Terms of Reference (ToR)

for the

Detailed Engineering Design

Of

IAZ Greenhouse Cluster Infrastructure Development

იმერეთის აგროზონა
IMERETI AGROZONE

for

61ha Baghdati Production Site

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Objectives & Scope of the Detailed Engineering Services

The Project Background

With the initiative of the Ministry of Environmental Protection and Agriculture of Georgia (MEPA), LLC "Imereti Agro Zone" (IAZ) is implementing a Greenhouse Cluster Development (GHCD) project in Imereti region, Georgia.

The 61ha Greenhouse Cluster Development production site is located in the village of Vartsikhe, Baghdati municipality, Imereti region, Georgia and is preliminary divided into 3 different technological zones: for high, medium and low-tech greenhouse production facilities to be sold out or leased to IAZ potential tenants for development of their own greenhouse production facilities for herbs, vegetables, berries and flowers.

According to the introduced project concept, IAZ intends to develop all necessary and required infrastructure on the existing 61ha land plot as the phase 1 of the overall project development concept, which is essential for planned greenhouse operations.

The Project Technical Details

Project Name:

Detailed Engineering TOR for 61ha Baghdati Greenhouse Production Site.

Location:

Vartsikhe Village (Cadastral Code: 30.01.39.016 and 30.01.39.017), Baghdati municipality, Imereti region, Georgia.

Specific requirements for the 61ha land plot infrastructure development

Detailed engineering design works should be prepared for developing relevant infrastructure and supply of energy resources to the greenfield 61ha potential greenhouse production site. The works required to be performed should include:

- Vertical land levelling for the whole territory;
- Rehabilitation of the existing melioration channels;
- Arrangement of the access and internal roads;
- High, middle and low voltage electrical network design;
- Detailed design for the supply of potable water for drinking and irrigation;
- Design of black and grey water pipeline network and disposal channels;
- Solution for local sewerage system pipeline network and disposal;
- Solution for disposal of used irrigation water;
- Development of cleaning facilities for sewerage, used irrigation and black / grey water;
- Development of centralised rain / storm water management network;
- Design of natural gas supply and distribution system.

Scope of requested works

The scope of the works to be undertaken by the detailed engineering design company (Service Provider) should include the following:

1. 61ha Production Site detailed survey and development of the site layout.
2. Preparation of all relevant Reports e.g.: geotechnical survey, melioration channels capacities and terms for rehabilitation and etc., that are not attached to this TOR;
3. Architectural schematical drawings, calculations, to be complied to the international norms and standards, including specifications for the required materials (mainly for roads, other defined zones, technical buildings etc.).
4. Master plan development and negotiations with local and other relevant Government of Georgia (GOG) authorities for obtaining required construction permits and authorizations.
5. Design of detailed electrical network drawings with attached specifications for the proposed grid and transformer stations. Load calculations, preparation of 0.4kV side user connections and

metering features. Preparation of interconnection project in between the existing local grid 35kV and GSE (Georgian electrical network) station 110/35kV. Obtaining relevant construction permits.

6. Design and preparation of drawings for the potable water, sewerage networks (on individually bases), rain / storm water collection and management.
7. Detailed design and vertical planning of networks, pump filtration stations, reservoirs and etc. should be considered as integral part of the scope of the project.
8. Natural gas pipeline network design and preparation of relevant detailed drawings. Suggested network and vertical planning, connection points, metering and etc. should all be detailed accordingly and included in the scope of the project.
9. Detailed cost estimations, BOQ and rate analysis should be included whenever relevant.
10. Obtaining all permits and necessary approvals for introduced design plans and for the required construction works.
    Note: IAZ will consider the possibility to support the bidding company in communication with relevant state institutions (if requested), but the full responsibility on obtaining necessary permits and approvals in the agreed project development timeframe will remain on the bidding company.

Detailed Design Works

Description of works to be performed

Detailed survey, design, drawings and estimation of the need to develop different types of infrastructural projects like:

a. access and internal roads;
b. buildings and relevant facilities (if necessary);
c. middle and low voltage electrical grid;
d. outdoor lightning, security and internet provision for the whole territory;
e. drinking / irrigation water supply network and disposal system;
f. centralised or individual sewerage system;
g. rain / storm water collection and disposal;
h. natural gas supply and distribution pipeline network.

Production site location

Vartsikhe Village, Baghdati municipality, Imereti region, Georgia (Cadastral Code: 30.01.39.016 and 30.01.39.017)

Project Duration

Maximum 8 months from signing the contract

Set Detailed Engineering Objectives

Selected Engineering Design Company or Consortium (Service Provider) is expected to prepare detailed master plan for the whole territory, design relevant layouts for the proposed infrastructure and site development works, conduct necessary surveys and geotechnical investigation works for developing potable water wells, prepare detailed high, middle and low electrical grid / network design, plan water supply, sanitation and disposal systems, prepare detailed drawings for all offered solutions and engineering designs, produce international standard Bill of Quantities (BoQ) and cost estimations, that should include market price cost rate analysis for the whole project.

Selected Service Provider Company or Consortium is expected to obtain all necessary design approvals for the expected construction works from the local and/or central government authorities and relevant service provider companies.

Upon request, IAZ could support in communication with relevant local and/or central government authorities, and will dedicate a person / coordinator during the submission process to local and/or central government authorities and service providers, but the full responsibility for obtaining required permits in timely manner will remain on the Service Provider.

Scope of Detailed Engineering Design Services

The detailed engineering design services to be provided by the engineering design company / consortium (Service Provider) will include, but is not limited to the following:

The 61ha production site investigation and survey works

1. The Service Provider should visit the proposed site to be familiarized with the existing conditions. A copy of the sketch map of the site will be provided for reference;
2. Provided detailed survey should show all the topographical features as may be required for the purpose of the detailed engineering design;
3. Identification and Survey of the appropriate water availability sources to be conducted by geotechnical well drilling methodology and to be confirmed by relevant laboratory analyses;
4. Relevant report is required to be submitted.

Soil investigation

1. Study out available Soil Investigation Reports to be provided to the Service Provider by the client. In case additional research is required the Service Provider should conduct the studies;
2. The final soil research and the produced report should furnish all necessary information to decide on the type and depth for building foundations and/or is necessary for road infrastructure arrangements.
3. Report with recommended structural decisions should be prepared and provided.

Design of Infrastructure

Relevant infrastructure should be planned and laid out in appropriate location as will be recommended by the Service Provider and will be finally approved by the client.

1. Suggested layout plans shall allow provisions for separate parking lots on the territory for vehicles and loaded trucks.
2. Suggested layout plans should include:
    - electrical cable lines;
    - natural gas distribution pipe lines;
    - drinking and irrigation water supply / distribution pipe lines and pumping stations;
    - sewerage treatment units and pipe lines;
    - rain / storm water – melioration channel features;
    - possible internet fibre optics cable installation locations and connection points;
    - black and grey water disposal network and cleaning facilities.
3. The detail design and introduced plans and/or drawings should conform to the requirements of the Client. The Service Provider is required to conduct relevant changes in consideration of the project site researched conditions.

