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REGULATORY IMPACT ASSESSMENT (RIA) OF DRAFT IRRIGATION / DRAINAGE TARIFF METHODOLOGY

USAID GOVERNING FOR GROWTH (G4G) IN GEORGIA

FINAL REPORT

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USAID CONTRACTING OFFICER'S REPRESENTATIVE: LEVAN PAVLENISHVILI

AUTHOR(S): ISET POLICY INSTITUTE

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Reviewed by: David Mujirishvili, Water Specialist, G4G

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ACRONYMS

CBA	Cost-Benefit Analysis
CIT	Corporate Income Tax
GA	Georgian Amelioration Ltd.
GFA	Georgian Farmers Association
GNERC	Georgian National Energy and Water Supply Regulatory Commission
ILMDP	Irrigation and Land Market Development Project
MFI	Micro Finance Institutions
MoA	Ministry of Agriculture of Georgia
NB	Net Benefit
NBG	National Bank of Georgia
NPV	Net Present Value
O&M costs	Operation and Maintenance costs
SP	Service Provider
RIA	Regulatory Impact Assessment
WB	World Bank

TERMS AND DEFINITIONS

Collateral	Property or other assets that a borrower offers a lender to secure a loan.
Collecting efficiency/Compliance rate/Payment rate	The rate that shows the percentage of expected revenues from the tariff collected by GA. It is equal to the income actually received divided by the expected income from the tariff.
Command area	The area that can be irrigated/drained by the amelioration company. The area in GA's capacity.
Contacted area	The part of the command area that is contracted and served by GA.
Contracting efficiency	The percentage of the command area contracted. It is equal to the contracted area divided by the command area.
Depreciation rate	The percent rate at which an asset is depreciated. It refers to the rate of decrease in value of tangible assets.
Discount rate	The rate of return that could be earned on an investment in the financial markets with similar risk.
Drip irrigation system	The drip irrigation system delivers water to crops using a network of mainlines, sub-mains and lateral lines with emission points spaced along their lengths. Each dripper/emitter supplies a measured, precisely controlled uniform application of water, nutrients, and other required growth substances directly into the root zone of the plant.
Gross margin	Farmers' revenues minus costs of production (excluding tariffs).
Irrigable area	The area that can be irrigated by the amelioration company. The area in GA's capacity.
Marginal gain	Additional gain received by a farmer switching from one option to another (by options we mean no irrigation, flood irrigation and irrigation using optimal irrigation techniques).
Net Present Value (NPV)	The difference between the present value of cash inflows and the present value of cash outflows.
Non-rival goods	Goods that may be consumed by one consumer without preventing simultaneous consumption by others.
Opportunity cost	The value of the best alternative forgone, where a choice needs to be made between several mutually exclusive alternatives given limited resources.
Optimal irrigation technology	Optimal irrigation technology assumes the optimal choice of technology i.e. stationary sprinkler, center pivot/linear move, per ha drip tubing (surface) and drip tape (surface).
Sprinkler Irrigation System	A method of applying irrigation water in a manner similar to rainfall. Water is distributed through a system of pipes, usually by pumping. It is then sprayed into the air over the entire soil surface through spray heads so that it breaks up into small water drops that fall to the ground.
Values in real terms	Nominal values adjusted for inflation. These are obtained by removing the effect of price level changes – the values after correcting for the effect of inflation.

CONTENTS

1. EXECUTIVE SUMMARY

Currently, the Georgian agricultural sector is characterized by relatively low productivity (by international standards) and its contribution to the GDP of the country is much lower than what it could be, considering that 45%[1] of the Georgian labor force is currently employed in agriculture. Increasing the productivity and competitiveness of the Georgian agricultural sector could, therefore, generate substantial economic and social benefits.
There are many bottlenecks that contribute to this current state of affairs:

- Low quality and quantity of irrigation and drainage services;
- Inefficient use of water by farmers;
- Lack of a well-functioning land market;
- High cost of capital and limited access to the financial market;
- High uncertainty;
- Farmers' low propensity for risk.

While all of these factors affect the productivity and competitiveness of the Georgian agricultural sector, it is clear that having well-functioning irrigation and drainage systems is a crucial pre-requisite for the development of the sector. Currently, Georgian amelioration services are falling short of what would optimal for the country, in both quantitative and qualitative terms.

Georgian Amelioration (GA) is a government-owned company that manages most of the country's irrigation/drainage infrastructure. It currently serves about 114 thousand hectares (88.4 irrigation and 25.5 drainage), compared to the 500 thousand hectares (386 irrigation and 114 drainage) that were served under the Soviet Union. While the area served under the Soviet Union (in 1988) was undoubtedly excessive (many areas were served at extremely high costs, exceeding the benefits provided), the area currently served can still be substantially increased, generating net benefits for society as a whole. Unfortunately, as emerged from our interactions with the main stakeholders, the *quality* of services provided by GA is not yet adequate. Most farmers mentioned the lack of reliable service provision by GA as the main problem – a fact that can cause significant losses, especially in the event of droughts.

Our consultations highlighted several factors behind the poor performance of GA's services. The main ones include:

(i) Deteriorated and inefficient infrastructure;
(ii) Inefficient water use by farmers;
(iii) Insufficient investment in infrastructure capable of increasing service reliability, especially in periods in which water is scarce (ex. additional storage facilities).

Things are made worse by both the lack of an adequate regulatory framework (in particular, current service fees are set per hectare, at a level too low to even ensure cost-recovery[2]) and Georgian farmers' attitudes towards paying water supply fees (i.e. the mentality of receiving water free of charge, translating into low contracting and collection rates). As a result, GA is a loss making company that needs to be constantly subsidized by the government in order to stay solvent.

Increasing efficiency in the use of water for irrigation purposes and, more generally, in the operations of GA, is becoming more and more important, not only for the development of the agricultural sector, but also for other sectors, whose development is conditional on the availability of an increasing (and reliable) supply of water (e.g. hydropower plants, fish farms, the industrial sector). Ideally, water pricing should be structured so that water is allocated to the uses that generate the highest value added for society.

[1] Source: Geostat household survey data 2014. Authors' calculations.

[2] At this stage, tariffs in the irrigation/drainage sector are charged based on an interim decree of the Georgian National Energy and Water Regulatory Commission that set fixed per ha tariffs for amelioration services in absence of a clearly defined tariff methodology. In addition, it should be noted that no metering is applied throughout the sector.

With this in mind, the Government of Georgia (GoG) intends to reform the Georgian amelioration sector to achieve the following objectives:

(i) Improve the reliability of the water supply through the renovation and rehabilitation of infrastructure;
(ii) Ensure the financial sustainability of amelioration service providers (SPs) by reducing their dependency on direct government subsidies;
(iii) Ensure the efficient allocation of water across alternative uses;
(iv) Increase the competitiveness of Georgia's agricultural sector by providing reliable irrigation and drainage services at reasonable prices.

One of the most important components of this reform is the development of a new irrigation/drainage tariff methodology. According to best international practices, tariff methodologies should focus on one of two strategies:

- Cost-recovery (ensuring the financial sustainability of SPs)
- Demand management (ensuring the efficient allocation of water resources)

The fact that tariffs are currently set at extremely low levels (not even covering the costs of service provision) and do not provide any incentive to use water efficiently, gives the Georgian government the opportunity to adopt a methodology that would lead to improvement in both aspects. There are different possible methodologies that could be adopted to set new tariffs for irrigation and drainage services, each affecting existing stakeholders in different ways.

We have identified a number of actors that will be affected by this policy intervention, including farmers, Georgian Amelioration Ltd. and the government. We consulted each of these stakeholders by conducting interviews, focus groups and collecting survey data. The consultations started on 18 November and finished on 18 December 2015.

On the basis of stakeholder consultations, we identified and analyzed three main policy options:

1. Option 1 (Baseline Scenario): The government does not introduce a new tariff methodology and keeps the status quo interim decree in force. The government primarily invests in the increase of irrigation/drainage land area, without investing in improving the reliability of the current water supply infrastructure. The government is providing GA with direct subsidies (sufficient to keep it solvent and unrelated to the number of hectares served) as the company cannot recover its costs under the current per ha tariff;
2. Option 2 (Lower-Bound tariffs): The government adopts a lower-bound pricing model with a two-component tariff per ha that covers the company's operation and maintenance costs. The first component of the tariff is a service fee that is paid by all customers who sign a contract with GA. The second component is paid by every owner of agricultural land with potential access to amelioration infrastructure (regardless of whether s/he receives any service from GA). The government is providing subsidies for the second component of the tariff, which starts at full subsidy and decreases by 5% each year. This tariff scheme makes it possible for the company to break even and not receive any profit. The government invests in **both** increasing the irrigation/drainage land area **and** improving the reliability of the current water supply infrastructure;
3. Option 3 (Upper-Bound tariffs): The government adopts an upper-bound pricing model with a three-component per ha tariff. The first two components of the tariff are identical to those in option 2, while the third enables the company to receive an 8.1% (nominal) rate of return on capital.[3] The third component is paid by every owner of agricultural land with potential access to amelioration infrastructure, but in this option the tariffs cover the real costs of service (i.e. operation and maintenance costs and rate of return on capital). In this option, as in option 2, the government provides subsidies to farmers on the fixed part of the tariff (now formed by components 2 and 3), starting from full subsidy and decreasing by 5% each year. The investment patterns are identical to the previous option.

[3] The choice of the rate of return on capital was made by Georgian Amelioration and was provided with the tariff calculations.

The decision to remove government's investment in the reliability of water supply infrastructure from option 1 significantly affected our estimation results and made it more difficult to disentangle the expected impact of the new tariff methodology from the impact of investing in the improvement of supply reliability (which has nothing to do with the tariff methodology). Therefore, to make the analysis more transparent and the results more comparable, in what follows we also refer to an additional option, which we call option 1*, in which the government keeps the current tariffs BUT invests in water supply reliability as in options 2 and 3.

We have compared the three options (and option 1*) across a number of different dimensions, adopting a multi-criteria approach based on both quantitative and qualitative analysis. In agreement with GA, we have limited our analysis to just six irrigation/drainage systems (five irrigation and one drainage) that were identified by GA as representative of the systems currently serviced.

A quantitative CBA was performed on the basis of the tariff values provided by GA, together with its cost and investment data and information about government subsidies. We also collected all available information about factors affecting the profitability of agriculture farms and used it to model the decision making process of farmers (working under the assumption that they would always choose to behave in a way that maximizes their profits). Using all these data and based on the existing evidence, economic theory, consultations with stakeholders and the opinion of our agricultural experts, we built a model describing how agricultural activities will develop in the following five years (the maximum time before tariffs must be reconsidered, also coinciding with the end of the 2020 agricultural strategy).

In short, farmers' decisions about whether keep or sell land; to irrigate it or not; what to cultivate; and what type of irrigation technology to apply, are all affected by (among other things) the level of the tariff charged and by the reliability of the service. Farmers' choices, on the other hand, determine their costs and revenues, agricultural productivity, GA's revenues, and the impact that a given tariff methodology has on the government budget.

After calculating the net benefits for each stakeholder, we proceed to discount them at the estimated social discount rate (8.7%[4]) in order to compare the different alternatives.

Unfortunately, due to data limitations and time and resource constraints, not all impacts could be quantified. Impacts that could not be quantified have been analyzed from a qualitative point of view, on the basis of economic theory, international and local experience, and making use of all available information.

The main results are summarized in the table below.

[4] The real discount rate on 5-year government loans.

Table 1. Summary of Main Results

EVALUATION CRITERIA	OPTION 1 (Status Quo)	OPTION 2 (Lower Bound)	OPTION 3 (Upper Bound)	OPTION 1* (Status Quo w/ investments in reliability)
Benefits (NPV) for Farmers over 5 years (mln GEL)	1,546	1,669	1,669	1,669
Costs (NPV) for Farmers over 5 years (mln GEL)	56	90	106	65
Benefits – costs (NPV) for Farmers over 5 years (mln GEL)	**1,489**	**1,579**	**1,564**	**1,604**
Benefits (NPV) for Georgian Amelioration over 5 years (mln GEL)	122	226	369	226
Costs (NPV) for Georgian Amelioration over 5 years (mln GEL)	122	128	128	128
Benefits – costs (NPV) for Georgian Amelioration over 5 years[5] (mln GEL)	**-**	**98 (43 thsd. GEL from the company's operations)**	**241 (144 mln GEL from the company's operations)**	**99 (all net benefits come from investment)**
Benefits (NPV) for the Government over 5 years (mln GEL)	-	0.008	25	-
Costs (NPV) for the Government over 5 years (mln GEL)	115	189	342	217
Benefits – costs (NPV) for the Government over 5 years (mln GEL)	**-115**	**-189**	**-317**	**-217**
Effectiveness 1	-	+ +	+	+
Effectiveness 2	- - -	+ +	+ + +	- - -
Effectiveness 3	- - -	+ +	+ +	-
Effectiveness 4	-	+ + +	+	+ +
Feasibility / Ease of implementation	N/A	-	- -	+ +
Minimization of risks associated with the reform	N/A	+ +	+	+ + +
Maximization of potential benefits associated with the reform	N/A	+ +	+	+

The results in Table 1 indicate that options 2 and 3 affect the stakeholders in significantly different ways.

Farmers are better off under option 2 (and even more so under option 1*) as they have to pay a lower tariff than under option 3, while their benefits from irrigation do not change.

GA is better off under option 3, as it is the option providing the largest revenues without increasing its costs.

Finally, the government budget is significantly better (less negative) under option 2 than under option 3, mostly because of the significant increase in subsidies paid to cover part of the increase in the tariff.

Although these quantitative results fail to include many potential impacts that could not be quantified due to insufficient data and difficulties associated with modeling them, these can be partially predicted based on economic theory and on the existing evidence from other countries. For example, our quantitative results underestimate the opportunity cost of public funds invested in irrigation/drainage and spent on direct/indirect subsidies; as well as any possible benefits for industries in the agricultural value chain and the rest of the economy. Our quantitative estimates also underestimate the negative impact of introducing an excessively high tariff on the profitability and competitiveness of the agricultural sector (particularly significant for option 3). We will discuss this issue in greater detail below.

Considering **"Effectiveness Criteria 1"** (contribution to the development of a reliable water supply through renovation and rehabilitation of infrastructure), we gave a slightly higher score to Option 2. While it is true that the investment in reliability would be the same in options 2 and 3, the service providers have an arguably stronger incentive to ensure service supply reliability under the lower-bound scenario. In fact, under option 3, most of their revenues are generated from a fixed component that does not depend on the quality of service provided, which makes it much easier for the company to cover its costs even at lower levels of contracting efficiency and compliance.

