coefficient between 2.5 and 5 and with a diameter from 4-6 mm.
- The gravel pack will extend above the top of the perforated casing height for minimum of two (2) meters to compensate for settlement during well development.

5. Well development and cleaning

- Well development means the work carried out after completion of the construction of a well and prior to test pumping. The objective of development is to improve well performance, to increase well capacity and to reduce an unacceptable level of the amount of sediment contained in the water yielded by the well. In a few cases further development may be required after testing.
- The development of the well shall remove the native silts and clays and drilling fluid residues deposited on the borehole face and in adjacent portions of aquifer during drilling process. Development shall also remove a predetermined finer fraction of filter pack. If organic drilling fluids are used, it must be broken down chemically according to manufacturer's recommendations before or during development.

- Borehole development must use an air lifting technique. The work must continue until the GIZ GBE is satisfied that the borehole, gravel pack and adjacent aquifer have all been adequately cleared of drilling fluid, aquifer fines and drill cuttings and a satisfactory yield has been attained. In case of caving formation where the borehole is drilled with mud rotary or percussion rigs, other techniques of development as bailing, back washing, surging, etc might be used.

6. Water quality analysis

- Water samples must be taken from the pump discharge for laboratory analysis. The sample should be taken according to a standard sample taking protocol. The containers should be clearly marked, showing name and number of well, date of sampling, hour of sampling and signature of person taking the sample.
- If water samples show that the water is not of suitable quality for irrigation use according to Ethiopian standards, the exploratory hole may be abandoned, and the contractor shall be ordered to recover the casings.

7. Pumping Tests

a. Pumping test equipment and pumping test plan

The Contractor shall provide pumping equipment capable of lifting 1liter/s of water from a depth of 20m or more. The required minimum yield for testing shall be 20m³/day. It is proposed to do all the pumping tests at one time after the completion of the digging of all wells except the first one where it shall be supervised for quality and performance thus its testing to be done separately.

b. Preliminary Test

The well will be pumped for 1 hour with full throttle of high capacity of the pump. This will help us to know the maximum yield of the well.

c. Step Drawdown Test

The well will be pumped at four successively higher constant pumping rates of one-hour pumping time for each step and draw down for each step will be recorded. Recovery will be taken after pumping is stopped until it recovers to its original water level or at least 95% in case of very slow recovery.

d. Constant Rate Test

The well will be tested with constant pumping rate as assessed on the basis of the step-draw down test. The test will have duration of 4hours. All care must be taken to maintain a constant pumping rate. The dynamic water level during the water pumping will be measured and recorded according to the logarithmic time- schedule normally used to allow better field data for the use in further assessment of aquifer parameters and potential.

e. Recovery Test

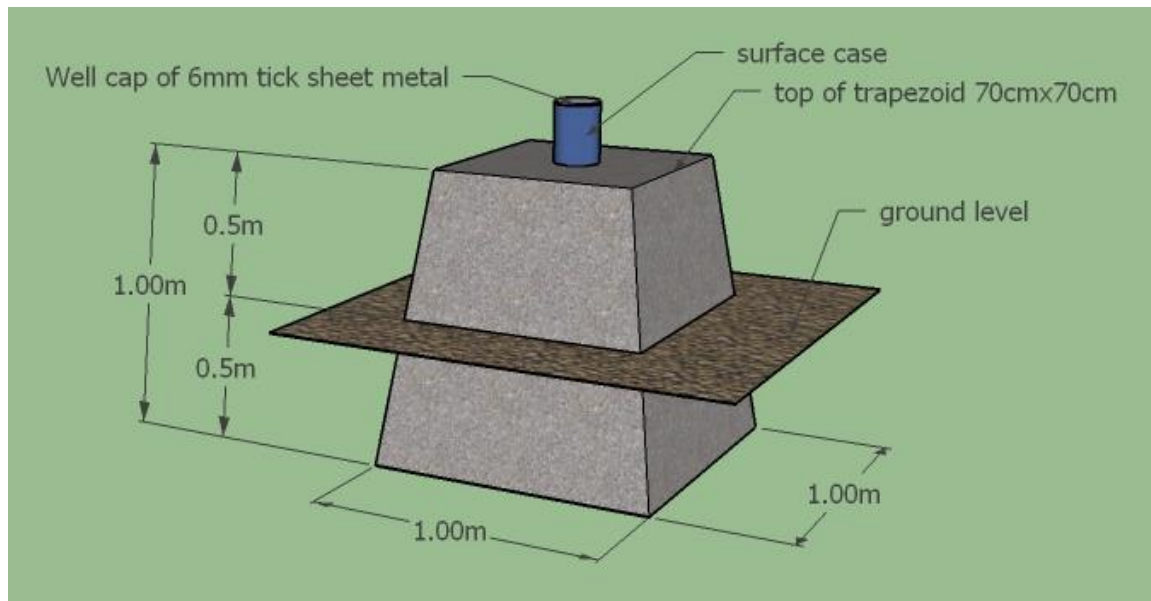
Once the 4hours of continuous pumping at a constant rate is performed, the pump will be turned off and the measurement of the recovery levels will be immediately undertaken.

8. Well Head Construction and Completion

- Constructing wellheads around the casing is necessary to complete productive wells. The surrounding of the well casing must be excavated until reasonable firm foundation is obtained for wellhead construction. The concrete wellhead will have a nominal dimension of 1m x 1m x 1m and must be embedded 0.5m below the ground and 0.5m above. It shall

have however a trapezoidal shape tapering up with the top surface having an area of 70cm X 70cm.

- The casing with the well's opening shall protrude a minimum of 0.5m above the concrete block unless and otherwise specified by the GIZ GBE.
- Well cap: After completion of the pumping test and removal of the test pump unit, and after the last water level recovery observation have been made, well caps shall be securely welded or screwed to the top of the surface or production casing with a steel plate of 6mm thickness to prevent illegal access to the well.



9. Maintenance and defects liability

- After the well testing and the take-over of the works by GIZ GBE and the Supervisor, the well will be handed over. The contractor, however, shall be liable for any defects related to the water production of the drilled wells for a period of 6 months.
- This defects liability is not affected by the construction of a solar water pump following the well drilling. Reason is that the submersible pump does not pose a risk to the wells' stability, whereas the rest of the pumping installation will be on the surface. Shortcomings that fall under the defects liability include, amongst others, significantly reduced production (as opposed to the initial testing results) following improper sealing or cracks in the cases, leading to blockages and/or strong sedimentation.
- A retainer of 5% of the contract sum for the well drilling shall be kept by GIZ until the end of the defect's liability period.

10. End of Borehole Drilling Report

The result of the water well and all the knowledge obtained from drilling, installation of casing, gravel packing and associated construction including well head construction, test pumping will be thoroughly compiled in an "End of Well Drilling Report" and submitted.

Annex II: BoQ

Separate BoQ document provided

Annex III: Typical well design

Separate well design document provided.

Annex IV: Technical assessment criteria for bids

Separate document provided