Detail Drawings for the Infrastructure Design

The drawings should be done in an appropriate style with the suitably fixed scales, the way they are easily readable at site and/or during the workshop with the naked eye. Except for the general views, the drawings should preferably be produced at the scale of: 1:200, 1:500, 1:2500, and for showing relevant details at the scale of: 1:100, 1:50, 1:20 (when necessary).

a. Relevant number of drawings are to be produced in order to appropriately represent all necessary and required details, views, etc.;
b. The details for pipe line installation and/or cable installation works should be a part of the provided drawings.
c. All provided drawings are to be produced in accordance to ISO A1, A2 format. Drawings for relevant details can be produced on A3 format and relevant explanatory notes and reports in A4 format.
d. For the purpose of tendering out documentation, drawings printed on A3 format sizes will be acceptable. However, the drawings are to be provided in metric system (i.e., meter, cm and mm).

Bill of Quantities (BOQ)

1. Requested BoQ is considered to be explicit and should cover the whole scope of works to be provided in details. It should be as exhaustive as possible to avoid changes, additions, deletions and substitutions during the execution, and therefore prevent all types of undesired disputes and claims;
2. The detalization of technical and material specifications should be a part of the provided BoQ;
3. Suggested quantities should be worked out in an accurate manner in order to avoid unnecessary possible variations during the execution of the planned works;
4. Availability and sources for materials are required to be specified for those elements, that could be unique in features;
5. Suggested materials are required to be readily available in Georgia (as much as possible);
6. Suggested materials are required to suit the climatic conditions of the designed land plot area.

Rate Analysis and Cost Estimates

1. Cost estimates should be accuratly worked out to indicate the approximate total cost of the entire project, with the deviation of max 10%-15% from the final cost of the project development;
2. Provided cost astimates should be accompanied by analysis of rates when necessary;
3. All types of taxes as e.g.: import, excise duties, sales tax, royalties, etc. applicable in Georgia and abroad, e.g. when materials are imported, should be incorporated in the cost analysis;
4. The cost estimates should be treated as highly confidential as is required with the nondisclosure conditions of the service provision agreement with the Client.

Key Personnel and/or Invited Senior Expertise

The Service Provider is required to engage minimum requested key personnel and/or invited Senior Expertise (CVs and provided work experience will be evaluated accordingly) apart from other supporting staff members and/or outsourcing service provider companies, to carry out required detailed engineering greenhouse cluster development infrastructure design works:

A. Team Leader / Project Manager (Senior Expert as a key personal member for the overall Project Management);
B. Urban Architect (can be an invited a Senior Expert and/or a specialized institution for master planning);
C. Greenhouse Engineer - can be invited a Senior Expert and/or a specialized institution for planning and developing big scale, high and middle-tech greenhouse facilities;
D. Structural / Civil Engineer - Senior Expert as a key personal member for planning and developing roads / buildings related infrastructure etc.;
E. Mechanical Engineer - can be invited a Senior Expert and/or a specialized institution for planning and developing potable water, sewerage, storm water, used irrigation water disposal and planning of cleaning facilities;
F. Electrical Engineer - can be invited a Senior Expert and/or a specialized institution for planning and developing high, medium and low voltage networks;
G. Natural Gas Engineer - can be invited a Senior Expert and/or a specialized institution for planning and developing high, medium and low-pressure networks;
H. Quantity Surveyor - can be invited a Senior Expert and/or a specialized institution for conducting big scale infrastructure feasibility studies, estimate of required materials, time and labour costs.

Minimum eligibility requirements

Team Leader / Project Manager

a. At least Bachelors Diploma Degree in Architecture and/or Civil Engineering (Master's and/or Doctor's Degree is preferable);
b. Obtained Professional Engineer (PE) licence is desirable;

c. To have managed minimum 3 relevant type of infrastructure planning & development projects, during the past 5 years;
d. Must be fluent in spoken & written English;
e. Essential Communication Skills;
f. Essential Time Management Skills;
g. Project Management Organizational Awareness;
h. Essential Problem-Solving Skills;
i. Essential Leadership Skills.

Urban Architect

a. Required to have designed minimum 3 relevant type of infrastructure planning & development projects, during the past 5 years;
b. At least Bachelors Diploma Degree in Architecture and/or Civil Engineering is the must if invited as a Senior Expert or is considered to be a key personal member;
c. Must be fluent in spoken & written English.

Greenhouse Engineer

a. Required to have managed minimum 3 high and middle-tech greenhouse development projects, with at least one project of minimum 5ha of high-tech greenhouse to have developed during the past 5 years;
b. Must be fluent in spoken & written English if invited as a Senior Expert or is considered to be a key personal member.

Structural / Civil Engineering

a. Required to have designed minimum 3 relevant scale of civil infrastructure planning & development projects;
b. Must have at least Bachelors Degree in relevant field;
c. Must have at least 5 years of experience in structural design works;
d. Must be fluent in spoken & written English.

Mechanical Engineer

a. BS degree in mechanical engineering, thermo-dynamics or related field. (Master's and/or higher degree in mechanical engineering, thermo-dynamics or related technical field will be considered as an advantage);
b. Must have at least 5 years of experience in outdoor mechanical networks design works;
c. Must be fluent in spoken & written English.

Electrical Engineer

a. Must have at least Bachelors Degree in Electrical Engineering;
b. Must have at least 5 years of experience in high, middle and low voltage Electrical Grid design works;
c. Must be fluent in spoken & written English.

Natural Gas Engineer

a. Bachelor’s Degree either in mechanical engineering, civil engineering or petroleum engineering;
b. Must have at least 5 years of experience in Natural Gas Engineering and working on big scale projects with the supply of high, medium and low pressure of natural gas to the customers;
c. Must be fluent in spoken & written English.

Quantity Surveyor

a. Must have at least Diploma in Civil Engineering (degree in quantity surveying or commercial management accredited by the Royal Institution of Chartered Surveyors (RICS) or by any other relevant authorized international institution will be considered as an advantage).
b. Must have at least 5 years of experience in Quantity Survey.

c. Must be fluent in spoken & written English if invited as a Senior Expert or is considered to be a key personal member.

Company and/or Joint Venture Experience

Potential Service Provider should submit detailed references of conducted 3 similar types of industrial infrastructure development (Supply of electricity grid, natural gas network, water network, access and internal road network etc.) detailed engineering projects, that were executed in last 5 years (either by the introduced individual applicant Company and/or by the Consortium (Joint Venture).
Potential Service Provider Company and /or Consortium (Joint Venture) should submit to the proposal, Curriculum Vitaes (CVs) of the introduced Key Personal, their qualification and experience certificate testimonies together with the letter of commitment expressing their strong will and readiness to be fully engaged in the process according to the requirements of this TOR.
All provided information and testimonies, qualification and experience records etc., will be evaluated by the Client at the stage of the price identification public procedure, and later on at the stage of the public, electronic Contest announcement, independently by both, the Client and the State Electronic Procurement Agency representatives.
Potential applicant will be automatically disqualified in case the required qualification record and/or experience certificates and/or provided letter of commitments of the Key Personal are not enclosed and/or confirmed.
A **methodology** should be submitted by bidders with a working tasklist time schedule for evaluation.