Considering **"Effectiveness Criteria 2"** (contribution to the financial sustainability of amelioration SPs and eliminating dependency on government subsidies), we gave a slightly higher score to option 3 than to option 2. While still extremely dependent on (now indirect) public subsidies, under policy option 3 the service provider can potentially become profitable in the very first year of the tariff policy implementation and can cover a greater fraction of its costs with the money paid by farmers.

Considering **"Effectiveness Criteria 3**" (contribution to the efficient allocation of water across alternative uses), we gave similar scores to policy options 2 and 3. As investment in reliability is identical in both options and the variable component of the tariff does not change, farmers have similar motivations to install water-saving irrigation technologies in the two policy options. However, it should be noted that the higher tariffs under option 3 carry the risk that farmers will have less disposable income to invest in modern irrigation. In this case, especially in the presence of limited access to credit and the high cost of capital, water savings might be smaller in option 3. However, neither of the two options receives the highest score as water metering is unfeasible at this stage.

Considering **"Effectiveness Criteria 4"** (contribution to the competitiveness of Georgia's agricultural sector by providing reliable irrigation and drainage services at reasonable prices), we gave the highest score to policy option 2, as it gives farmers incentives to irrigate with better technologies, while increasing their production costs the least. It is important to note that at the current values of the tariffs (and in absence of public subsidies to farmers), option 3 would mean Georgian farmers facing water related costs well above those of neighboring countries. This could depress the land market and reduce incentives to engage in agricultural activities, even for the potentially most productive farmers.

As for other criteria, policy options 2 and 3 have a lower score in **feasibility** and **ease of implementation** as they primarily depend on the effectiveness of government investment in improving water supply reliability. Option 3 receives the lower score of the two because of the higher likelihood of resistance from farmers under this option making it more difficult to implement.

Option 2 is the best in **minimizing the negative socio-economic consequences** associated with the introduction of the new tariff methodology and it has the smallest (negative) impact on **government finances**.

Option 2 is also better **in maximizing the potential gains** from the introduction of the new tariff methodology. On one hand, it requires GA to keep high service provision standards in order to achieve the contracting and collection goals necessary to break even. On the other hand, it creates identical incentives for Georgian farmers to switch to better irrigation technologies while leaving them with a higher disposable income to be re-invested in their activities.

In addition, to provide a clear understanding of the impact of each policy option on the amelioration sector, we analyzed how the sector's costs will be distributed among agents. Table 2 shows the expected government spending in the amelioration sector and the expected impact on farmers. Data about the estimated investment required in amelioration infrastructure were provided by GA.

Real Government Spending on the Amelioration Sector under the Analyzed Options

One of the questions raised by some stakeholders was how the different options would impact the government budget in the next 5 years if one included also the investments necessary to expand the command area. In response, we have produced Table 2.
In Table 2 we calculated the Present Value (PV) of the total expected government spending in the Amelioration sector during the next 5 years. Government spending in the Amelioration sector in the coming 5 years will result from the sum of two main components: 1) Government direct contribution to the investments needed to expand the area potentially serviced, and 2) Government expenditures associated with the "ordinary functioning" of the sector under each of the proposed options[6].
We have excluded option 1 from this table as it is not comparable with the other options in terms of required future investment and it is anyway inferior to all others in terms of net benefits. Data about the estimated investment required in amelioration infrastructure were provided by GA.

Table 2. Government Spending on Amelioration Sector under the Analyzed Options (Present Value, in MLN GEL).

		Option 1*	Option 2	Option 3
1	**Additional investment required to expand the area potentially serviced[7]**	267	267	267
2	GA excess resources generated in the next 5 years, under different tariffs (from RIA)	0	0.043	144
3	**Required direct Government Investment in the sector[8] [1-2]**	**267**	**267**	**123**
4	Other ("ordinary") Government expenditures in the Ameliorations sector in the next five years [estimated budgetary impact of the different options – from RIA (excluding investment in increase of command area)]	216	189	317

[6] We are aware of the fact that these are just approximate figures (RIA estimates, for example, refer to the impact of the alternative options keeping the command area fixed) and we emphasize that Table 2 is just illustrative.

[7] Estimates provided by Georgian Amelioration i.e. the investment needed to increase existing command area.

[8] Conditional on GA reinvesting in the amelioration infrastructure ALL its NET Benefits – excluding contributions in kind

5	**Total Government expenditure in Amelioration sector (5 year horizon)**	**483**	**456**	**440**
6	**Farmers' additional payments (with respect to status quo)**	**0**	**25**	**41**

In row 1 of Table 2 we report GA estimates of the financial resources required over the next 5 years in order to expand the potentially serviced area to the desired level (267 mln GEL[9]).

In row 2 we report the excess resources (revenues exceeding the operation and maintenance costs) that GA should be able to generate during the coming 5 years under each option. These resources could potentially be used by GA to partially finance the above mentioned investments. Only in Option 3 GA contribution could be significant, provided that: 1) compliance and contracting rates do not decline with respect to the other option; 2) GA manages to collect the fixed component of the tariff from the farmers who do not sign a contract with it, without a significant increase in collection costs; 3) GA agrees to use ALL its profits to finance the development of the amelioration infrastructure.

Subtracting from the financial needs of the sector GA's potential contribution we can identify the amount Government should finance directly under all three options (row 3). Option 3 clearly requires (if all above mentioned assumptions are satisfied) a substantially lower direct investment from the Government.

Determining the total impact on the Government budget associated with each of the analyzed options over the next 5 years requires adding to the Government contribution to future investments the other expenditures - relative to the amelioration sector - that will also be financed by the Government under the three options in the same period. These expenditures, estimated during the RIA process, are indicated in row 4.

Once investment and other expenditures are summed (row 5), the differences between the budget impacts of the three options under analysis are greatly reduced. In fact, most of the apparent reduction in Government investment expenditures in option 3 is offset by the increased amounts paid by the Government to GA as "subsidy to farmers".

Basically, the only real benefit the government budget will receive in the coming 5 years from the introduction of Option 3 will be due to the shifting of part of the investment costs to increase the command area on the farmers (row 6).

It is also important to note that the (limited) gains for the government budget will not necessarily extend beyond the 5th year. This is due to the fact that, when most of the required investments to increase command area will have taken place, Option 3 – as it can be easily deduced observing rows 4 and 6 – will be imposing a substantially higher costs both to the government (until subsidies will have been phased out) and to farmers.

[9] This amount is the NPV of the required investments over the next 5 years.

Final recommendations

Our analysis shows that introducing the new tariff methodology can contribute to the achievement of the goals set by the Georgian government. However, this will happen only in the presence of sufficient investments in the reliability of irrigation services and under properly functioning land and financial markets, with close monitoring of SP's management and cost structures. The last two points are particularly critical as under option 3 the SPs obtain most of their revenues from the collection of the fixed component of the tariff – a component paid by all potential customers, regardless of the quality of the service provided. In addition, we should remember that even the variable component of the tariff is calculated on the basis of the company's costs. This is particularly important as it means that higher SP costs directly translate into higher tariffs, even if they are due to inefficient management.

The hasty introduction of this methodology (particularly of option 3, the upper-bound scenario that implies significantly higher costs for both the government and farmers) when all these preconditions are not fulfilled presents high risks. Such risks include the loss of competitiveness of the agricultural sector and widespread socio-economic costs (which would be highest for the most vulnerable subjects) that could potentially fuel resistance to the implementation of the reform and even cause political unrest.

In order to maximize the benefits from the introduction of the new tariff methodology while minimizing the associated risks, our recommendations are the following:

1. Adjust the tariff methodology in order to change the incentives faced by SPs;
2. Design a logical sequence of reforms, starting by building the necessary preconditions;
3. Proceed incrementally;
4. Continuously monitor internal and external developments;
5. Periodically reassess the situation and, if necessary, adjust the long-term strategy accordingly.

A possible and reasonable implementation strategy might look as follows:

Phase 1:

- Investments in infrastructure aimed at increasing reliability/quality of service;
- Completion of the land registration process and liberalization of access to the land market[10];
- Awareness raising campaigns about the potential gains of adopting more modern irrigation methods;
- Broadening the coverage of financial support programs for investments in more modern irrigation methods (conditional on land registration);
- Thorough auditing of service providers and a re-assessment of inventories (including inventory evaluation);
- Implementation of regulatory accounting and regulatory auditing to ensure the high quality and transparency of the tariff setting process;
- Establishment of a regulatory body in charge of monitoring SP operations and the adequacy of the proposed tariffs.

As a result of Phase 1, one could reasonably expect an increase in contracting and collecting efficiency (an increase in irrigated area), leading to an increase in GA's revenues even at the current tariff levels (which could be slightly increased during Phase 1 as investments in reliability take place). The implementation of Phase 1 could also be expected to lead to a decrease in government transfers, a rise in farmers gradually switching to more modern irrigation methods, and to a better allocation of agricultural land.

Phase 2:

[10] Land registration should be encouraged by only allowing access to government programs supporting agricultural activities to those owners of registered land and on the basis of the amount of land registered.

- The regulatory body and SPs should agree on a reasonable tariff (including both fixed and variable components – preferably the lower-bound tariff);
- A gradual and well-advertised introduction of the new tariff. The total amount of the tariff and its structure (fixed and variable components) is announced. The government starts by subsidizing farmers, but declares its intention to reduce its subsidies over time according to a preannounced schedule;
- Awareness raising campaigns and financial support programs continue for the entire transition period;
- Regular auditing of service providers and a re-assessment of inventories take place;
- The regulatory body constantly monitors SP activities through a regulatory accounting and auditing process. A re-assessment of the expected impacts of the lower- and upper-bound tariffs based on the data available.

Phase 3:

- The final tariff methodology is introduced and the amount of the tariff is periodically updated (over a period of 3-5 years) based on the evolution of the cost and revenue structure of the SPs and the water market;
- Subsidies, the awareness campaigns and financial support programs are phased out.

The successful implementation of such an agenda (and, more generally, of any reform effort) will be impossible without **the long-term commitment of stakeholders**, especially the **government**, which needs to become the driving force behind the process.

In particular, the government will have responsibility for:

- investing in service reliability;
- ensuring that all required legislative and administrative frameworks are in place;
- ensuring that all affected stakeholders are involved in the process.

While potentially constituting an improvement over the status quo, each of the tariff methodologies we have compared suffer from a major flaw that we have already anticipated. According to the tariff estimates we have received, a large part of the SP's revenues come from a component unrelated to the quality of service provided. This component is imposed on all farmers in the areas potentially serviced, even if no contract is signed. It is obvious that, if maintained, such a structure will provide limited incentives for SPs to increase service quality. These incentives could be substantially increased with a different tariff structure, giving more weight to the variable component and also linking the fixed component to the real demand for irrigation services from farmers (instead of linking it to potential demand). Such a tariff would enjoy an additional benefit: farmers would be free to choose the best source of water for irrigation, without being forced to subsidize the SPs.

2. PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

2. 1. ORGANIZATION AND TIMING

The Regulatory Impact Assessment (RIA) of the irrigation tariff methodology was implemented between 13 November 2015 and 11th February 2016.

On 13 November, the RIA team started checking the available data, performing a review of the relevant literature, and organizing interviews and meetings with the main stakeholders.

On 16 November, the RIA team held a preliminary meeting with G4G to explore the potential objectives of the RIA as well as possible scenarios for the analysis. After the meeting, the RIA team received the draft law on the irrigation tariff methodology.

The first milestone, including the preliminary meeting for the definition of a detailed action plan and the preliminary discussion of the objectives of the RIA, was completed by 16 November.

On 19 November, the RIA team met two main stakeholders: Georgian Amelioration (GA) and the Ministry of Agriculture of Georgia (MoA). The goal of the GA meeting was to develop an understanding on ongoing issues and challenges in the sector, current constraints, problems related to tariff payments, and the company's view on the proposed tariff methodology. The meeting with the direct supervisory body from the GoG (i.e. the Amelioration and Land Management Department of the MoA) helped develop an understanding of the government's view of the reform process, as well as its commitment and future plans.

On 20 November, the team developed tentative RIA scenarios based on the consultations.

The second milestone, the detailed action plan, was developed and sent to G4G on 21 November.

On 26 November, the RIA team had a meeting with Nikoloz Abuashvili (advisor of GA's director) to discuss a preliminary structure for the cost-benefit analysis and agree on the specifics of the proposed model. GA also provided, as had been requested, the historical data of the company and its development plans.

On 26 and 27 November, meetings and consultations with farmers occurred. Two focus groups were conducted in the Marneuli and Akhmeta municipalities. The agenda for the meetings with stakeholders included the following items: their views on the current situation, satisfaction with service supply quality, loss estimates during past water shortages (if any), concerns about future possible changes, estimated price responsiveness, etc. RIA team members also met the head of the Akhmeta municipal council to discuss his views on the amelioration system.

On 2 December, RIA team members met the Georgian Farmers' Association (GFA) to discuss their experience with amelioration. The decision was made to conduct a survey with the help of the GFA to assess farmers' willingness to pay for irrigation/drainage services. The questionnaire and sample design for the survey were developed and presented to the GFA within a day and the farmers' survey then took place between 4 and 10 December.

On 4 and 8 December, the RIA team had meetings with G4G and GA. The goal of the meetings was to update the main stakeholders on the status of the project and familiarize them with the proposed structure of the cost-benefit analysis.

On 5 December, a focus group with farmers was conducted in Senaki municipality in western Georgia to identify current issues related to drainage.

On 9 December, the RIA team received calculated tariff rates using the new methodology for the lower- and upper-bound scenarios for different command areas. Based on this data, and in consultation with GA, six amelioration schemes were chosen for CBA.

On 11 December, RIA team representatives met with the amelioration reform working group to make sure that the planned methodology and approach was relevant and in line with the reform.

The RIA team contacted the MoA's regional information consultation centers in eleven target municipalities on 11 December and requested data on the shares of eight major crop types in total cultivable areas. All requested data was received by 14 December.

The period of 14-25 December was devoted to data analysis. On 16 December, the RIA team presented the preliminary results of the cost-benefit analysis to G4G and on the next day presented them to GA. All comments and suggestions raised during the meetings were incorporated into the final model.

The third and fourth milestones – the summary of the data collection process and the preliminary results of the data analysis respectively – were sent to G4G on 25 December.

The mid-term report was delivered to G4G on 30 December.

All comments on the midterm report were received by 11 January 2016.

On 12 January, the RIA team met representatives of G4G to discuss their comments.

The presentation of the RIA results with the main stakeholders took place on 20 January.

The final RIA report was submitted to G4G on 11 February 2016.

The RIA team included ISET-PI researchers and was supported by ISET Assistant Professor Norberto Pignatti (a CBA and RIA expert) and external irrigation consultant Simon Appleby. The team included researchers with experience in agricultural economics, agricultural insurance, resource economics, CBA and RIA. Tasks were divided in accordance with competences of the researchers. The external consultant assisted the team with his expertise on the current market situation of the irrigation system in Georgia, and shared related literature about international experiences and existing data.