Information and Documentation for the Service Provider

To insure high quality performance and accuracy while preparing the 61ha detailed engineering design layout and relevant technical and/or financial documentation (as is described and requested with this TOR), the Service Provider can carry out its own sstudies of the project site and/or received documentation from the Client, to confirm and/or suggest any applicable relevant data, with the clear understanding and full acceptance of the responsibility on reliability and accuracy of the data received and/or collected in the process.
The selected Service Provider will be supplied by the Client with the following available information and documentation:

1. Sewage System Layout;
2. Road Network Layout;
3. Road Profiles Information;
4. Potable Water Network Layout;
5. Natural Gas Network Layout;
6. Greenhouse Zoning Layout;
7. Topography Map;
8. Land Information;
9. Geology Report;
10. Water Analyses;
11. Soil Analyses;
12. Existing Energy Resource/Infrastructure Information;
13. CCTV, PAGA, security, utility control and automation (scada)
14. **Maintenance concept:**
    a. All infrastructure needs to be accessible easily with non or min. excavation work for example with manholes and if required galleries;
    b. Low maintenance cost for operation, wide service range / regional existence of technical service needs to be considered by designer during system selection;
    c. Adequate workshop should be in-place;

Required Reports and Documentation from the Service Provider

The selected Service Provider will be required to submit and present for review, comments, suggestions and/or final approval the following reports to the Client:

Inception Report

To be submitted by the end of the first following month after signing the Service Provision Agreement with the following minimum required documentation to be included:

1. Designed preliminary Master Plan;
2. Geotechnical investigation reports for water wells;
3. Investigation reports for the melioration channels.

Interim Report

To be submitted by the end of the third following month after signing the Service Provision Agreement with the following minimum required documentation to be included:

1. Master plan with complete site development works included;
2. Architectural drawings with all necessary details and specifications included.

Draft Final Report

To be submitted by the end of the 5th following month after signing the Service Provision Agreement with the following minimum required documentation to be included:

1. Detailed Master Plan with all necessary site development works included;
2. Architectural drawings with all necessary details included;
3. Detailed potable drinking and irrigation water supply and disposal, together with sewerage and storm water collection and disposal networks, the drawings for disposal pipeline network and the cleaning facilities to be included;
4. Detailed Electrical Grid supply and distribution network drawings, that include data and drawings for required substations;
5. Detailed natural gas supply and distribution network drawings, that includes data and drawings for the required Gas Control Points (GCP);
6. Internet and security low voltage cable, fibre optics network drawings with. Obtained approval from local network providers to be included;
7. Structural and infrastructural civil engineering and urban development detailed drawings;
8. Required material and equipment full and detailed specifications;
9. Structural analysis and detailed design calculations;
10. Mechanical network analysis and detailed design calculations;
11. Electrical grid network analysis and detailed design calculations;
12. Natural gas network analysis and detailed design calculations;

Final Report

To be submitted by the end of the 6th – 8th following month after signing the Service Provision Agreement with the following minimum required documentation to be included:

1. Detailed Work Specifications;
2. Detailed measurement and abstract of estimated costs and BOQ;
3. All required construction permits and design approvals to be obtained from the relevant and responsible institutions / authorities and or companies;
4. USB drive containing the plot files as well as the prepared drawings (in .dwg format).
5. Three sets of BoQ and Materials / Technical specifications printed out as had copies and bounded accordingly;
6. Three sets of detailed design drawings printed out on A3 and A4 formats for the tendering / contest announcement process;
7. Cost estimate and rate analysis for all items of work – one hard copy (properly sealed) and a soft copy provided with the USB drive.

Post Approval Process

The Service Provider should submit required approvals for all provided drawings, and upon request, submit any missing details upon Client's assigned representative request and/or instructions and/or while officially being requested and/or instructed by the appointed detailed engineering process oversight legal entity experts and/or official representative.

If necessary, after obtaining the approved drawings, all provided estimations are to be revisited and reconsidered for any required project changes if any.

Glossary

Given below are the abbreviations and the respective definitions in alphabetical order:

BoQ – Bill of Quantities;
GCP – Gas Control Point(s);
GHCD – Greenhouse Cluster Development;
GoG – Government of Georgia;
GOGC – Georgian Oil and Gas Corporation;
IAZ – LLC Imereti Agro Zone, or any other future legal entity it may restructure into;
ISO – International Organization of Standardization;
LLC – Limited Liability Company;
MEPA – Ministry of Environmental Protection and Agriculture of Georgia;
ToR – Terms of Reference;

Annexes to the TOR

Annexes to the TOR includes recommendations for infrastructural design works and are to be considered as initial requirements provided by the Client, that can be reconsidered by the Service Provider if necessary and/or some better solution can be recommended, that will need to be justified accordingly and finally is to be agreed and approved by the Client in brief.