The decision making approach adopted by the team was collegial and coordinated by the team leader.

2.2. CONSULTATION AND EXPERTISE

Consultations with various stakeholders were held throughout the project implementation period. Data collection mainly took place during 16 November to 10 December.

The first step was identifying the main stakeholders and categorizing them in an influence-interest matrix format. Table 2 presents this matrix.

Table 3. Influence-Interest Matrix

INFLUENCE / INTEREST	LOW INFLUENCE	HIGH INFLUENCE
Low Interest	Local Government Representatives	Parliament of Georgia

High Interest	Farmers GFA	GA Amelioration and Land Management Department of the MoA Amelioration reform working group

Several meetings were held with these stakeholders in order to get a comprehensive overview of the irrigation system in place, to reveal current issues and problems facing each stakeholder, and to identify possible solutions.

Multiple methods were used to reach this goal: desk research, requests for official data, face-to-face consultations, a phone survey, focus group discussions and in-depth interviews. Table 4 below summarizes the information collected and the methods used.

Table 4. Description of data and research methods

DATA AND INFORMATION	METHODS USED / SOURCE
International experience on cost recovery and water pricing for irrigation and drainage	Desk research
Yearly data about the number of irrigation and drainage consumers by covered area and region; Historical data about irrigation tariffs; Historical data of GA costs; Annual billing data, collecting efficiency of irrigation and drainage tariffs	Requesting information from GA
Amount of government subsidies for each year and future plans	Requesting information from GA and the MoA
GA development plans	Requesting information from GA
Administrative, infrastructure, operation and maintenance costs of GA	Requesting information from GA
Calculated tariff rates according to the proposed draft law for several amelioration systems	Requesting information from GA
Government plans and objectives to develop the Georgian amelioration system	Desk research, particularly an analysis of the GoG's 2020 Strategy and the Strategy for Agricultural Development in Georgia (2015-2020)
Farmers' willingness to pay; Average yields of rain fed and irrigated crops[11]; Crop financial gross margins for Georgian farmers;	Phone survey and focus groups with farmers; Desk research[12]

[11] This was revealed via desk research as well as field work.

[12] Particularly, ILMDP 2015.

Farmers' willingness to switch to modern irrigation technologies	
Shares of eight major crop types in total cultivable areas in eleven target municipalities	Requesting information from the MoA's Regional Information Consultation Centers in target municipalities
Approximates of change in irrigation technologies; Investment cost of different irrigation technologies; Optimal irrigation choice for different cultures; Water usage for different irrigation technologies; Forecasted change of cropping patterns from 2015-2020	Requesting information from the consultant

Consultations with the different stakeholders served different purposes. The meetings with G4G at the beginning of the RIA were aimed at defining the general purpose of the analysis. Later meetings with G4G were devoted to project updates, the discussion of the collected information, and the opinions of different parties.

Consultations with the MoA provided insight about the position of the government of Georgia regarding the amelioration system and the level of their commitment to continue subsidizing the sector.

Consultations with GA served to identify all the problems the company now faces, the reasons behind each of them and possible solutions. GA also provided calculated tariff rates for the analysis according to the new methodology.

The meeting with the amelioration reform working group provided clarifications about the reform strategy, plans and proposed types of regulations for the sector.

Farmers' positions were clarified during the focus group discussions and the in-depth interviews conducted with members of the farmers' association. The key findings of the consultations with the main stakeholders are summarized in Table 5 below.

Table 5. Summary of Consultation Process

STAKEHOLDER / STAKEHOLDER GROUP	METHOD OF CONSULTATION	SUMMARY OF RESPONSES	COMMENT
G4G	Interviews, meetings: 1. 16 November 2. 16 December	1. The goal of the first preliminary meeting was to explore the potential objectives of the RIA as well as possible scenarios for the analysis. During the meeting, G4G presented the major changes in tariff methodology and the options provided by the draft law. The following issues were discussed during the meeting: • The objectives and targets of the reform of the irrigation and drainage tariff methodology; • Tariff reform options: status quo, lower bound tariffs (ensuring the viability of the system by operating at a break-even point) and higher bound tariffs (ensuring the profitability of the system); • Defining key stakeholders;	Response taken into consideration

		• Major challenges in the existing setup: the land registration problem and high dependency on state subsidies; • Possible gaps in institutional memory were mentioned, because the system was restructured in 2010; • Four tariff schemes were proposed: per ha, per cubic meter, per normal allocation[13] and per application[14]. • Options to group customers based on: (i) location, (ii) size, and (iii) type; • Adjustment of proposed tariff schemes by type of infrastructure (water saving/efficient); • Available literature about the Georgian irrigation/drainage system and possible sources of data. 2. RIA team presented the preliminary results of the CBA.	
GA[15]	Interviews, meetings 1. 19 November 2. 26 November 3. 5 December 4. 8 December 5. 17 December	1. The goal of the meeting was understanding ongoing issues and challenges to the sector; the current constraints and problems related to tariff payments; the company's view on the proposed tariff methodology; and possible scenarios for the analysis. 2. The goal of the meeting was to discuss the preliminary structure of the CBA with GA and agree on the specifics of the proposed model. The RIA team agreed that the analysis will be done for four regions (West Georgia, Shida Kartli, Kvemo Kartli and Kakheti) for six amelioration systems based on the tariff rates provided by GA. 3 & 4. The goal of these meetings was to update the main stakeholders on the status of the project and familiarize them with the proposed structure of the CBA. 5. The RIA team presented the preliminary results of the CBA. GA suggested making some changes in the model. In particular, incorporating	Response taken into consideration

[13] Irrigation tariff per normal allocation means that tariff rates reflect established water norms for different crops.

[14] Irrigation tariff per application means that price is charged based on the crop planted and its water needs based on specific standards.

[15] A G4G representative attended all meetings with GA.

		the effects of switching to modern irrigation technologies.	
External consultant Simon Appleby	In-depth interviews on: 1. 16 November 2. 19 November	1. Consultant discussed the current amelioration system in Georgia and shared international experience related to amelioration tariffs. 2. Consultant shared his ideas about how the costs and benefits of the reform could be quantified.	Response taken into consideration
Amelioration and Land Management Department (MoA)	Interview 19 November	The main purpose of the meeting was to understand the government's view of the reform process. At this stage, the state's policy towards the development of irrigation/drainage systems is to increase the command area. To achieve this goal, the government is undertaking infrastructure construction and rehabilitation projects that will be subsequently given to GA as an asset. At this stage, the ministry sees a need for a transparent and straightforward tariff methodology, however it does not have an official vision on what the state's actions on new tariffs will be. The only option that GoG is discussing at this stage is giving direct customer subsidies after the introduction of new tariffs. The GoG's position is to address the issue of the Soviet mentality by periodically decreasing customer irrigation subsidies, starting from a partial subsidization of price changes.	Response taken into consideration
Farmers, Agro businesses	Focus groups 1. 26 November (Marneuli municipality) 2. 30 November (Akhemeta municipality) 3. 5 December (Senaki municipality) Farmer's survey	The focus groups helped reveal: 1.Current problems of farmers who are GA customers; 2.General problems of all farmers related to irrigation and drainage; 3.Some positive tendencies of the amelioration system; 4. Farmers' future expectations.[16] The farmers' survey[17] revealed that: 1. Farmers are losing on average 25-50% of their crop harvest because of droughts and insufficient irrigation;	Responses were partially taken into consideration

[16] A detailed summary of focus group discussions is presented in Appendix 1.

[17] The total number of respondents was 119. The average amount of cultivated land was 33 ha. The number of respondents with over 5 ha of land was 37 (31%), the number of respondents with below 5 ha was 82 (69%). The survey questionnaires are provided in Appendix 2.

		2. Farmers' willingness to pay for good quality irrigation does not exceed 300 GEL per ha. A total of 70% of the farmers surveyed will only pay up to 100 GEL, 24% 100-200 GEL and only 5% are eager to pay 200-300 GEL per ha. 3. 59% of farmers will change crop if better quality irrigation is in place.	
All stakeholders	Workshop TBA	TBA	

3. PROBLEM DEFINITION

3.1. POLICY CONTEXT

The Government of Georgia (GoG), with the cooperation and support of international donors, intends to reform the amelioration (irrigation and drainage) sector in Georgia. The reform envisages elaborating a sector development strategy, introducing a new amelioration law, and developing a methodology for setting tariffs on irrigation and drainage services.

The Georgian law "On the Amelioration of Lands" was abolished on 17 December 2010 with introduction of an interim regulatory framework from the Georgian National Energy and Water Supply Regulatory Commission (GNERC) and the GoG (as was envisaged under the cancelation of the law). Today, the Georgian amelioration sector is regulated based on three decrees:

(i) **Decree #2 of 11 February 2011 of the Georgian National Energy and Water Regulatory Commission "On Setting Amelioration Tariffs"** – sets tariffs for amelioration service providers (SPs). Without any methodological basis, the decree defines three tariffs for SPs around the country. The tariffs for irrigation and drainage are set annually per hectare (ha) and are different in eastern and western parts of the country. Eastern Georgia, with relatively limited water resources, has a 75 GEL irrigation tariff but does not have a specific tariff defined for drainage. Western Georgia is abundant with water resources and has irrigation tariffs of 45 GEL and a drainage tariff of 40 GEL. All three tariffs include value added tax (VAT). As the tariffs are set annually, farmers can irrigate as many times as needed.

(ii) **Decree #409 of 31 December 2013 of the Government of Georgia "On Technical Regulation of Operation of Amelioration Systems"** – sets standards for operating amelioration infrastructure and covers all technical aspects, including monitoring rules.

(iii) **Decree #31 of 3 January 2014 of the Government of Georgia "On Technical Regulation of Exploitation of Reservoirs Used for Irrigation Purposes"** – sets rules for using water from reservoirs for irrigation purposes. Aside from technical specifications, the decree sets rules for the optimal use of water when demand exceeds supply. In this case, the first priority users are drinking water suppliers and the second are irrigation SPs, after which other users, such as fisheries and hydropower, can be satisfied.

Originally, the GNERC decree set amelioration tariffs for three service providers in eastern Georgia (Sioni-M Ltd., Mtkvari-M Ltd. and Alazani-M Ltd.) and one service provider in western Georgia (Kolkheti-M Ltd.). All four service providers were under government ownership and in 2012 were merged into Georgian Amelioration Ltd. (GA), which has the GoG as a 100% shareholder. GA currently holds most of the irrigation and drainage infrastructure around the country and is thus a government monopoly for the provision of amelioration services.

In general, the amelioration sector is characterized by high costs for infrastructure investment, operation and maintenance. As the main customers of irrigation and drainage services are farmers with very limited ability to pay for expensive services, the sector is normally not attractive for private investors. Furthermore, to ensure food security and poverty reduction in rural areas the government tries to keep costs low. Investments in and further subsides for irrigation systems are thus part of the development expenditures of many countries. Given the involvement of the government in the sector, through direct and indirect subsidies, the sector in most countries is regulated. This, of course, does not prevent the possibility for farmers in water-abundant countries (such as Georgia) deciding to build their own irrigation infrastructure for their plots of land using alternative water sources. Such actions are harder for drainage, for which individual initiatives are not as effective as collective ones.

At this stage, a large part of the amelioration infrastructure of Georgia has deteriorated. It operates inefficiently and provides unreliable services. Government intervention in the sector is essential to:

1. Develop a reliable water supply through the renovation and rehabilitation of infrastructure;

2. Ensure the financial sustainability of amelioration SPs (eliminate dependency on direct government subsidies);
3. Ensure the efficient allocation of water across alternative uses;
4. Increase the competitiveness of Georgia's agricultural sector by providing reliable irrigation and drainage services at reasonable prices.

3.2. PROBLEM DEFINITION

Irrigation water charging usually pursues two main policy objectives: cost recovery (financial sustainability) and demand management (resource sustainability).

Cost recovery considers full supply costs (O&M as well as capital costs), but does not examine opportunity costs or externalities associated with water allocation. Demand management seeks to encourage the most productive use of water. In this context, raising prices should force irrigators to irrigate more efficiently (reducing water consumption) and lead to saving more water.

In most countries the water price is set aiming at cost recovery. However, if the full cost recovery price is much lower than the opportunity cost of water (as is typically the case in agriculture) it will do little to reduce water demand to a sustainable level. When designing policy interventions in the irrigation sector, these two objectives (financial sustainability and demand management) are often combined, but the recommendation is to match water charging with just one of the objectives (FAO, 2004).

There are understandably large differences in charges and charging mechanisms in different countries (as well as within single countries). These reflect different water sources, degrees of water scarcity, irrigation schemes with diverse technologies, farm types, and socio-economic objectives.

The current irrigation and drainage **tariffs** in Georgia do not reflect either of the objectives mentioned above. They are set at such a **low** level that the state-owned amelioration company GA can never break even, let alone invest in new capital improvements, without financial support from the state.

This problem is made worse by the fact that tariff **collection rates** are also **low** in Georgia. GA currently manages to collect only 52% of its credit. The combination of low tariffs and low collection rates leads to the situation in which GA can collect approximately 30%[18] of what it would need to cover the costs associated with the provision of water to farmers. Without solving compliance issues, even setting a tariff sufficient for covering GA's operation and maintenance costs would not ensure the full financial sustainability of GA due to delinquent accounts and the theft of water from irrigation systems.

These problems are particularly relevant in terms of drainage services. Here, collection rates are almost 0%. This is hardly surprising, as it is not possible to exclude farmers from the service even if they do not pay for it. Once the drainage infrastructure is in place and the height of the water table has been changed, everyone in the area will benefit. Also, from an economic point of view, even if it were possible to exclude those who do not pay, doing so would be inefficient as their increased productivity does not cause any extra cost to the collectivity.

Georgia is not an exception.[19] Low collection rates are typical features of irrigation/drainage systems in many countries: Italy, Turkey, Argentina, Bangladesh, India, Macedonia, Pakistan, etc. (Easter & Liu, 2005). It should be noted that the rates frequently depend on the structure of the supply system. Collection rates tend to be higher in countries where headworks and primary channels are controlled by one entity, which sells wholesale water to irrigation service providers, who, in turn, sell the water on to large retail customers and water-user co-ops. Secondary and tertiary channels are typically owned and maintained by irrigation service providers and co-ops.

[18] Source: GA. In the first eight months of 2014, the cost of service delivery for farmers was 3 mln GEL and tariff revenues were 0.9 mln GEL.

[19] In 2014, the collection rate was 52% in Georgia. Source: GA.

Payment default under such circumstances can result in the water supply being cut off, which creates a powerful incentive for market players to collect water tariffs efficiently and pay in a timely manner. Conversely, the lack of such structures makes it harder to collect service fees.