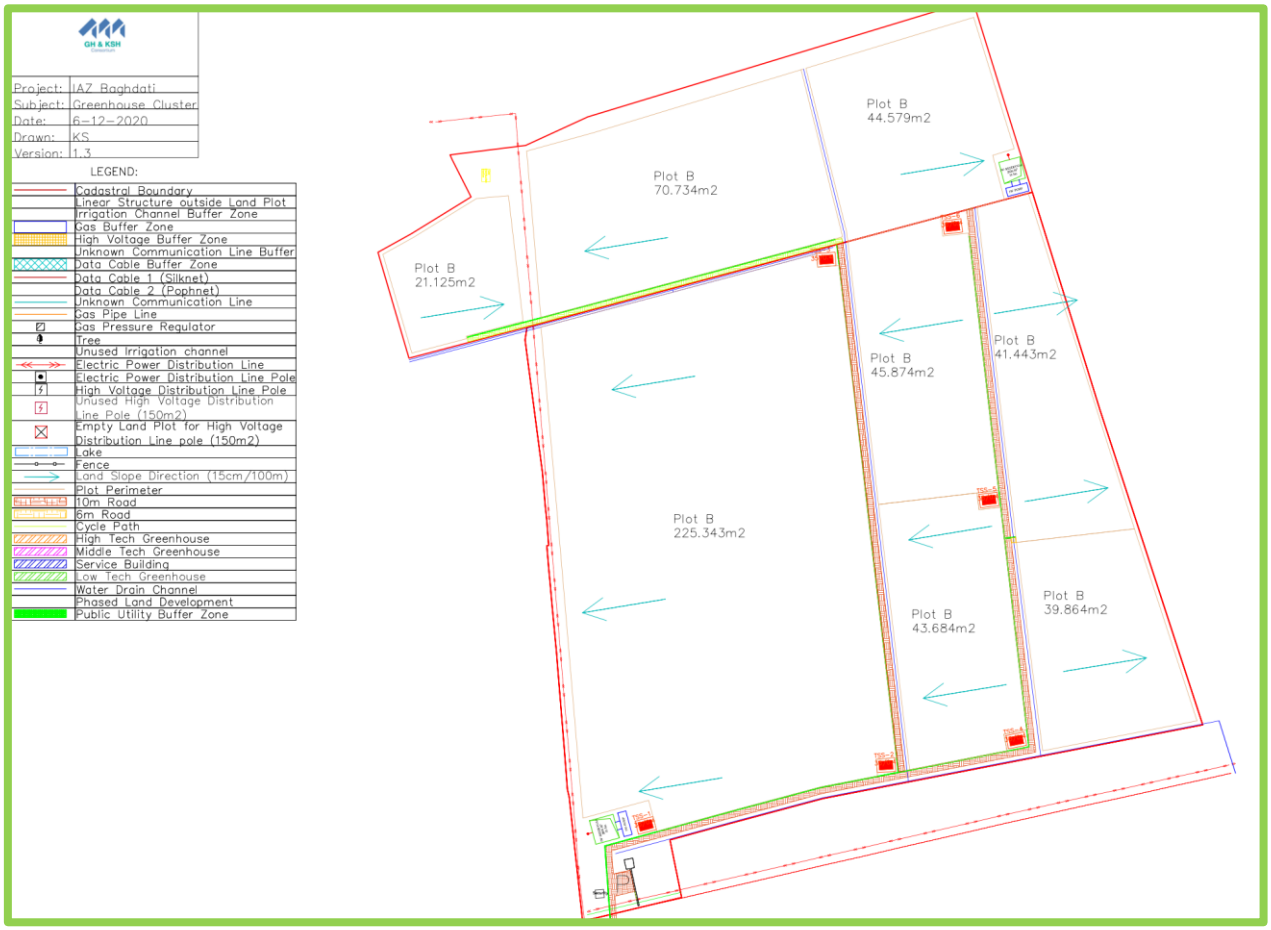
Economic life span expectation of the project can be added, material and system selections will be done accordingly.

Generic **standard and code reference** (eurocode, euro standard or gost, snip, etc) which will be base of design works needs to be defined, accordingly the detailed standardization shall be done by designer.

Energy efficiency expectation is important for system and equipment selection, it will affect capex expenditures but reduce Opex expenditures.

Annex 001 – 61ha Land Plot Layout

For the execution of the requested, with this TOR, detailed engineering project design and assuring better understanding of the suggested greenhouse production technological zone concept, together with its possible technical requirements, please find the 61ha land plot preliminary layout, that was designed and prepared by the JV "GeoHolding & KSH Consortium" Member Company K. Spiertz Holding B.V. in 2021 within the scope of IAZ GHCD project Consultancy Service provision:



Annex 002 – Land Leveling Requirements

As advised by the JV “GeoHolding & KSH Consortium” Member Company K. Spiertz Holding B.V. in 2021:

For the execution of the detailed engineering project, it is necessary to determine the elevation of different points along the alignments of the proposed elevations.

Leveling is employed to provide an accurate network of heights, covering for the entire area of a project and is of prime importance to the engineers, both in acquiring necessary data for the design of the project and also during the project execution.

Land grading involves reshaping the ground surface to planned grades as determined by an engineering survey, evaluation, and layout. Land grading provides more suitable topography for buildings, facilities and other land uses and helps to control surface rainwater runoff, soil erosion from the ungraded land during and after construction.

Land grading is applicable to sites with uneven or steep topography or easily erodible soils, because it stabilizes slopes and decreases the water runoff velocity. Grading activities should maintain existing drainage patterns as much as possible.

For the purpose of greenhouse constructions, the plot of land should be levelled under a slope of**:**

15 cm per 100 meters.

The operation of the land levelling can be kept to the simple method of cutting and filling.

Annex 003 – Road Infrastructure Design

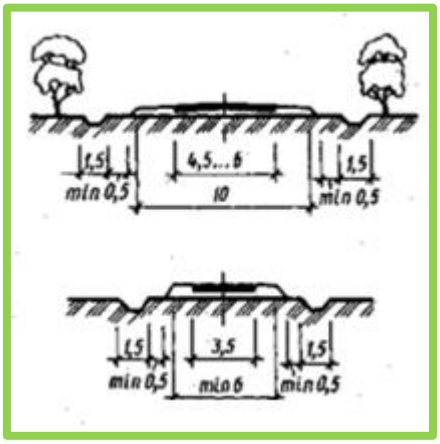
As recommended by the JV IGCC Member Company SAXON:

The road and transport network of the territory should include main accesses and secondary internal roads, parking lots and turnarounds for heavily loaded trucks, pedestrians and bicycle paths.

The network of streets, driveways and footpaths of the territory should be as simple as possible in outline, should correspond to the directions of the main pedestrian and transport links, and should provide convenient and short communication accesses to the external road network.

The main roads are considered to serve for intra-settlement transport and pedestrian links, connecting groups of individual zones with other areas of the territory. The recommended arrangements for the main roads are provided in the attached picture 1. Main roads should be minimum of 6m width, though the desired and recommended width is 10m.

Picture 1. Main roads and internal roads arrangement sample detail.



On the narrow road sections after 100m from the starting point, passing platform areas should be arranged for oncoming cars and heavily loaded trucks. If the parking spaces are supposed to be planned on one side of the road, then the minimum width of the road must be 5m.

The secondary roads should be designed minimum of 3.5m width (picture 1), but is recommended to be consider 6m as a desired width. Suggested paths should have minimum of 3.5m width and are initially planned to be designed without a solid surface consideration.

As concrete and asphalt is considered to have an adverse impact on the environment and generally solid coatings destroy the microclimate and rob plants of solar energy, are unpleasant for walking and plants or animals hardly survive in such environment, the project should foresee available green zones with plants and bushes to be planted all along the main access roads and at the sites where solid concrete surface is used.

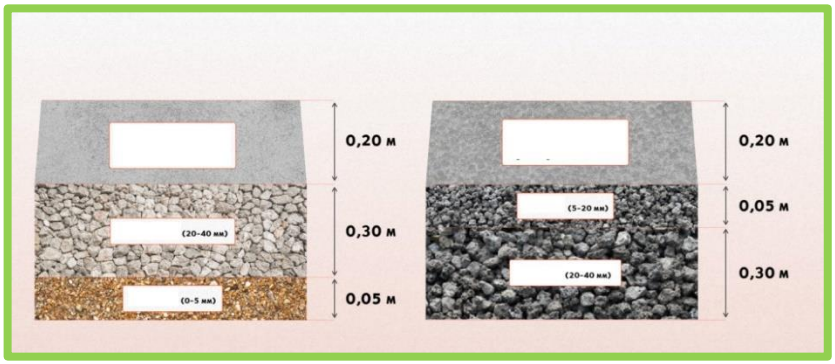
The runoff of the surface water should be carried out along the streets and roads with a hard surface. Surface water (rain / storm water) from the streets should be sloped and linked to the existing melioration channels, that are to be accordingly planned and considered.