The main factors making collection of service fees more problematic in Georgia are:

i. Absence of water-user associations managing collection and secondary/tertiary channels;

ii. The Soviet legacy of receiving free water, making it harder to collect irrigation/drainage service fees. Any attempt to recover the true costs of utility service provision in villages is generally met with fierce resistance from villagers and various lobby groups. This issue is as much political as it is budgetary;

iii. Channels are mostly open-topped and concrete-lined, meaning that anyone can pump water out of a channel to their own property using their own pumps and pipelines without significant restrictions. Compounding this problem is the fact that with less than 20-30%[20] of farmland being properly titled on the cadastral map, when theft is discovered it is difficult to determine whose property is being illicitly irrigated, and enforcement is thus poor. In addition to the difficulty in actively monitoring and preventing water theft, GA does not have the legal basis to apply direct sanctions against such practices.[21] Therefore, under such circumstances, few small water users bother signing contracts or paying water bills as they can steal water with impunity. All of these factors cause low rates of both collection and contracting.

iv. Finally, even when GA signs contracts with farmers holding untitled land and makes a demarcation with GPS points for the squatters, uncertainty remains. According to GA, land plot sizes end up being under-estimated by 25% on average.

The government transfers substantial funds to Georgian Amelioration through the Ministry of Agriculture's budget (in some cases supplemented with aid funds). There are two main items:

- Direct subsidies covering Georgian Amelioration Ltd.'s operational deficits (14 mln GEL);
- Money spent to finance capital projects – such as increasing the total irrigable area;

Soviet-era irrigation and drainage systems received very little maintenance from 1991 onwards, and subsequently experienced regular collapses and breakdowns throughout the country. More than 80% of Soviet-era systems were inoperative by 2003. This was as a result of poor government finances, corruption, and mismanagement.

In terms of rural infrastructure, from 2003 to 2012 the emphasis was on roads, gas, electricity and drinking water supplies. Most irrigation system remediation was done with aid money on an ad-hoc, project-to-project basis, with little commitment to a long-term infrastructural overhaul of irrigation and drainage.

The existing tariff methodology does not discourage **wasteful water use**. This constitutes a problem because, as the irrigable area increases, competition between irrigation, technical water users, hydropower plants and drinking water supplies will intensify and wasting water will generate economic costs. As the current fees are based on the area irrigated, rather than the volume of water used, there is little financial incentive for irrigators to use water prudently. In addition, primitive flood irrigation methods are used on more than 90% of Georgia's irrigable land, resulting in wastage of almost 70%[22] of irrigation water compared to that used in modern sprinkler or drip systems.

Although better results can be achieved on-farm (by using better weed control, better soil composition, less salinization, less fungal diseases, making sloping land that can be more effectively irrigated, etc.), many small- and mid-scale farmers do not invest in modern water-saving

[20] Source: Strategy for Agricultural Development in Georgia 2015-2020 http://moa.gov.ge/fileman/Uploads/STRATEGIA_ENG_print.pdf

[21] This means that the only way for GA to act against such behaviors is through the courts, which is a much more costly and slow procedure.

[22] External expert's judgment.

irrigation technologies. This is primarily due to unreliable water supply and financial constraints. Investing in modern technologies can be costly and borrowing is expensive[23], thus making capital investment in modern water-saving irrigation equipment unwarranted. Poor education and a lack of awareness about the potential gains resulting from the adoption of more modern irrigation technologies leads to low levels of investment in irrigation technologies.

The main groups of society that are affected by the changes in tariff methodology are the following:

Farmers

Commercial farmers: These represent farms organized as limited liability companies (LLCs), with professional management, proper accounting and regular tax payments. Around 2,000 such farms operate in the country.[24] Such farms are relatively professionally managed, have accounting and admin systems in place, employ permanent labor, and use some modern technology. These are more likely to invest in drip or sprinkler irrigation equipment, and hence are able irrigate land on slopes or hillsides. Some are victims of channel hijacking and blockage during the irrigation season. Larger operators install on-farm water storage facilities to mitigate the risk of a channel failure during the irrigation season. These are very expensive to build, but are a sound investment given the current lack of reliability. Some of these farms have already invested in wells and reservoirs and thus do not depend on the irrigation services provided by GA. Most commercial farms are located in Kvemo Kartli and Kakheti (AgriGeorgia in Samegrelo is an exception). They are payers of land and property tax, who thus feel entitled to good government services.

SME farmers: There are around 20,000 farms in the country that are family owned and managed.[25] They are introducing modern admin, labor management, mechanization, post-harvest management and irrigation equipment. These farms are sometimes integrated with livestock production (cattle, pigs, sheep). They are payers of land tax, but pay property tax only in exceptional cases.

Smallholders: There are around 500,000 such households in the country.[26] These can be sub-classified into two categories:

Dynamic smallholders[27]: There are around 100,000 of these in the country. They work on-farm for 30-50 hours a week and reinvest most of their profits back into their microenterprises. As most smallholders do not have a sufficient collateral for loans, most of them use MFI's offering relatively expensive funds for operating capital.[28] If irrigating, they usually practice flood irrigation. They commonly derive additional income from off-farm employment such as seasonal farm labor, construction work or taxi driving. Some lease additional small plots of land from passive smallholders, either for cash or on a production-sharing basis. Most leases are unregistered. They are payers of land tax, but pay property tax only in exceptional cases.

Passive smallholders[29]: There are around 400,000 of these in the country. Such smallholders are commonly elderly and semi- or fully retired, receiving income from remittances or pensions. In some cases, the householders are of working age but not actively working due to ill health or substance abuse. In other cases, the owners are resident in the city or abroad and spend only a few weeks a year in the village picking the seasonal produce that grows semi-wild on their plots.

[23] Water saving irrigation systems range from between 2,000-9,000 GEL/ha in capital cost, with a life of 1-30 years.

[24] This is a rough estimate based on consultations with YFN Director Simon Appleby.

[25] This is a rough estimate based on consultations with YFN Director Simon Appleby.

[26] This is a rough estimate based on consultations with YFN Director Simon Appleby.

[27] Dynamic smallholders – very small household entities, often unregistered, providing sufficient scale for self-sufficiency and some small surplus for barter or sale. The operators are actively working and managing the entity on a regular basis.

[28] The interest rate on one-year loans without collateral is 31%, compared to 16% for loans with collateral. Source: National Bank of Georgia (NBG).

[29] Passive smallholders – very small households, often unregistered, predominantly subsistence farming. Have little active management of the entity and much of the household income is derived off-farm.

They rarely use irrigation and almost no such smallholders sign contracts with GA. They are payers of land tax, but pay property tax only in exceptional cases.

According to experts' estimations and farmer interviews, the existing water tariffs do not constitute a high share of farmers' costs. The farmers' survey showed that the average annual cultivation cost per ha for those farms with contracts with GA amount to 5,160 GEL.[30] Unfortunately, the data do not give the possibility to determine this figure separately for commercial, SME and dynamic smallholders – even though the relatively high amount of GEL per hectare seems to indicate that the farmers interviewed may mostly belong to the first two categories. According to the focus groups and expert estimations, farmers will react to the increase in irrigation tariff rates in the following way:

Commercial farmers: Can handle a tariff increase if supply reliability improves. They often have water-saving irrigation equipment in place so volumetric charging would not disadvantage them. Collecting tariffs from them is potentially easier.

SME farmers: The tariff increase will be unpopular. However, as most SME's lack on-farm water storage and are vulnerable to crop damage if the supply is interrupted in mid-season, a more reliable supply (due to better infrastructure funded by the reformed tariffs) would not leave them worse off overall in the long run. Volumetric charging would be hard to monitor as hydrants and meters are not present, and no water user associations are in place to handle small retail billing. A possible long-term aim in order to increase collection rates would be to consolidate such SME's in water user associations.

Smallholders: Currently, most smallholders do not irrigate, or they steal water and/or do not pay their invoices. This is unlikely to change if the tariffs are reformed. However, those who pay will have stronger incentives to stop doing so. Vital prerequisites for improving collection rates are the reform of the land title registration and the development of water user associations. Volumetric billing would be ignored in most cases unless these prerequisites are met.

Fish Farms

All commercial pond systems are recirculating. They require a certain rate of water change, dependent on the species raised. Trout, for example, require more water changes per season than carp. Typically, the inflow will exceed outflow due to seepage through the unlined bottoms of ponds and evaporation, but a large proportion of the water pumped into ponds returns to the same source it was taken from. As is the case with irrigation/drainage customers, fish farms are charged per ha (150 GEL).

Water is one of the smaller overheads for fish farmers, so a modest increase in the tariff per ha would not affect them badly. Their major overheads are feed and security (preventing people from stealing fish).

Technical Water Users

Manufacturers (including food factories, smelters, steelworks, etc.) have relatively inelastic demand under the existing infrastructure. Water conservation methodologies are a new concept in Georgian manufacturing and are typically located on the fringes of cities and towns. These techniques, which can include manufactures sinking their own bores and filling storage on site, sometimes counter manufacturer dependence on the technical water supply through channels/pipelines.

Hydropower Plants

As discussed in the description of the legal framework, drinking and irrigation water take priority over other water uses, including hydropower. As generation output is directly related to the flow rate, water shortages caused by imprudent irrigation water use will impair their earnings. Another essential factor for ensuring the stability of HPPs is the proper scheduling of the water supply for

[30] RIA team survey of farmers, 2015.

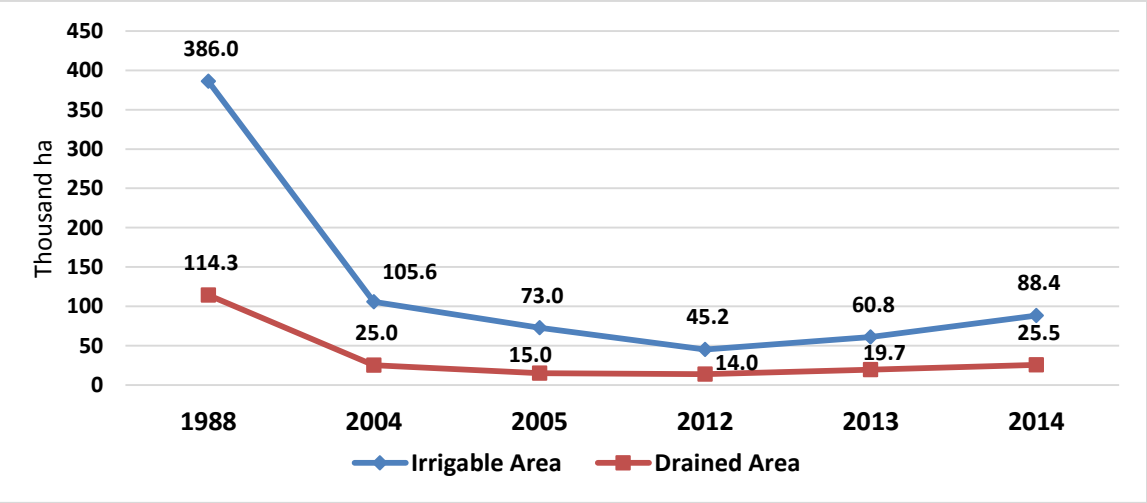
irrigation and electricity generation purposes. In general, the optimal allocation of resources is key for both the irrigation and hydropower sectors to maximize gains from their respective operations.

It should be noted that the purpose of this RIA is to quantitatively analyze the impacts only for farmers.

3.3. BASELINE SCENARIO

Major developments in the irrigation infrastructure of Georgia occurred during the Soviet period, resulting in a total irrigated area of about 386 thousand ha and a drained area of about 114 thousand ha in 1988. However, much of the irrigated area in Soviet times was obtained at extremely high costs. Such irrigation did not make any economic sense and had huge opportunity costs. The irrigation systems were mainly located in the most arid areas of eastern Georgia and most of the schemes were large-scale, serving the relatively large *Kolkhozes* and *Sovkhozes* Soviet collective farms. The troublesome years of transition after the breakup of the Soviet Union, marked by civil war, harsh economic conditions, vandalism and theft of irrigation equipment, resulted in a significant deterioration of the amelioration systems. The country experienced a sharp decrease in irrigable and drained areas. Figure 1 below depicts the evolution of the ameliorated area in Georgia. The current irrigation and drainage systems represent only around 23% of the system of Soviet times. The reduction of the area under irrigation and drainage continued until 2012. In 2012, when GA was established and the government started investing heavily in infrastructure, the decreasing trend was finally reversed. Amelioration is one of the strategic directions of the Strategy of Agricultural Development in Georgia 2015-2020. The state plans to triple the current levels of total irrigated and drained areas by 2020.[31]

Figure 1. Evolution of Irrigable and Drained Area in Georgia 1988-2014



Source: GA

Currently, the state invests in the construction and rehabilitation of infrastructure; funds given to GA as capital injection. The state also finances the company's losses because of operational costs exceeding revenues. State subsidies keep the company solvent and help it grow. Table 6 below shows the amount directed from the state budget during 2013-2015 as investment in the amelioration sector and the direct subsidies given to GA.

[31] Source. MoA. Strategy of Agricultural Development 2015-2020, p.25.

Table 6. State budget expenses on the amelioration sector (mln GEL)

	2013	2014	2015
Capital expenses	48.6	36.1	49.5
Subsidies to GA	11.1	14.0	10.0

Source: GA

State subsidies are insufficient to cover the company's asset depreciation, therefore the company is making net losses that amounted to 14.9 mln GEL in 2014.

In 2014, GA was potentially able to irrigate 88.4 thousand ha. However only 39.6 thousand ha were contracted (only 45%). In 2015, the contracted area increased to 43.8 thousand ha. Drainage area amounted to 789.4 ha. The table below presents irrigated and drained land by region.[32]

Table 7. Regional distribution of contracts and ameliorated area in Georgia for 2015[33]

Region	Irrigation		Drainage	
	# of contracts	Area (ha)	# of contracts	Area (ha)
Kvemo Kartli	14,707	19,047	0	0
Shida Kartli, Mtskheta Mtianeti, Samtskhe-Javakheti	23,727	12,936	0	0
Kakheti	9,836	10,688	0	0
West Georgia (Imereti, Adjara, Guria, Samegrelo)	2,256	1,098	30	789
Total	**50,526**	**43,769**	**30**	**789**

Source: Georgia Amelioration Company (GA)

Given the peculiarities Georgia's climate and relief, the situation in terms of irrigation and drainage differ in the different regions of the country.

Kakheti: This region has a more intense seasonal drought than other Georgian regions and is thus more irrigation dependent. Irrigation is typically used for maize, orchards and vineyards. Water shortages late in the season (August/September) are a common problem. Interruptions to supply due to malfunctions are not uncommon.

Kvemo Kartli: A major producer of vegetables, potatoes and other high value crops. Key areas such as Marneuli, Rustavi, Gardabani, Sartichala and Jandara are heavily dependent on irrigation. Interruptions to supply due to malfunctions are common.

Shida Kartli: Irrigation is typically used on orchards, especially apple orchards. That key water resources are shared with a breakaway region is a major concern.

Mtskheta-Mtianeti: Mostly mountainous, with relatively little irrigation practiced apart from in the villages in the Mtkvari Valley.

[32] These numbers represent the number of ha contracted by GA.

[33] The regions represent GA's definition of regions and do not necessarily coincide with the administrative classification.

Samtskhe-Javakheti: Largely mountainous, and irrigation water is mainly used for potato production. The high altitude and dilapidated Soviet infrastructure are problematic.

Imereti: The Rioni valley typically irrigates maize and green herbs. Many channels are unlined and susceptible to collapse. Drainage in many areas is poor, with springtime water tables of 20 cm, and drainage infrastructure in need of repair.

Adjara: Very high rainfall and little demand for irrigation. Drainage along the coastal strip is poor; if remediated so that the water table is perpetually >150 cm from the surface, low value grazing land could be planted with citrus and other orchard crops.

Guria: Very little demand for irrigation, however maize growers could increase yields by 30%[34] by doing so – although there is a lack of awareness about this. Drainage is a problem on the Kolkheti plain; if remediated so that the water table is perpetually >150 cm from the surface, low value grazing land could be planted with citrus and other orchard crops.

Samegrelo: The same situation as in Guria.

Tariffs. Current amelioration tariffs are 75 GEL for irrigation in eastern Georgia and are 45 GEL for irrigation and 40 GEL for drainage in western Georgia. Not only do the tariffs not reflect the true cost of service delivery, they are fixed and do not take into account the number of water uses delivered or volumes consumed. Accordingly, the existing tariffs do not create an economic incentive to avoid wasteful uses of water.

The procedure for the provision of irrigation services begins with the customer signing a contract with GA at the beginning of the irrigation period. The contract contains basic information on the customer such as the size of land and nature of crops cultivated, as well as the desired period of irrigation. Water is supplied according to the demand and availability of the water. Payment for the service should be made prior to the next irrigation season.

As previously mentioned, only 20-30% of agricultural land is registered in the cadastral maps, which makes it hard for GA to check the accuracy of the contracts in terms of ha. The problem of weak physical control of water by GA (i.e. open-topped channels), results in a higher number of beneficiaries than contractors.

Poor contract enforcement and the low reliability of services results in a low collection efficiency rate. On average, only 60% of planned tariff revenue was recovered in 2014.[35] Collection efficiency varies vary across the different irrigation schemes, and are frequently dependent on how reliable the water supply is in different areas.

The farmers' survey and focus groups revealed some of the reasons behind the low payment and contracting rates. The current tariff rates are not excessive for most farmers. A total of 73%[36] of respondents thought that irrigation and drainage tariffs were acceptable. Only 27% stated that they are either very high or high. Instead, the main problems identified are accessibility and reliability.

Looking at the amelioration system from the **consumer's perspective**, it seems that low contracting efficiency for irrigation is mostly a result of the low quality of service delivery. A lack of reservoirs results in a shortage of water in hot seasons when farmers need irrigation the most. Farmers cited their own or their neighbors' poor quality of irrigation in past years as the major reason that they have not signed a contract with the company in places where infrastructure is present. High contracting efficiency may thus only be reached if the quality and reliability of the service delivery is increased. A total of 93% of respondents stated that they would be willing to sign a contract if there were a proper irrigation service.[37]

Improved irrigation will also give incentives to farmers to switch to higher value crops. A total of 31% of respondents said that they would change to a higher value crop in the event of reliable

[34] Source: Estimates of external consultant.

[35] Source: GA.

[36] Source: Farmers' phone survey.

[37] Source: Farmers' phone survey.

irrigation/drainage. Only 3% of respondents answered that they are already growing the highest possible return crop. A similar attitude was observed during the focus groups.

4. OBJECTIVES

4.1. GENERAL OBJECTIVES

The general objectives of the regulatory reform of the irrigation and drainage sector for the key stakeholders – the government of Georgia and Georgian Amelioration – is to:

1. Develop a reliable water supply through renovation and rehabilitation of infrastructure;
2. Ensure the financial sustainability of amelioration SPs (eliminate dependency from direct government subsidies);
3. Ensure an efficient allocation of water across alternative uses;
4. Increase the competitiveness of Georgia's agricultural sector by providing reliable irrigation and drainage services at reasonable prices.

4.2. SPECIFIC AND OPERATIONAL OBJECTIVES

A number of specific and operational objectives are associated with the general objectives listed above:

1. Develop a reliable water supply through the renovation and rehabilitation of infrastructure:
   a) Construction, renovation and rehabilitation of amelioration infrastructure to ensure service reliability and minimize water losses.
2. Ensure the financial sustainability of amelioration SPs:
   a) Cover the costs of providing the service without direct subsidies to SPs – either covering O&M costs or including capital expenses;
   b) Develop a tariff methodology to ensure tariff transparency, management accountability, and the creation of billing and accounting systems for the proper management of GA;
   c) Encourage wise investment decisions from the government to maximize economic effects.
3. Ensure an efficient allocation of water across alternative uses:
   a) Provide incentives for the efficient use of limited water resources;
   b) Foster awareness about the real opportunity cost of using water for irrigation.
4. Increase the competitiveness of Georgia's agricultural sector by providing reliable irrigation and drainage services at reasonable prices:
   a) Foster awareness among Georgian farmers about the increased use of drip and sprinkle irrigation systems to increase crop yields per ha;
   b) Ensure a high quality irrigation service to increase the confidence of farmers to switch to higher value crop production;
   c) Protect farmers from paying excessively high water prices.

Table 8. Summary of Objectives

OBJECTIVE	SPECIFIC OBJECTIVES	INDICATOR	RESPONSIBILITY
1. Develop a reliable water supply through the renovation and rehabilitation of infrastructure	a) Construction, renovation and rehabilitation of amelioration infrastructure to ensure service reliability and minimize water losses	1. Increase of investments on main channels (GEL) 2. Increase in command area (%) 3. Increase in collection efficiency (%) 4. Increase in number of contracts and contracting efficiency (%) 5. Number and capacity of new reservoirs	Georgian Amelioration and the Government of Georgia
2. Ensure the financial sustainability of amelioration SPs (eliminate dependency from direct government subsidies)	a) Cover the costs of providing the service without direct subsidies to SP – either covering O&M costs or including capital expenses	1. Generated revenues – cost recovery value (GEL) 2. Rate of return on investment (%) 3. Contracting efficiency (%) 4. Collection efficiency (%)	Government of Georgia and Georgian Amelioration
	b) Develop a tariff methodology to ensure tariff transparency, management accountability, and the creation of billing and accounting systems for the proper management of GA	1. Adapting the draft law 2. Tariffs set by GA (GEL) 3. Irrigated/drained area (ha)	Georgian Amelioration, the Government of Georgia and the Parliament of Georgia
	c) Encourage wise investment decisions from the government to maximize economic effects	1. Average water consumption per ha 2. Increase in water availability (%) 3. Infrastructure investment (GEL)	Government of Georgia and Georgian Amelioration
3. Ensure an efficient allocation of water across alternative uses	a) Provide incentives for the efficient use of limited water resources	1. Share of farmers/land using optimal irrigation technology (%) 2. Average discounts on tariffs for using modern irrigation technologies (%)	Government of Georgia
	b) Foster awareness about the real opportunity cost of using water for irrigation	1. Contracting efficiency (%) 2. Collection efficiency (%)	Government of Georgia and Georgian Amelioration
4. Increase the competitiveness of Georgia's agricultural sector by providing reliable irrigation and drainage services at reasonable prices	a) Foster awareness among Georgian farmers about the increased use of drip and sprinkle irrigation systems to increase crop yields per ha	1. Share of farmers/land using optimal irrigation technology (%) 2. Increase in crop yields	Government of Georgia and Georgian Amelioration

5. POLICY OPTIONS

This section describes the policy options suggested under the draft methodology on irrigation and drainage tariffs and the peculiarities of its implementation process as discussed in consultations with the major stakeholders (GA and the MoA).[38] The draft methodology of tariff calculation proposes several methods of service pricing. Of these, the two most feasible options were selected for the impact assessment. This study thus covers three major policy options:

1. Policy option 1: Government does not introduce a new tariff methodology, instead keeping the status quo interim decree in force (Baseline Scenario);
2. Policy option 2: Government adopts a lower-bound pricing model having a two-component tariff that covers the company's operation and maintenance costs. Thus, the company breaks even, but does not receive any economic profits;
3. Policy option 3: Government adopts an upper-bound pricing model having a three-component tariff that enables the company to cover real costs of service receiving an 8.1% nominal rate of return on capital.

It is important to note that the draft tariff methodology envisages the calculation and setting of irrigation/drainage tariffs separately for different command areas. Due to time and data constraints, and in agreement with GA and G4G, the results of the quantitative analysis are calculated for six systems (five irrigation and one drainage system, which amount to 45% of the current total command area). The specifications of each system are presented in Appendix 3. The costs and benefits of all major agents are thus only studied for these six systems.

The stakeholders whose costs and benefits will be analyzed are:

1) GA;
2) Farmers;
3) The government (all GA's costs that cannot be covered through its revenues are covered through government subsidies and are thus counted as government costs).

5.1. POLICY OPTION 1

In this option, the tariff reform is not implemented and the tariff rates discussed above are kept unchanged. Government does not give any direct subsidy to farmers to irrigate and keeps financing GA's operating losses (including depreciation expenses). Government does not make any investment to increase GA's service reliability within the existing command area. The government's priority in the case of policy option 1 is to increase the command area (which is outside of the scope of this study) using existing water resources.

Irrigation/Drainage

The main assumptions of the baseline scenario are:

- Government does not subsidize farmers for switching to modern irrigation technologies, such as drip and sprinkle irrigation.
- Farmers choose the irrigation method that gives them the highest marginal profit for the crop they are cultivating (including the cost of water in the analysis).
- Observation of current irrigation choices shows that the adoption of modern irrigation technology is slow, despite its potential profitability. Our expert has produced a table modeling the expected switch to modern irrigation technology in the status quo (Appendix 4, Table 2).

[38] Disclaimer: The Ministry of Agriculture of Georgia and its representative head of the amelioration and land registration department do not have an official view on the implementation of the irrigation drainage reform as they are waiting for the preparation of the tariff methodology to be finalized.

Dynamics of the farmer compliance rate

One of the major interests for this study and in the general literature on irrigation/drainage pricing is the farmer compliance rate (Easter & Liu, 2005). In both developing and industrialized countries, payment rates for irrigation services tend to be very low due to farmers' inability to pay. Accessibility to different avoidance strategies is another constraint for achieving high payment rates. In countries where compliance rates are very high, or close to 100% (such as several regions in China[39]), this is primarily due to the presence of restrictive technical methods that do not allow farmers to cheat. Based on our survey and the focus groups with farmers, we assume that the reliability of the irrigation service is directly linked to farmers' willingness to pay the fees. Reliability is improved through investments in infrastructure renovation and rehabilitation, as well as through investments in new reservoirs. Thus, with the government not investing in the improvement of existing infrastructure in option 1 there is no basis for the compliance rate to increase.

In the case of drainage, due to the public good nature of the service, the incentives for avoiding contracting and paying for the service are much higher and do not necessarily depend on the reliability of the service. A crucial element for compliance is thus likely to be the amount of the tariff.

More specific assumptions for this scenario are presented in the section describing the methodological approach.

Advantages and disadvantages

The main ***advantages*** of this scenario with regard to the reform objectives – as identified during our stakeholder consultations and analysis of the existing economic literature – are:

- The current tariff rates are very low, representing an insignificant portion of farmers' production costs.
- The payment method is relatively straightforward, with simple billing procedures and low administration/enforcement costs.
- GA's subsidization is simple for the government (covering its operational losses).

The ***disadvantages*** include:

- Current tariff rates cannot cover the company's costs, even in the case of a 100% farmer compliance rate.
- There is no tariff transparency for customers, the government and the company. Tariffs are set without any clear methodology at an arbitrarily low level, without links to the real costs of irrigation.
- GA needs constant subsidization of its costs from the government, in addition to investments in the construction and rehabilitation of infrastructure.
- Lack of a transparent and cost-based methodology, together with the acknowledged need to subsidize, makes it more difficult to hold the company's management accountable for bad results.
- Government subsidies and investments occur on an ad-hoc basis due to a lack of transparency in the company's accounts.
- In the case of irrigation, as the tariff is an annual fixed payment for irrigation services with an unconstrained amount of water usage, it does not create any incentive for water saving. Nor does it promote shifting to less water-demanding crops or adopting modern irrigation technologies that could potentially need less water and increase crop productivity.

Potential risks associated with the option

[39] Source: Easter and Liu (2005).

- The company could become immediately insolvent if the government decided to suspend subsidies or to delay transfers.
- Without increasing the potential water supply (via rehabilitation or the construction of new reservoirs) the company may face more dissatisfied customers due to water shortages in the hot season as the command area expands.
- Low incentives for water savings might reduce the water available for alternative uses (not included in this analysis).

5.2. POLICY OPTION 2

In this option, a lower-bound tariff is applied. GA will reach the break-even point at the expected levels of contracting efficiency and client compliance rate. At such levels, the company will cover its operation costs, while not making any economic profits. In this policy option, the company will not need any direct subsidization from the government as far as regular operations are concerned. The government of Georgia, as a 100% shareholder of the company, will be making capital investments for the construction of new infrastructure such as reservoirs, headworks, pumping stations, etc. However, if compliance and contractual rates fall below expected levels, the government will still have to step in and provide direct subsidies to compensate for the revenues shortfall.

The lower-bound option is a two-component tariff that consists of:

1. A per ha tariff paid as a service fee for irrigation/drainage (service fee).
2. A fixed per ha tariff that every farmer in the command area has to pay for availability of irrigation/drainage infrastructure.

It is important to note that the tariffs are set for each command area separately. The first component (service fee) will be charged only to customers who have a contract for irrigation/drainage services. Based on the proposed tariff methodology[40], the second component of the tariff is going to be paid by everyone owning agricultural land in the command area, notwithstanding their demand for the company's services.

Several peculiarities in the implementation of this policy option were underlined in our discussions and consultations with major stakeholders.

As far as the *first component* of the tariff (the variable component) is concerned, farmers will be charged different (lower) fees if using modern irrigation technologies (such as drip and sprinkle irrigation). The rebate will be calculated based on the water needs of the crop cultivated, given the irrigation technology adopted[41]. Having consulted the stakeholders, we assume that the government is going to initially subsidize the second (fixed) component and that these subsidies are going to decrease over time, so that the tariff will increase gradually, in parallel with an increase in quality. Thus for the purposes of the cost-benefit analysis we have assumed a subsidy that decreases as time passes. In practice, the company's bills to farmers will include all components of the tariff in order to keep pricing transparent and will show farmers the real costs of irrigation/drainage. It should be noted that no rebate can be provided for drainage services, thus customers pay in full the first component of the tariff.