The smallest allowable slope of the roads are to be planned within the minimum range of 0.3% to 0.5%, and to the largest slope point of 0.6% to 0.8%. The road slopes are to be accurately reconsidered according to the general land leveling slope parameters as are given in Annex 002 of this TOR.

Territory infrastructure design works should include arrangements for car parking lots at the main access and internal roads.

To increase strength for the concrete roads it is recommended to foresee and include reinforced steel mesh with the recommended size of not less than: 5BP 100/100 2350, L=6m. (to be finally adjusted after the detailed design is prepared).

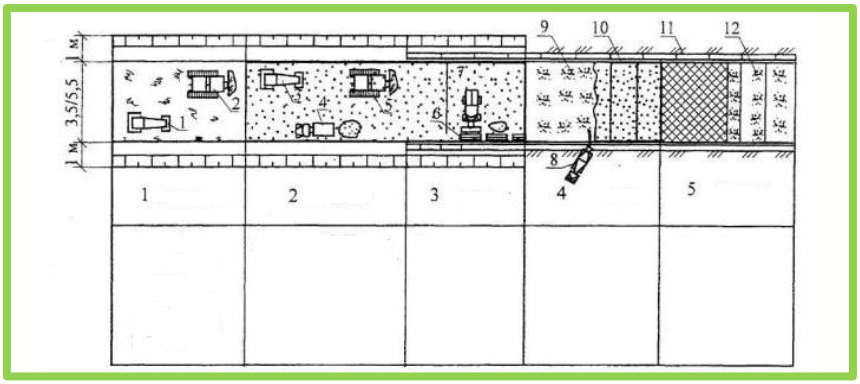
Picture 2. Concrete road arrangement sample detail



The base for considered concrete roads should have a strength of not less than – 1200 kg/cm2. The 1st concrete layer of class M200 should be considered with the thickness of min 5cm. The 2nd concrete layer of class M400 should be considered with the thickness of min 15cm. The reinforced mesh is to be considered in between two layers (to be finally adjusted after the detailed design is prepared).

Suggested technological arrangement card for concrete roads and parking lots is provided with picture 3 bellow:

Picture 3. Sample concrete road arrangement technological process.



Expected traffic density, max tonnage, clearance height and max. Length of the vehicles for turning radius calculation will be needed to define design parameters.

Annex 004 – 61ha Production Site Fencing

As advised by the JV IGCC Member company SAXON:

For the total territory perimeter, fencing should be foreseen as a 3d fence type (a steel mesh covered with pvc material (and or zinc coated).

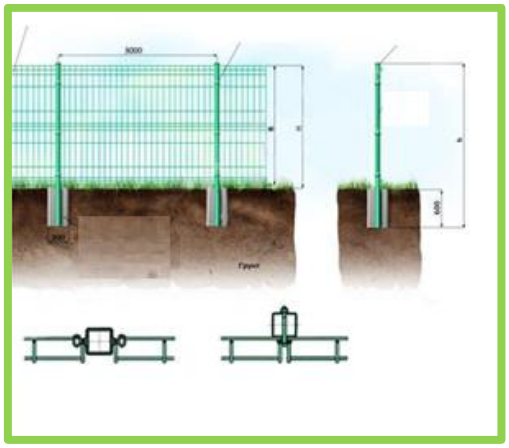
Poles should be located in the distance of not less than 2.56m each, and all of them should have a concrete foundation of 200 x 200mm with the depth of 600mm.

Poles are considered to be from steel – size 60 x 60mm with the Height of 2.0m. The fence height is considered to be max 1.73m (1.50m could be enough to protect the territory from the cattle).

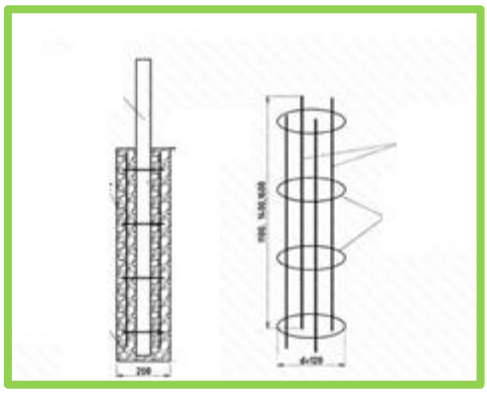
The wire section of 4mm and the panel type of 1730 x 2500mm (suggested design and type can be reconsidered at the detailed engineering stage as the main goal of fencing in general, is to only protect the territory and the glass greenhouses from the cattle roaming around).

Painting colour code RAL 7016 (the paint usage and the fence type can be reconsidered to the cheaper, but functional version during the detailed project design stage).

Picture 4. Territory fence arrangement sample details



Picture 5. Territory fence foundation arrangement details



fence basement size can be affected due to soil condition, fence type, wind etc. it should on the direct responsibility of the designer upon calculations therefore instead of giving such design details it is more appropriate to give operational scenarios, organization responsibilities, capacity expectations, system performance expectations, expected construction cost as per project budget, etc.

Annex 005 – Electrical Grid Design Considerations

For the execution of the requested, with this TOR, detailed engineering project design and to insure better understanding of the suggested greenhouse production technological zone concept, its electricity consumption requirements, possible volumes and suggested distribution considerations, please find below the energy requirements calculations provided by the JV "GeoHolding & KSH Consortium" Member Company K. Spiertz Holding B.V. in 2021, prepared within the scope of IAZ GHCD project Consultancy Services.

Suggested electricity consumption volumes were reconfirmed by the JV "Imereti Greenhouse Cluster Consortium" (IGCC) Member Company, Phoenix Greenhouse Solutions, in July 2022, after conducting an independent survey within the scope of the IGCC Consultancy Service Provision mandate from 2022.

IAZ Bagdati : Future estimated power requirements:

Assumptions for Imereti Region	
Min temperautre	-6°
Max temperature in GH	+18°
Delta T required	+24°
Required artificial lighting 20.000Lux	
Power supply lighting systems from the grid	
Required for 20.000 Lux = 165W/m2	
Operational power 0,05Mw per ha	

Future estimated power requirement in Mega-Watt per hour							
		High-tech GH	Medium-tech GH	Low-tech GH	Road		
Phase 1	Constructed area in ha	16.14	0.00	6.64	2.2607	**25.0471**	ha
	Mw per ha / hour	1.70	0.75	0.30	0.50		
	SUC 15%	0.26	0.11	0.05	0.08		
	Total Mw per ha / hour	31.56	0.00	2.29	0.58	**34.43**	Mw/h
Phase 2	Constructed area in ha	0.00	13.15	2.79	0.00	**15.9444**	ha
	Mw per ha / hour	1.70	0.75	0.30	0.50		
	SUC 15%	0.26	0.11	0.05	0.08		
	Total Mw per ha / hour	0.00	11.34	0.96	0.58	**12.88198**	Mw/h
100% Occupied IAZ Baghdati	Constructed area in ha	16.14	13.15	9.43	2.26	**40.9915**	ha
	Mw per ha / hour	1.70	0.75	0.30	0.50		
	SUC 15%	0.26	0.11	0.05	0.08		
	Total Mw per ha / hour	31.56	11.34	3.25	1.15	**47.31**	Mw/h

It is recommended by the JV IGCC Member Company SAXON, that while calculating the expected load, no diversity of the supply has been considered, as it is expected, there will be certain cases and times when the full load for the estimated greenhouse consumption will be used, therefore the supply network cables must be able to sustain the totally estimated load.