Farmers who own land in the command area and are not service customers, will receive a bill for only the second component of the tariff.

The **main assumptions** of lower-bound tariff option are the following:

Irrigation/Drainage

[40] Source: Draft tariff methodology: *Selection of Form and Structure and Calculation of Tariffs.*

[41] The rebate scheme is proposed by Georgian Amelioration Company and is not part of draft methodology for irrigation/drainage tariffs.

- Government invests in improvements of existing irrigation/drainage infrastructure, to increase reliability of service supply
- The cost of irrigation increases significantly with respect to option 1. The increase in water costs is mitigated by a rebate if the farmer chooses to irrigate using modern (more efficient) irrigation technology. This rebate is supposed to increase the incentive to use water more efficiently.
- As in option 1, farmers choose the irrigation method that gives the highest marginal profit for the crop they are cultivating (including the cost of water in the analysis). However, in this case – due to the change in the water cost – farmers may also change the type of crop they cultivate. Based on our expert's predictions, we have updated the crop distribution accordingly.
- Observation of the current irrigation choices shows that the adoption of modern irrigation technology is slow, despite its potential profitability. Our expert has produced a table modeling the expected switch to modern irrigation technology in the status quo (Appendix 4, Table 2).
- Government fully subsidizes the fixed component of the irrigation/drainage tariff in the first year and decreases the subsidy every year. Government does not provide any subsidy to farmers on the first (variable) component of the tariff.
- The cost of drainage increases significantly with respect to option 1.

More specific assumptions for this scenario are presented in the section describing the methodological approach.

The main **potential advantages** of this scenario with regard to the reform objectives are:

- More transparent irrigation/drainage tariffs will support improvements in the company's billing, accounting and other administrative procedures, enabling better control from the major shareholder (the government).
- Transparent pricing will help identify the main cost components associated with the service provision. This will help achieve a better understanding of the critical issues characterizing the provision of irrigation/drainage services, and will help GA to clearly define its goals and permit the government to monitor the company's performance.
- At relatively high levels of contracting and collection efficiency, GA will not need subsidies to cover its operational losses.
- Farmers' awareness of the real costs associated with the provision of irrigation/drainage services will be increased by the new (transparent) billing system representing all costs associated with the provision of such services.
- As far as irrigation is concerned, due to the increased quality of service delivery, this option results in higher payment and contracting rates, potentially decreasing the costs of enforcing tariff payments through court cases.
- The increase in cost associated with holding inactive land might encourage the transfer of land from less to more active farmers.

The **potential disadvantages** include:

- Should contracting and compliance rates remain below those needed for reaching the break-even point, GA might still need direct government subsidies to cover its costs. At the initial stage of tariff policy implementation, such direct subsidies are inevitable.
- Implementing a rebate scheme on the first (variable) component is associated with additional operation costs (such as additional monitoring costs) for the company. Furthermore, it complicates the billing procedure and possibly creates ambiguity during the implementation process.[42]

[42] For example, it might be problematic to quantify the rebate for a farmer that cultivates several crops on the same plot of land while applying the same irrigation technology.

- Because the tariff paid by farmers is going to increase with time, billing and collecting it is going to become more challenging and costly as time passes[43], especially for drainage (because it is technically hard to exclude those not paying for the services).
- Collection of the first (variable) component of the tariff may be more problematic (and costly) from an administrative standpoint due to the necessity of keeping an adequate number of inspectors to help prevent water stealing and other avoidance strategies (which become more likely as the cost of water increases). Such issues are likely to be particularly acute in the case of drainage services due to the public good nature of the service.
- For those farmers who could irrigate at lower costs without the water supply from the centralized system, imposing a fixed payment regardless of their irrigation needs leads to inefficiencies and causes a decrease of such farmers' competitiveness.

Potential risks associated with the option:

- The company may still suffer losses due to insufficient contracting and/or compliance/payment rates.
- Setting the tariff at an excessively high level might negatively affect the competitiveness of Georgian farmers as well as the functioning of the Georgian land market[44], impairing the development of the Georgian agricultural sector.
- In some cases, because of the increase in water cost, farmers might decide to stop irrigating. This might lead to a reduction in the irrigated area, with a resulting decrease in productivity on those land plots and, more generally, a decrease in agricultural production. This would also reduce GA's revenues.
- Another possible result of the increase in the tariff, even in the case of an increased reliability of service, is an increase in the number of farmers attempting to use water and drainage services without signing any contract. This would also reduce GA's revenues.
- Collection of the tariff might become more problematic because of the stronger incentives to avoid payments. This would cause an increase in administrative costs (an increased number of inspectors would be needed to help prevent water stealing and other avoidance strategies).
- The introduction of the fixed component for all land owners in the command area is going to negatively affect all farmers, particularly those that currently do not irrigate or who will cease irrigating in the aftermath of the reform. Those most affected will typically be the most vulnerable and less active farmers, which might have potentially significant economic and social side effects such as:
    - Increased vulnerability and risk of poverty for small landholders (which might even force some of them to sell their land);
    - Attempts to block the implementation of the reform or to cancel it once implemented.

5.3. POLICY OPTION 3

In this option, an upper-bound tariff is applied. At the expected levels of contracting efficiency and client compliance rate, GA will cover its real costs receiving a certain rate of return on capital. In the long run (well beyond the time horizon of this report) the company will not need any subsidization from the government, including for capital. This will be possible thanks to the company's profits. After a successful transition period to the upper-bound tariff, the company could be privatized. However, when compliance and contractual rates fall below expected level, the government might still have to step in and provide direct subsidies to compensate for the revenues shortfall and/or to support capital investment. In such a context, privatization might become problematic. In the initial periods, the government might still have to provide direct subsidies, albeit to a smaller extent than in options 1 and 2.

[43] The expected gains from not paying for the service increases.

[44] The increase in the cost of water for irrigation, combined with the introduction of a fixed component to be paid by all land-holders in the command area (even those who do not need the services of GA) is going to reduce the expected net revenues from holding land and, therefore, negatively affect demand for Georgian land and, possibly, (if the farmers try to compensate by increasing prices) for Georgian products.

The upper-bound option is a three-component tariff that consists of:

1. A per ha tariff paid as a service fee for irrigation/drainage.
2. A fixed per ha tariff that every farmer in the command area has to pay for the availability of irrigation/drainage infrastructure;
3. An additional fixed component per ha that provides remuneration for investments in infrastructure made by the company, based on a "fair" rate of return on capital (typically the weighted average cost of capital (WACC) of the company).

Similarly to option 2, tariffs are set for each command area separately and the first component (service fee), will be charged exclusively to customers who use irrigation/drainage services. Based on the proposed tariff methodology[45], the fixed components of the tariff are going to be paid by everyone who owns agricultural land in the command area, notwithstanding their demand for the company's services.

It has to be noted that the option 3 tariffs cover the real costs of service (i.e. operational and maintenance and the rate of return on capital).

Also in this case:

(a) for the first (variable) component of the tariff, farmers will receive a rebate if using modern irrigation technologies (such as drip and sprinkle irrigation)[46];

(b) the government is going to subsidize the last two components of the tariff;

(c) subsidies are going to decrease over time and thus for the purposes of the cost-benefit analysis, a level of subsidy decrease has been assumed.

In practice, as in option 2, the company's bills to farmers will include all components of the tariff in order to keep pricing transparent and show farmers the real costs of irrigation/drainage.

Farmers who own land in the command area and are not the service customers will receive bills for the last two components.

The **main assumptions** of upper-bound tariff option are:

Irrigation/Drainage

- The cost of irrigation increases significantly with respect to options 1 and 2. The increase in water costs is mitigated by a rebate if the farmer chooses to irrigate using modern (more efficient) irrigation technology. This rebate is supposed to increase incentives to use water more efficiently.
- As in option 1, farmers choose the irrigation method that gives the highest marginal profit for the crop they are cultivating (including the cost of water in the analysis). However, in this case, like in option 2, farmers may also change the type of crop they cultivate due to the change in the water cost. Based on our expert's predictions, we have updated the crop distribution accordingly.
- Observation of current irrigation choices shows that the adoption of modern irrigation technology is slow, despite its potential profitability. Our expert has produced a table modeling the expected switch to modern irrigation technology in the status quo (Appendix 4, Table 2).
- As in option 2, the government fully subsidizes the fixed component of the tariff in the first year and decreases the subsidy every year. Government does not provide any subsidies to farmers on the first (variable) component of the tariff.
- The company's O&M costs are covered. In addition, the company receives an additional amount corresponding to the rate of return on capital (defined in the tariff methodology as the weighted average rate of return) applied to the regulatory asset base.

[45] Source: Draft tariff methodology: *Selection of form and Structure and Calculation of Tariffs*

[46] The rebate scheme is proposed by Georgian Amelioration Company and is not part of draft methodology for irrigation/drainage tariffs.

- The cost of drainage increases significantly compared to options 1 and 2.

More specific assumptions for this scenario are presented in the section describing the methodological approach.

The main **potential advantages** of this scenario with regard to the reform objectives are:

- More transparent irrigation/drainage tariffs will support improvements in the company's billing, accounting and other administrative procedures, enabling better control from the major shareholder (the government).
- Transparent pricing will help identify the main cost components associated with service provision. This will provide a better understanding of the critical issues characterizing the provision of irrigation/drainage services, help GA to clearly define its goals, and enable the government to monitor the company's performance.
- Farmers' awareness of the real costs associated with the provision of irrigation/drainage services will be increased by the new (transparent) billing system representing all costs associated with the provision of such services.
- As far as irrigation is concerned, due to the increased quality of service delivery, this option, as in option 2, is likely to result in a higher payment rate compared to option 1, thus decreasing costs of enforcing tariff payments through court cases.
- GA can break even and become profitable even under the current contracting efficiency and compliance rate.
- In addition to the government investment plan, in this scenario the company has funds available to invest in its development (in infrastructure, service quality, administration and accounting, etc.).
- The increase in the cost associated with holding inactive land (which is even greater than in under option 2) might encourage the transfer of land from less to more active and efficient farmers.
- The company can be privatized after the completion of the implementation of the tariff methodology without the need for additional adjustments in the tariff methodology.

The **potential disadvantages** include:

- Due to the subsidy scheme applied on the fixed component of the tariff, for the period in which company remains in public ownership the government is going to pay a rate of return on capital to its own subsidiary.
- The company might face softer short-term budget constraints, thanks to the higher revenues that are unrelated to reliability, thereby potentially reducing the need to increase efficiency and reliability.
- Because the tariff paid by farmers is going to increase with time, billing and collecting it is going to become more challenging and costly as time passes.[47] This is especially true for drainage because it is technically hard to exclude those not paying for that service.
- Implementing a rebate scheme on the first (variable) component is associated with additional operation costs (such as additional monitoring costs) for the company. Furthermore, it complicates the billing procedure and possibly creates ambiguity during the implementation process.[48]
- Attempting to bill and collect the fixed component from all land owners in the command area is going to be more challenging and costly in the long term. This is likely to be even harder than in option 2 as the fixed component will be higher, thus increasing incentives to avoid payments.
- Collection of the first (variable) component of the tariff may be more problematic (and costly) from an administrative standpoint due to the necessity of keeping an adequate number of inspectors to help prevent water stealing and other avoidance strategies (which become more likely as the cost of water increases). This issue is likely to be most apparent

[47] The expected gains from not paying for the service increases.

[48] For example, it might be problematic to quantify the rebate for a farmer that cultivates several crops on the same plot of land while applying the same irrigation technology.

in the case of drainage services, due to the public good nature of that service. The increase in such costs is likely to be larger than under option 2, as the incentives to avoid payments will also be larger.

- For those farmers who could irrigate at lower costs without the water supply from the centralized system, imposing a fixed payment regardless of their irrigation needs would lead to inefficiencies and causes a decrease of such farmers' competitiveness. The effect of this disadvantage is larger than in option 2.

Potential risks associated with the option:

- The risk of setting the tariff at an excessively high level and thus negatively affecting the competitiveness of Georgian farmers and the functioning of the Georgian land market is even greater under this option.[49] As a consequence:
  - Some farmers might decide to stop irrigating. This might lead to a reduction in the irrigated area, with a resulting decrease in productivity on those land plots and, more generally, a decrease in agricultural production;
  - Another possible result of the increase in the tariff, even in the case of increased reliability of services, is an increase in the number of farmers attempting to use water and drainage services without signing any contract. This would also reduce GA's revenues;
  - The development of the Georgian agricultural sector might be impaired.
- In the case of a decrease in contracting and compliance/payment rates, the company might still need direct government subsidies to cover its costs. At the initial stage of implementing the tariff policy such subsidies are unavoidable.
- Collection of the tariff might become more problematic because of the stronger incentives to avoid payments (even more so than in option 2). This will cause an increase in administrative costs (an increased number of inspectors needed to help prevent water stealing and other avoidance strategies).
- With high levels of non-compliance, it might still be impossible to privatize the company, as rate of return on capital might be too low.
- The company's management might face less incentives to increase efficiency and reliability (as a consequence of softer budget constraints).
- The introduction of the fixed component for all land owners in the command area under this scenario will have the largest negative impact on farmers, particularly those that currently do not irrigate/drain or that will cease to irrigate in the aftermath of the reform. These are typically the most vulnerable and less active farmers. This is the option most likely to lead to potentially significant economic and social effects, such as:
  - Loss of value of agricultural land, caused by a reduction in the expected value of revenues from farming (with respect to option 2);
  - Increased vulnerability and risk of poverty for small landholders (which might even force some of them to sell their land – a course of action that is even more damaging as the value of land will be lower). This effect could also be potentially very damaging for the public budget as government may need to step in to help/compensate vulnerable smallholders;
  - Attempts to block the implementation of the reform or to cancel it once implemented.

[49] The increase in the cost of water for irrigation, combined with the introduction of a fixed component to be paid by all land-holders in the command area (even those who do not need the services of GA) is going to force farmers choose between accepting a lower margin on their production (to keep their market share) or accepting selling less. In any case, this change is going to reduce the expected net revenues from holding land and, therefore, negatively affect the demand for Georgian land and (possibly) products.

6. ANALYSIS OF IMPACTS

6.1. METHODOLOGY APPROACH

The methodology applied in the analysis of the impacts is a Cost Benefit Analysis (CBA), coupled with qualitative analysis for those components that were impossible to quantify given the time and data constraints.

As it was mentioned above, we consider the costs and benefits for the following stakeholders:

- Customers (farmers);
- GA;
- The government.

We analyze the costs and benefits over a time horizon of five years. The discount rate used is 8.7% (i.e. the real discount rate on 5-year government loans). A sensitivity analysis was performed at 6.7% and 10.7%.

We complemented this partial quantitative analysis with a qualitative analysis based on economic theory, economic literature and empirical evidence from other countries.

The main assumptions used in our quantitative analysis are the following:

GENERAL ASSUMPTIONS

The general assumptions for all scenarios are the following:

Areas, tariffs and subsidies

- The command area does not change over time and is set to the 2015 number of 116,775 ha (88,400 ha for irrigation and 28,375 ha for drainage). We applied this assumption for two reasons: (i) the investment scenario chosen in consultations with GA does not foresee an increase of the command area; (ii) the tariffs calculated and provided by GA treat the command area as constant;
- NPVs are calculated for only six sub-regions. These sub-regions where chosen by GA as a representative sample of the amelioration sector. Four of them are located in eastern Georgia and provide irrigation (Mtkvari-Jandara, Tashiskari-Saltvisi, Kvemo Alazani and Kvemo Samgori) and the other two are located in western Georgia and represent irrigation (Kvirila-Tskhenistkali) and drainage providers (Khobi-Enguri Pool). The sample studied represents 45% of the total command area (see Appendix 3 for more details);
- Tariffs do not change over five years (the maximum time horizon for a tariff indicated in the methodology guidelines).

Farmers' irrigation/drainage choices and revenues

- The distribution (share) of small and large farms is assumed to be the same as in the 2004 Agricultural Census;
- We assume that agricultural land (and total land devoted to crops) is distributed between large and small farms similarly as with the total land;
- We define small farms as those that possess an area of land up to 5 ha. Large farms are those with 5 ha and more of land;
- Compliance rates and irrigation choices change depending on marginal (net) gains from irrigation (i.e. customers irrigate only in the case when half of the marginal (net) gain from irrigation is more than the tariff they pay). The same criterion is applied to drainage.
- Different categories of farmers have different conditions of access to credit. Nominal interest rates on loans are assumed to be 21.1% for small farms and 13.8% for large ones. These rates represent NBG rates on long-term loans without and with collateral respectively;
- Customers irrigate crops according to marginal (net) gains. Crops with the highest (net) gains are irrigated first;
- Customer revenues are generated from the production of eight major group of crops: hazelnuts, potatoes, vegetables, orchards, vineyards, beans, maize, and wheat;

- The gross margins[50] per ha with treatment and without, for all crops except hazelnuts, were taken from the ILMDP 2015 study. The hazelnut budget was estimated based on interviews with farmers (see Table 1 in Appendix 4 for more details);
- Increases in gross margin per ha with optimal irrigation technology[51] are included in the calculations. Assumptions were made based on consultations with the external irrigation expert. Increases in gross margins per ha for each crop and farm size using optimal irrigation technologies are given in Table 1, Appendix 4;
- The actual costs of irrigation do not only include irrigation tariffs.
    - Under flood irrigation farmers have to make a temporary distribution channel between land plots. These costs are included in the analysis and are assumed to have a 100% amortization rate each year;
    - Under modern irrigation, farmers have to invest in additional equipment, whose costs have different amortization times;
- 2015 crop prices are taken in real terms.

GA's costs and revenues

- The costs (operative, maintenance, administrative and other) of GA are assumed to be constant in real terms over five years;
- The depreciation rate is assumed to be 3.1%.

Government's costs and revenues

- Profit tax (paid by GA) is 15% and is not changing over the five years.

ASSUMPTIONS SPECIFIC TO POLICY OPTIONS

The policy options differ by *tariff rates*. The status quo is set at the current tariff rates (in eastern Georgia 75 GEL for irrigation, and in western Georgia 45 GEL for irrigation and 40 GEL for drainage). The tariff rates under the lower-bound and upper-bound scenarios were calculated and provided by GA using the new methodology for amelioration tariffs proposed by the draft law. Table 9 below presents the tariff rates for each studied system under the different policy options. As was already stated above, the tariffs do not change over time.

Table 9. Tariff Rates for Systems under Each Scenario (per ha, per year, GEL)

Region / Policy Option	Status Quo	Lower-Bound Tariff			Upper-Bound Tariff		
		Fixed component	Service Fee	Total	Fixed component	Service Fee	Total
Mtkvari-Jandara	75	81	76	157	255	76	330
Tashiskari-Saltvisi	75	192	189	380	670	189	859
Kvemo Alazani	75	218	190	408	637	190	827
Kvemo Samgori	75	211	205	416	666	205	871
Kvirila-Tskhenistkali	45	311	309	621	1,048	309	1,357
Khobi-Enguri Pool	40	202	175	377	691	175	865

Source: GA

Subsidies and incentives to switch to optimal irrigation technology are different in each policy option.

[50] Total revenues–total cost with the exception of irrigation tariffs.

[51] Under optimal irrigation technology, a stationary sprinkler, center pivot/linear move, per ha drip tubing (surface) and drip tape (surface) are assumed.

Particularly:
Option 1

- Government is subsidizing GA directly.

Options 2 & 3

- GA is not financed directly. Farmers receive subsidies on the fixed per ha components of the tariff and these subsidies are decreasing every year by 5%;
- Farmers are not subsidized for the irrigation/drainage service fee (i.e. component 1 of the tariff);
- Farmers receive rebates on the tariff depending on: (i) the type of technology utilized, and (ii) the crop.

Government investment

In the *status quo* the government is not investing in the rehabilitation of existing infrastructure. It is only investing in the expansion of the command area, which is out of the scope of this study.
In *options 2 and 3*, 25 mln GEL is invested annually for five years in order to increase the reliability of services in the current command area. Government investment in options 2 and 3 are divided among systems based on the share in the total command area.

Contracting efficiency

In the status quo, where there is no investment in service reliability or in the rehabilitation of existing infrastructure, throughout the analysis contracting efficiency is assumed to remain stable at 2014 levels.[52] In the other options, contracting efficiently is assumed to increase substantially over the years as investments in service reliability take place and GA has more incentives to attract clients. The predicted changes in contracting efficiency were made in consultation with the external expert and are given in Table 10 below, together with status quo figures. It is assumed that contracting efficiency is the same in options 2 and 3 (as the improvements in reliability are expected to be the same).[53]

Table 10. Contracting Efficiency Used in Options 2 & 3

	Option 1	Options 2 & 3				
Contracting efficiency	**2016-2020**	**2016**	**2017**	**2018**	**2019**	**2020**
Mtkvari-Jandara	77%	78%	78%	79%	79%	80%
Tashiskari-Saltvisi	50%	55%	60%	65%	70%	75%
Kvemo Alazani	67%	69%	70%	72%	73%	75%
Kvemo Samgori	67%	68%	70%	72%	73%	75%
Kvirila-Tskhenistkali	17%	21%	24%	28%	31%	35%
Khobi-Enguri Pool	100%	100%	100%	100%	100%	100%

Farmers switching to optimal irrigation technologies mainly depends on food prices and expected revenues, but also depends on the reliability of irrigation services. If reliability increases, and assuming other things remain constant, farmers will have more incentives to switch to optimal irrigation. This effect is conceived in our study and we have come up with the percentage of farmers using modern irrigation technologies based on recent trends and the views of the external irrigation expert. Assumptions were also made about future changes (see Table 2 in Appendix 4 for detailed assumptions about the percentage of farmers using modern irrigation by crop type and farm size).

[52] Contracting efficiencies used in the analysis are the following: Mtkvari-Jandara 77%, Tashiskari-Saltvisi 50%, Kvemo Alazani 67%, Kvemo Samgori 67%, Kvirila-Tskhenistkali17%, Khobi-Enguri Pool 100%. For all sub-regions contracting efficiency is set to 2014 numbers, the exception to this is Khobi-Enguri Pool where it is assumed to be 100% (based on consultations with GA).

[53] This assumption might overestimate the benefits for option 3 relative to those option 2. In option 3 the costs incurred by farmers are substantially higher and might lead to lower contracting efficiency.

The switching process is assumed to be slower in option 1 than in the other options, as it has lover service reliability.

The analysis was done in the following sequence:
Farmers' demand for drainage depends the marginal gains from signing a drainage contract. If their gains from doing so are higher than half of the service fee they are asked to pay, farmers decide to purchase the service.

Irrigation also depends on farmers' marginal gains from irrigation. If the gross margin (revenues minus the cost of production, excluding irrigation tariffs[54]) is higher than the irrigation tariff, farmers decide to irrigate. In options 2 and 3, farmers also take into consideration the rebates associated with switching from flooding to a modern (optimal[55]) irrigation technology.

Farmers rank crops by the size of marginal gains from irrigation (including irrigation costs) and irrigate the most profitable culture first. Once the most profitable crops are irrigated, farmers irrigate the second most profitable and so on.

Farmers' demand translates into revenues for GA (tariff charged times hectares irrigated). In the status quo, the company receives direct subsidies from the state to cover losses, while in options 2 and 3 it receives indirect subsidies. If the company is making profits it has to pay profit tax. However, in options 2 and 3, in the event of losses the government will still intervene to directly subsidize the company.

[54] Total irrigation costs include not only tariff rates but also additional costs related to service provision.

[55] The optimal irrigation technology has been identified for each crop, based on the expert's opinion.

6.2. ANALYSIS OF IMPACTS

The analysis of impacts should present possible impacts as well as distributional effects (even though they are not calculated).

Table 11. Summary Impact of Selected Options

IMPACT	OPTION 1 STATUS QUO	OPTION 2 LOWER-BOUND SCENARIO	OPTION 3 UPPER-BOUND SCENARIO
Administrative	GA has to deal with low compliance rates by enforcing contracts and bringing non-payers to court. Due to very low tariffs and the inability of the company to cover its costs, GA does not have any financial benchmark that will encourage the company's efficient operations.	GA has strongest incentives to ensure a high compliance rate and proper reliability compared to option 1. GA has higher administrative costs compared to option 1 because in this case it has to comply with higher transparency standards of its accounts. Additionally, the company has to make additional investments in monitoring systems in order to be able to calculate the rebates to be applied on the second component of the tariffs. Break-even tariffs force GA to maximize its efforts to ensure high compliance rates (by increasing numbers of monitoring personnel, improving its monitoring system, etc.). It is vital for the tariff setting process to choose the correct regulatory body (and procedure) in order to avoid conflicts of interest and ensure objective price setting. Different options for such a regulatory body are discussed in the recommendations section of this report.	GA has stronger incentives to ensure a high compliance rate and proper reliability compared to option 1. However, the incentives are likely to be smaller than in option 2 given that the company can cover its costs and become profitable even at current compliance rates. This effort is associated with a similar increase in administrative costs as in the case of option 2. It is vital for the tariff setting process to choose the correct regulatory body (and procedure) in order to avoid conflicts of interest and ensure objective price setting. An early announcement of the tariff methodology is likely to slow down land registration. This could result in higher administrative costs for GA as well as lower revenues. As the tariff is higher under this option, resistance from farmers to registration will be stronger (in order to avoid future tariff payments). The negative effects will be more pronounced than for option 2.

		An early announcement of the tariff methodology is likely to slow down land registration. This could result in higher administrative costs for GA as well as lower revenues.	
Economic	In the status quo, farmers keep benefiting from a low water tariff. This increases the potential profitability of the agricultural sector, together with its potential to be competitive. On the other hand, the excessively low cost of water and, in particular, the lack of relationship between the amount of water used and the amount paid, encourages wasteful practices. As far as the excessive use of water for irrigation is caused by a lack of awareness about the productivity gains from adopting more modern (and water-saving) irrigation technologies, the current system can also lead to lower-than-optimal profits. The lack of investment in reliability is likely to cause a decrease in the profitability associated with irrigation. In addition, wasteful practices in the irrigation sector can also lead to the under provision of water for other	In option 2: (a) Discounts for the variable component of the tariffs are expected to encourage the introduction of optimal irrigation technologies for different crops; (b) The increase in reliability of services, an important part of this policy option, might have additional economic benefits that are underestimated in our cost-benefit analysis, such as increased output in other sectors of the agricultural value chain.; (c) Option 2 gives additional incentives for a better allocation of agricultural land, through increasing the cost of keeping agricultural land inactive and/or underutilized. Such incentives can be expected to lead to a more efficient redistribution of agricultural land. On the other hand, in some areas the increase in the cost of irrigation services risks offsetting the gains (compared to neighboring countries). The presence of a fixed component of the tariff to be paid by everyone in the command	In option 3, as in option 2: (a) Discounts for the variable component of the tariffs are expected to encourage the introduction of optimal irrigation technologies for different crops; (b) The increase in reliability of services, an important part of this policy option might have additional economic benefits that are underestimated in our cost- benefit analysis, such as increased output in other sectors in agricultural value chain.; In option 3 the cost of keeping agricultural land inactive and/or underutilized is the highest. On one hand this could be expected to lead to a more efficient redistribution of agricultural land, the substantial increase in the costs associated with land ownership is very likely to offset these gains (compared to neighboring countries). In particular, as mentioned in option 2, the presence of a fixed component of the tariff to be paid by everyone in the command area, without the option to waive this component for those having access to better (and cheaper) irrigation options is going to introduce costly inefficiencies

	sectors and contribute to overall economic losses.	area, without the option to waive this component for those having access to better (and cheaper) irrigation options is going to introduce costly inefficiencies in the system. This might have negative impacts on production choices, the value of agricultural land, employment opportunities, exports, poverty reduction, the agricultural trade deficit and, more generally, on the competitiveness of the Georgian agricultural sector. Other sectors should gain from a more efficient use of water resources in irrigation.	in the system. This might have negative impacts on production choices, the value of agricultural land, employment opportunities, exports, poverty reduction, the agricultural trade deficit and, more generally, on the competitiveness of the Georgian agricultural sector. The likelihood of such negative effects is much higher in this scenario. In this scenario, the privatization of the company is more likely once the subsidies are over. However, GA will only be attractive to private investors if there is sufficient demand for its services at an unsubsidized price. However, in this scenario the government will have to pay additional attention to the investment choices of the company in order to avoid inefficient overinvestment due to the incentives associated with the rate of return regulation.
Social	Based on 2014 data, 50.1%[56] of employed persons in Georgia were in agriculture and the vast majority (49.9%) were self-employed. Access to affordable, good quality irrigation and drainage services, leading to increased productivity and higher income thus has a strong social dimension.	The positive social effects of irrigation remain in this hypothesis and are strengthened by the government's investments in reliability. However, the substantial increase in the tariff risks having substantially negative effects on the most vulnerable farmers by: • reducing their disposable income (and with it the possibility to invest in better	The positive social effects of irrigation remain in this hypothesis (albeit being smaller than in option 2) and are strengthened by the government's investments in reliability. However, even more so than in option 2, the substantial increase in the tariff risks having substantial negative effects on the most vulnerable farmers, by:

[56] Source: GeoStat HIS 2014; authors' estimations.