It is estimated, that GSE will have to issue technical requirements for developing internal electrical network 35/0.4kV design and also to provide a separate detailed project for connection in between the internal electrical network and the substation 110/35kV.

As an option to be researched out, GSE could provide the required load, with an available 10kV electrical network. It is recommended, that the 61ha production site electrical network and planned transformer substations, are to be considered of 10/0.4kV type.

Recommendations for MV Power Distribution

It is recommended by the JV IGCC Member Company SAXON, that the suggested power grid should consist of 1 No 35kV closed ring circuit, feeding the transformer substations with 35kV/0.4kV.

All the MV power distribution cables are to be considered with aluminium conductors, though they are much larger in dimensions, but could be cheaper than their alternatives of copper conductors.

The MV cables are to be calculated and accurately selected - single core aluminium conductor, XLPE insulated with water blocking powder, and PVC over-sheath can be recommended as well. The above given specification is specifically developed for MV buried cables. The applied international standards for the LV cables to include IEC, VDE, CENELEC and BS.

Recommendations for LV Power Distribution

As is recommended by the JV IGCC Member Company SAXON:

The LV cables should connect each transformer substation to the relevant greenhouse user. Calculated cable sizes are considered to be relevant to individual consumers and are to be designed accordingly. Calculated cable sizes should be in accordance with the cable manufacturer's technical data, with an emphasis that should ensure the max voltage drop from the transformer to the greenhouse user, with not more than 3%.

The LV cables should have aluminium conductors with XLPE insulation and tough PVC over-sheath. All the LV cables are to be suitable for direct burial in the ground.

The LV cables sized from 16mm2 to 35mm2 should be designed as four core composite cables.

The LV cables sized from 50mm^2 to 300mm^2 should be designed as single core cables.

The applied international standards for the LV cables should include IEC, VDE, CENELEC and BS standards.

Recommendations for Transformer Sub Stations

As is recommended by the JV IGCC Member Company SAXON:

Transformer substations 35/0.4 should be designed with minimum footprint area, the way the load capacities are to be limited to maximum 5MW per one substation unit.

Minimum 8 transformer substation should be foreseen for the territory in order to reach all possible 0.4 users in distance that very from 200m to 400m.

A transformer substation with the closest location to the territory entrance, should be used to terminate 35kV cable from GSE station 110/35kV and start form the internal ring 35kV.

Also, suggested transformer substations should be of the package type (container type) already preassembled in the factory (Picture 1).

Picture 1. Sample of the Transformer Substation

Substations should include transformers (2 pcs for each substation), the MV incoming and outgoing switchgear, LV distribution board for the LV feeding cables to be considered for every individual user (zone) on the production site.

The package substations to be delivered to the project, in completely built and fully tested condition. Prior to delivery, the bases for each of the substations will be completed with the installed pipes for the cables to enter from the cable trench below. The pipes should have slow bends so as not to compromise the manufacture's recommended bending radius of the cables.

LV distribution gear should be designed in details after receiving exact user's connection points and expected loads. It is considered to be provided by the landlord.

Recommendations for Metering

As is recommended by the JV IGCC Member Company SAXON:

Electrical meters should be planned and designed for all individual users on the territory for easy and comfortable connection. Electrical meters in LV panel 0.4kV for individual user connections – to be provided by the landlord while the control meters can be designed on the tenant's territory.

Metering also should be foreseen for the main 35kV line feeder of the whole production site. Exact location for this metering point is to be provided with the "Electrical Grid" drawing.

Recommendations for the Road Lightening

As is recommended by the JV IGCC Member Company SAXON:

All type of roads on the production site are to be lightened according to the international standard DiaLux and Lumen calculations. Preferably LED and/or other energy efficient light units to be planned to be installed and thus to be designed accordingly. Cable installation type is to be considered as according to the Client requirements, and is to be buried in the ground or follow the road tranches, that are considered for the electricity, middle and or low voltage network.

Light pole heights, installation distances from the roads and in between the poles should be calculated together with selected LED and/or other energy efficient light unit photometry and are to be designed respectively.

Recommended by SAXON lightning intensity on the roads are provided in a table below.

Table 1. Territory lightning intensity requirements

Road Type	Lux (lx)
Access Roads	minimum 4 lx
Internal Main Roads	minimum 4 lx
Internal Secondary Roads	minimum 2 lx

Lightning (thunderbolt) protection is quite important infrastructure and it needs to be added.

Annex 006 – Estimated Water Consumption

For the execution of the requested, with this TOR, detailed engineering project design and to insure better understanding of the suggested greenhouse production technological zone concept, its water consumption requirements, possible volumes and suggested distribution considerations, please find below the drinking and irrigation water consumption requirement calculations, provided by the JV "GeoHolding & KSH Consortium" Member Company K. Spiertz Holding B.V. in 2021 and prepared within the scope of IAZ GHCD project Consultancy Services.

Suggested drinking and irrigation water consumption requirement volumes were reconfirmed by the JV "Imereti Greenhouse Cluster Consortium" (IGCC) Member Company, Phoenix Greenhouse Solutions, in July 2022, after conducting an independent survey within the scope of the IGCC Consultancy Service Provision mandate from 2022:

IAZ Baghdati: Future estimated drinking water requirements

Assumptions for Imereti Region

Drinking water per person 110 litres per day
Drinking water for cleaning fresh product: 2m3 per Mt/day
Estimated work force: 4,5 people per hectare
Estimated work force added value chain: 3,5 people per hectare

Future estimated annual drinking water consumption

		High-tech GH	Medium-tech GH	Low-tech GH	Road				
Phase 1	Constructed area in ha	16.1	0.0	6.6	2.3	25.0	ha		
	Employees primery production	73	0	30					
	Employees added value chain								
	Total labor force	73	0	30	0	103	Employees		
	Total drinking water m3/day	8.0	0.0	3.3	0.0	**11.3**	m3/day	3497	M3/year
Phase 2	Constructed area in ha	0.0	13.2	2.8	0.0	15.9	ha		
	Employees primery production	0	59	13					
	Employees added value chain								
	Total labor force	0	59	13	0	72	Employees		
	Total drinking water m3/day	0.0	6.5	1.4	0.0	**7.9**	m3/day	2447	M3/year

Future estimated annual drinking water washing fresh product

		High-tech GH	Medium-tech GH	Low-tech GH	Road				
Phase 1	Constructed area in ha	16.1	0.0	6.6		22.8	ha		
	Product In Mt per ha	900	600	250					
	Total product in Mt	14530	0	1660		16191	Mt/year		
	Total drinking water m3/Mt/year	2906	0	332	0	**3238**	m3/year	**14.7**	**m3/day**
Phase 2	Constructed area in ha	0.0	13.2	2.8		15.9	ha		
	Product In Mt per ha	900	600	250					
	Total product in Mt	0	7891	698		8589	Mt/year		
	Total drinking water m3/Mt/year	0	1578	140	0	**1718**	m3/year	**7.8**	**m3/day**

Future estimated m3 drinking water per DAY	
Phase 1	**26**
Phase 2	**16**
100% Occupied IAZ B	**42**
Future estimated m3 drinking water per YEAR	
Phase 1	**6735**
Phase 2	**4165**
100% Occupied IAZ B	**10899**

IAZ Baghdati: Future irrigation water requirements:

Assumptions for Imereti Region

Min temperautre -6°
Max temperature in GH +18°
Delta T required +24°
HT & MT water recycling systems
Water consumption HT 40m3 / ha / day
Water consumption MT 60m3 / ha / day
water consumption LT 80m3 / ha / day
Water storage capacity 1 day & 2 days

Future estimated irrigation water consumption in m3 per day						
		High-tech GH	Medium-tech GH	Low-tech GH		
Phase 1	Constructed area in ha	16.1	0.0	6.6	**22.8**	ha
	M3 water / ha / day	646	0	531	**1177**	m3/day
Phase 2	Constructed area in ha	0.0	13.2	2.8	**15.9**	ha
	M3 water / ha / day	0	789	223	**1013**	m3/day
100% Occupied IAZ Baghdati	Constructed area in ha	16.1	13.2	9.4	**38.7**	ha
	M3 water / ha / day	646	789	755	**2190**	m3/day

Estimated irrigation water storage capacity in m3 per day						
		High-tech GH	Medium-tech GH	Low-tech GH		
100% Occupied IAZ Bag	Constructed area in ha	16.1	13.2	9.4	**38.7**	ha
	Storage m3 for 1 day	646	789	755	**2190**	m3/day
	Storage m3 for 2 days	1292	1578	1509	**4379**	m3/2days

Potable Water Design Considerations

As is recommended by the JV IGCC Member Company SAXON:

Potable water municipality network is not available at the production site, thus is to be planned and designed accordingly. Several potable water local artesian types of individual boreholes are to be planned and designed on the production site.

Artesian type of boreholes are considered to be designed with the depth of between 60m and 100m (to be confirmed with a specialized Geological Survey research and the report provided by the Service Provider.

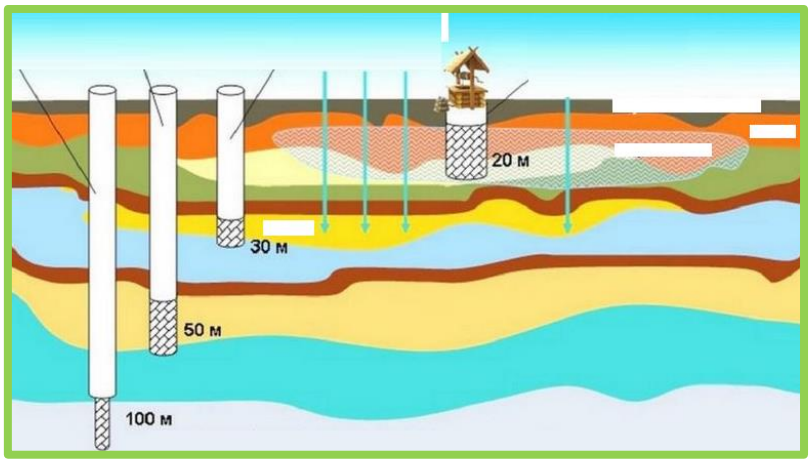
Water supply network is recommended to include:

1. well / borehole type artesian individual pumps;

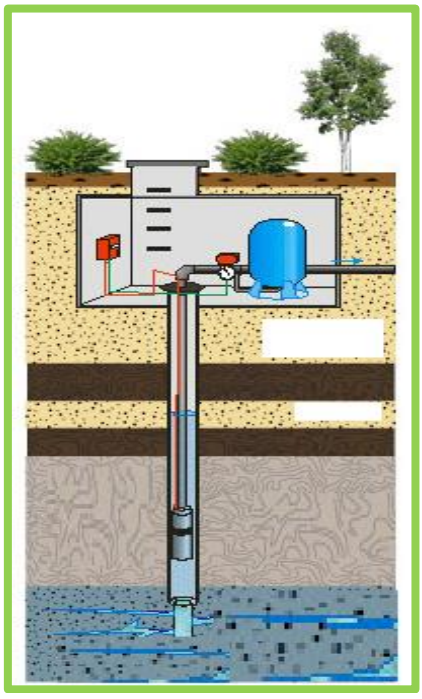
2. water reservoirs;
3. booster pumps;
4. filtration equipment;
5. manifolds for drinking and irrigation water distribution pipelines;
6. individually installed water meters for individual land plots.

Relevant filtration equipment will need to be selected and designed according to the well / borehole water laboratorial analyzes and the prepared report results by the Service Recipient.

Picture 2. Potable water – sample local well / borehole (artesian type – 100m depth)



Picture 3. Potable water – pumping station typical arrangement



Possible locations for the artesian wells and pump stations are marked on the attached potable water network layout.

Totally, the need of 8 artesian wells with local pump stations is foreseen to be located in a close distance to the transformer substations and to potential users of the land plots.

Potable water users are considered to be connected to the closest local pump stations with individual pipe lines, thus for this moment a central potable water pipeline network is not foreseen in the requested

detailed engineering design (subject to reconsideration in the process of the research and detailed planning).

Recommendations for Storm / Rain Water Network Design

As is recommended by the JV IGCC Member Company SAXON:

The production site does not have any central city storm / rain water collecting pipes or possible connection points. It is an open field project and in the nearest future a central city collector system is not foreseen to be allocated at the nearby territory.

It is foreseen, that individual high and middle-tech greenhouse owners will be contractually obliged to collect the rain water at its own production facilities for irrigation use and will develop their own supply and distribution pipelines accordingly.

Existing melioration channels are recommended to be used as a way to collect, utilise and filter through the specially designed cleaning facilities exceeding storm / rain and disposed water from the individual production sites.

Existing melioration channels need to be studied out on existing conditionality and are to be designed the way they could handle expected water disposal capacities. Special report is to be prepared and confirmed by relevant authorities (if applicable).

Picture 4. Melioration channels reinforced slopes.

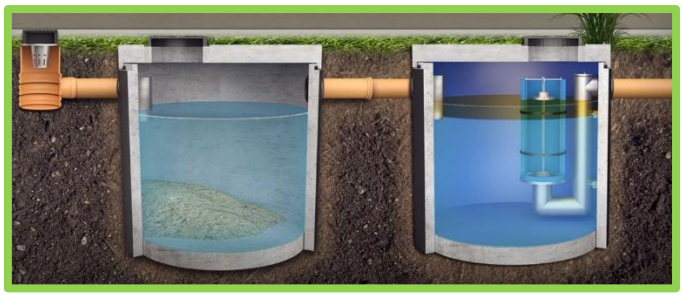
Existing melioration channel slopes should be reconstructed and adjusted to the production site requirements and needs, all around the land plot.

Concrete (and/or other) pipes / trunks with the truck load bearing capacities are to be designed underground for the channel crossings roads.

Melioration channels location places and slopes are provided in the attached to this TOR drawing “storm water network”.

For the roads and parking areas, a storm water cleaning equipment and/or facilities should be foreseen and are to be considered in the requested detailed engineering design, together with the mud collectors and oil separators, especially in the areas where heavy transportation movement (especially loading and unloading zones) is planned to take place.

Picture 5. Sample storm water management drawing for the road mud and oil separators.



Utilization of large amounts of storm / rain water settlements, also are to be researched and planned for the irrigation system of natural green areas adjacent to hard surfaces like pavements, roads etc.

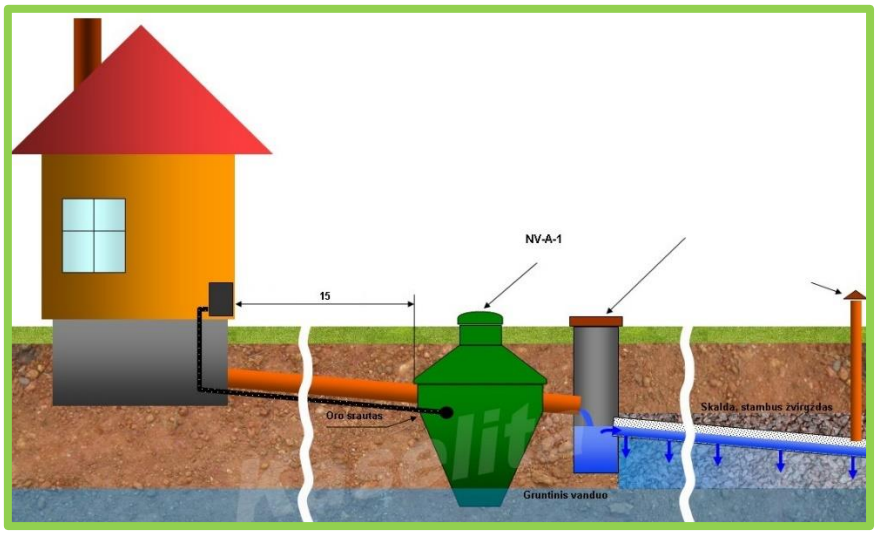
Recommendations for Waste / Sewerage Network Design

As is recommended by the JV IGCC Member Company SAXON:

For the waste water utilization solution, biological treatment plants / facilities are to be considered and planned with cleaned water utilisation possibilities, using the surrounding melioration channels. In case additional depth will be required the upper underground water levels are to be considered as a possible solution.

Local compact facilities are to be foreseen for individual commercial land plots. For individual connection arrangements, the project detailed engineering design is to be prepared according to the individually defined commercial land plot areas, to be agreed on after the detailed architectural / infrastructural design is developed and is finally approved by the Client.

Picture 6. Sample waste water biological treatment facility for the clean water management



Biological treatment, min. discharge water quality expectation and compliance requirement as per local codes of MEPA are needed to define design parameters.

Annex 007 – Estimated Natural Gas Consumption

The Greenhouses Infrastructure Development Project at 61ha Bagdati production site has three levels of natural gas consumption requirements. For the execution of the requested, with this TOR, detailed engineering project design and to insure better understanding of the suggested greenhouse production technological zone concept, its natural gas consumption requirements, possible volumes and suggested distribution pipeline network considerations, please find below the natural gas consumption requirement calculations, provided by the JV "GeoHolding & KSH Consortium" Member Company K. Spiertz Holding B.V. in 2021 and prepared within the scope of IAZ GHCD project Consultancy Services.

Suggested natural gas consumption requirement volumes were reconfirmed by the JV "Imereti Greenhouse Cluster Consortium" (IGCC) Member Company, Phoenix Greenhouse Solutions, in July 2022, after conducting an independent survey within the scope of the IGCC Consultancy Service Provision mandate from 2022:

IAZ Baghdati: Future Estimated gas requirements:

Assumptions for Imereti Region

Min temperautre	-6°
Max temperature in GH	+18°
Delta T required	+24°

Energy savings by thermal screen 40%
Required 160W/m2
Required per hectare 1,6Mw
Assumption caloric value gas: 1m3=35,17Mj
Required gas capacity per ha 1,6 * 115m3 = 184m3/h
Required gas capacity lighting 20.000Lux 1,65 *115 = 190m3/h

Future estimated maximum gas consumption per hour

		High-tech GH	Medium-tech GH	Low-tech GH		
Phase 1	Constructed area in ha	16.1	0.0	6.6	**22.8**	ha
	M3 gas / hour	6038	0	266	**6304**	m3/hour
Phase 2	Constructed area in ha	0.0	13.2	2.8	**15.9**	ha
	M3 gas / hour	0	2420	112	**2532**	m3/hour
100% Occupied IAZ Baghdati	Constructed area in ha	16.1	13.2	9.4	**38.7**	ha
	M3 gas / hour	6038	2420	377	**8835**	m3/hour

Future estimated total annual gas consumption

		High-tech GH	Medium-tech GH	Low-tech GH		
Phase 1	Constructed area in ha	16.1	0.0	6.6	**22.8**	ha
	Annual M3 gas / m2	1350	80	40		
	Total m3 *1000 gas	21795	0	266	**22061**	M3*1000
Phase 2	Constructed area in ha	0.0	13.2	2.8	**15.9**	ha
	Annual M3 gas / m2	1350	80	40		
	Total m3 *1000 gas	0	1052	112	**1164**	M3*1000
100% Occupied IAZ Baghdati	Constructed area in ha	16.1	13.2	9.4	**38.7**	ha
	Annual M3 gas / m2	1350	80	40		
	Total m3 *1000 gas	21795	1052	377	**23225**	M3*1000

Recommendations for Natural Gas Network Design

As is recommended by the JV IGCC Member Company SAXON:

As a local natural gas supplier state owned company, Georgian Oil & Gas Corporation (GOGC), will have to issue special technical requirements for natural gas supply and internal network design upon the Client's request to be drafted by the Service Provider.

GOGC will have to provide a separate project design to insure connection to the internal gas network with GOGC existing network at the closest connection point to the 61ha production site. Possible natural gas pipe line is provided with the attached drawing "gas network" and also in the section with the drawings for the road arrangement "Roads Profiles" to be researched and finally confirmed with the relevant report by the Service Provider.

All natural gas user greenhouse production sites are considered to be individually connected to the internal natural gas distribution network and personal natural gas meters are considered to be installed for individual users.

IGCC

IMERETI GREENHOUSE CLUSTER CONSORTIUM

2022