	Well-functioning and cost-effective amelioration is expected to contribute to the reduction of farmers' financial vulnerability by: (a) increasing expected incomes; (b) reducing income volatility; (c) serving as insurance against drought. Irrigation also helps to maintain minimum levels of population in sensitive areas and thus helps to slow the progress of desertification in arid regions. In the status quo, irrigation and drainage services are much cheaper with respect to the other options. This potentially allows even the poorest farmers to take advantage of them and improve their condition. In case the government also decided to invest in reliability in this scenario, this would definitely become the most beneficial option for farmers.	irrigation technologies and higher value crops); • forcing them to stop irrigating; • forcing them to sell their properties for a price inadequate to compensate them for the loss of their land and the services it provides them. These effects, unless compensated by some properly designed government policy, risk being significant and could lead to substantial social costs compared to the status quo.[57] The increased opportunity cost of owning unused land (reflected by the fixed component of the tariff) significantly increases. Selling the land might lead to a more optimal allocation of land among farmers, but from the social perspective the most vulnerable groups are likely to suffer. This is especially true when the land cannot be sold at a "fair" price because of the poorly developed land market and when the price of land is depressed by the steep increase in irrigation tariffs.	• reducing their disposable income (and with it the possibility to invest in better irrigation technologies and higher value crops); • forcing them to stop irrigating; • forcing them to sell their properties for a price inadequate to compensate them for the loss of their land and the services it provides them. This option is by far the riskiest from this point of view, in particular because of the introduction of a substantial fixed component charged to all farmers (which is much larger than in option 2), regardless of whether they irrigate or not. These effects, unless compensated by some properly designed government policy, risk being significant and lead to the highest social costs with respect to the status quo and could possibly be coupled with political unrest. The increased opportunity cost of owning unused land (reflected by the fixed component of the tariff) significantly increases. Selling the land might lead to a more optimal allocation of land among farmers, but from the social perspective the most vulnerable groups are likely to suffer. This is especially true when the land cannot be sold at a "fair" price because of the poorly developed land market and when the price of

[57] However, this impact is not quantified as farmers' decisions in our analysis depend on marginal cost and benefits. The fixed component of the tariff is not affecting irrigation choice, whilst the option of selling land is not included in the model due to the complexity of the issue.

			land is depressed by the steep increase in irrigation tariffs. This effect is significantly stronger in option 3.
Environmental	In general, the environmental impacts of irrigation are related to the changes in the quantity and quality of soil and water. These impacts stem from the changed hydrological conditions owing to the installation and operation of the scheme. An irrigation scheme often draws water from a river and distributes it over the irrigated area. As a hydrological result it is found that: (a) downstream river discharge is reduced; (b) the evaporation in the scheme is increased; (c) the groundwater recharge in the scheme is increased; (d) the level of the water table rises; (e) pest management is triggered because agriculture will intensify in the coverage areas, which could entail more intensive usage of pesticides;	Similar impacts to option 1 are expected for this option. However, this option's higher efficiency of water use is expected to result in less environmental damage.	Similar impacts to option 1 are expected for this option. However, this option's higher efficiency of water use is expected to result in less environmental damage.

	(f) irrigation has immediate effects on the provision of moisture to the atmosphere, inducing atmospheric instabilities and increasing downwind rainfall. The lower the irrigation efficiency, the higher the environmental losses. Smaller losses are attributed to the use of modern irrigation technologies (sprinkler irrigation and drip irrigation).[58]		
Public financing	The GoG covers the difference between GA revenues and costs as well as investing money in infrastructure development. This approach is inefficient from the public finance perspective as it is hard to plan future losses. Also, it gives no incentives to the management of GA to increase efficiency and cut costs, potentially resulting in ever expanding government transfers.	The GoG subsidizes farmers directly and invests money in infrastructure development. Public money can be spent more efficiently if the incentives to improve quality and reliability of services and GA's efficiency in general are in place. The fixed component of the tariff it is accrued on the total command area and therefore the subsidy from the government can be clearly assessed. GoG has better tools to monitor GA's performance as well as objective parameters to use to evaluate the performance of GA's management.	In this scenario (like in option 2) the GoG subsidizes farmers directly and invests money in infrastructure development. Like in option 2, public money can be spent more efficiently if the incentives to improve quality and reliability of services and GA's efficiency in general are in place. In this context, however, GA's incentives to be more efficient are likely to be lower than in option 2 because lower efficiency would not automatically translate into operational losses. Even more so than in option 2, in option 3 it is necessary that the government closely monitors the performance of the company, does not

[58] Source: FAO 2004.

		However, this should not be taken for granted: (i) there are more incentives to increase the quality and reliability of services ONLY IF the government does not automatically close any budget gap that GA might develop; (ii) incentives to increase efficiency will increase only if management is held accountable and rewarded/sanctioned on the basis of objective criteria. In this scenario (if we assume that in the status quo the government does not invest in reliability), the government has to utilize more financial resources. However, the improved quality of irrigation means that other state agricultural development programs' finances (such as the state vouchers for plowing) are not wasted.[59]	automatically close any budget gap that GA develops, and holds the management accountable and rewarded/sanctioned on the basis of objective criteria. As in option 2, the improved quality of irrigation means that other state agricultural development programs' finances (such as the state vouchers for plowing) are not wasted.[60] However, in this scenario the government has to spend the most financial resources (at least while it subsidizes the fixed component of the tariff).

High impact **Medium impact** **Low impact**

[59] Focus groups with farmers showed that without proper irrigation much of the state subsidies going to plowing, fertilizers, etc. are wasted.

[60] Focus groups with farmers showed that without proper irrigation much of the state subsidies going to plowing, fertilizers, etc. are wasted.

6.3. COST-BENEFIT ANALYSIS

OPTION 1 THE STATUS QUO REGULATION IS KEPT IN FORCE WITHOUT CHANGES (BASELINE SCENARIO)

We consider the costs and benefits for the following stakeholders: GA, farmers and the government.

OPTION 1: COSTS

Farmers. The costs of irrigation include:

(a) a fixed tariff charged only to those who choose to irrigate and sign a contract with GA (see Table 9);
(b) investment costs (see Table 1 in Appendix 5);
(c) variable costs (see Table 1 in Appendix 5);
(d) amortization of investment in irrigation (see Table 1 in Appendix 5).

A fixed per ha tariff is set under the current regulations. The investment costs of irrigation consist of the share of investments costs that should be imputed to the production year, plus the real interest paid on the amounts borrowed for the purpose of investing in irrigation. It should be also noted that different interest rates are chosen for large and small farmers. Amortization for the modern technology is accrued based on the annual depreciation of the technology and its lifetime. As for flood irrigation, based on the focus group results and expert opinion, costs are all imputed in the year during which they occur. For the drainage system, the only costs associated are tariff costs and no investments are accrued.
Switching to optimal irrigation technology is the result of the interaction between:
(i) the switching table (i.e. estimates of the share of farmers switching to optimal technology, see Table 2, Appendix 4);
(ii) profitability of switching, which is determined by farmers' costs to irrigate.

GA. The costs of GA include operative, maintenance (i.e. ongoing, periodic, surface and emergency rehabilitation of infrastructure), administrative (i.e. expenses to sustain a head office and regional branches) costs, depreciation and profit tax.[61] All costs aside from depreciation are divided into two equal parts and accrued in beginning and the end of the period (see costs per command area in Table 2, Appendix 5).

Government. The government costs include direct subsidies to GA covering the company's operational losses and total investment per command area. Therefore, the annual net losses of Georgian Amelioration are counted as costs of the government.

OPTION 1: Benefits

Farmers. The benefits to farmers are the average return per ha depending on the crop type and irrigation choice (i.e. (i) no irrigation, (ii) flood irrigation, (iii) irrigation with optimal technology). For drainage, average returns are calculated for treatment and without.

GA. The benefits to GA include operating revenues from the provision of irrigation services to farmers, which consists of a fixed tariff per ha irrigated/drained that is determined based on farmers' choices to irrigate/drain and their payment rate. For the calculation of net benefits, we also add the direct transfers from the government.

[61] It should be noted that property tax is not included in the costs of Georgian Amelioration due to the ambiguity of ongoing negotiations regarding property tax exemption.

Government. The benefits to the government include profit and property taxes. Government revenues do not include an increase in profit tax (CIT) from farmers as most of the large operators that are subject to CIT already use optimal irrigation.

OPTION 1: RESULTS

Farmers. We estimated the possible irrigated land under the status quo scenario considering its cropping and irrigation patterns. Farmers' willingness to undertake all irrigation and drainage costs, including tariffs, has been taken into account.

The results of net present value of farmers' net benefits are presented in Table 12.

Table 12. NPV of Net Benefits for Farmers (GEL)

Year	2016	2017	2018	2019	2020
NPV Net Benefits	147,979,706	139,598,226	131,523,831	124,603,739	118,752,520

The reliability of services does not change significantly in the case of policy option 1, as government investment is oriented towards increasing the command area and NOT towards increasing reliability. Therefore, most of the improvements in farmers' net benefits come from two sources: (i) the conventional increase of those farmers who irrigate using optimal technology; (ii) the real value of the tariff in option 1 decreasing over time. For similar reasons, we observe increases in the irrigated/drained land area (see Table 13).

Table 13. Irrigated/Drained Land Area in Status Quo Scenario (GEL)

Year	2016	2017	2018	2019	2020
Total Command Area (ha) for 5 irrigation systems analyzed	35,600				
Total Command Area (ha) for drainage system	16,340				
Irrigated land area (ha)	8,854	9,197	9,487	9,723	9,967
Drained land area (ha)	8,497	8,497	8,497	8,497	8,497

To proxy the differences between irrigated/drained and non-treated land, we calculated average returns for marginal/small farmers (0.8 ha) and medium/large farmers (30 ha). The returns for farmers who irrigate/drain increases as irrigation tariffs decrease in real terms. Table 14 shows the returns for farmers with and without irrigation.

Table 14. Returns for Farmers With and Without Irrigation (GEL)

Farmer/Treatment/Year	Not-irrigated	2016	2017	2018	2019	2020
Marginal/Small Farmer (0.8 ha)	1,883	2,944	2,943	2,949	2,964	2,980
Medium Large Farmer (30 ha)	70,608	110,383	110,347	110,603	111,136	111,767

GA. The revenues and costs for GA have been calculated for each command area separately. Therefore, the estimated total costs and revenues represent the simple sum of the results of the analysis of each command area. It should be noted that all costs aside from depreciation are kept constant in real terms, while depreciation increases due to an increase in the regulatory asset base. The costs, benefits and net benefits for GA are given in Table 15.

Table 15. Costs, Benefits and Net benefits for GA (GEL)

Year	2015	2016	2017	2018	2019	2020
Benefits[62]	3,236,755	13,614,723	13,614,723	13,614,723	13,614,723	10,377,968
Costs	3,236,755	13,614,723	13,614,723	13,614,723	13,614,723	10,377,968
Net Benefits	-	-	-	-	-	-

As Table 15 shows, the costs significantly exceed revenues. However, it should be noted that GA's net benefits cannot become negative as the government subsidizes all of the company's losses (which are counted as government costs).

Government. Estimates of government costs represent the company's losses and investments in reliability, while the benefits are acquired only through taxes to GA. Therefore, as GA makes losses, the government does not acquire any benefits. Table 16, presents the government costs in the status quo policy option.

Table 16 Government Costs in the Status Quo Scenario (GEL)

2015	2016	2017	2018	2019	2020
3,236,755	12,674,837	12,696,244	12,721,213	12,749,159	9,539,292

The NPV of the net benefits for all considered stakeholders are presented below (Table 17). It is positive for farmers, negative for the government and zero for GA, as expected from the summary of the baseline.

Table 17. NPV of Net Benefits for Stakeholders (GEL)

NPV Farmers	662,458,021
NPV GA	-
NPV Government	-50,912,230
Total NPV	611,545,791

OPTION 2 LOWER-BOUND TARIFFS ARE INTRODUCED (LOWER-BOUND SCENARIO)

We consider the costs and benefits for the following stakeholders: GA, farmers and the government.

OPTION 2: COSTS

Farmers. The costs of irrigation include:

(a) a two-component tariff under the new regulations (Table 9);
(b) investment costs;
(c) variable costs;

[62] Direct subsidies from the government to keep GA solvent are included in the company's benefits.

(d) amortization (see (b), (c) and (d) in Table 1, Appendix 5).

The amount paid by farmers for the first (variable) component depends on how much water is consumed (relative to the flooding). The second (fixed) component of the tariff is identical for all farmers within a given command area and is subsidized as described in the section about policy options. Water consumption will depend on the crop cultivated and the irrigation technology adopted. The investment costs of irrigation consist of the share of investment costs that should be imputed to the production year, plus the real interest paid on the amounts borrowed for the purpose of investing in irrigation. It should be also noted that different interest rates are chosen for large and small farmers. Amortization for modern technology is accrued based on the annual depreciation of the technology and its lifetime. As for flood irrigation, based on the focus group results and expert opinion, costs are all imputed in the year during which they occur.

Switching to optimal irrigation technology is the result of the interaction between: (i) the switching table (i.e. estimates of the share of farmers switching to optimal technology, see Table 2, Appendix 4); and (ii) the profitability of switching, which is determined by farmers' costs to irrigate.

For the drainage system, the only costs associated are tariff costs and no investments are accrued.

GA. The costs of GA include operative, maintenance (i.e. ongoing, periodic, surface and emergency rehabilitation of infrastructure), administrative (i.e. expenses to sustain a head office and regional branches) costs, depreciation and profit tax (see Table 2, Appendix 5).[63] All costs, aside from depreciation, are divided into two equal parts and accrued in beginning and the end of the period (to approximate the fact that they are spread over the whole year).

Government. The government costs include direct subsidies to farmers on the second component of the tariff (decreasing with time) and direct subsidies to GA for covering excess costs (see Table 1, Appendix 5). Government also covers the costs of investments in reliability.

OPTION 2: Benefits

Farmers. The benefits to farmers are the average returns per ha depending on the crop type and irrigation choice (i.e. (i) no irrigation, (ii) flood irrigation, (iii) irrigation with optimal technology for the crop). For drainage, average returns are calculated for treatment and without (see Table 1, Appendix 5).

GA. The benefits to GA include operating revenues from the provision of irrigation services to farmers. This consists of government subsidies to farmers on the second component of the tariff, which is directly paid to GA on the total command area. Additional revenue comes from farmers paying the first component of the tariff (based on their estimated water consumption). In addition, until GA manages to improve the compliance rate to the break-even level, the company receives direct subsidies from the government. In such a case, additional direct government subsidy is accrued in GA's benefits. GA also receives benefits from government investments in reliability.

Government. The benefits to the government include profit and property taxes. Government revenues do not include an increase in profit tax (CIT) from farmers as most large operators that are subject to CIT already use optimal irrigation.

OPTION 2: RESULTS

Farmers. We estimated the possible irrigated land under the lower-bound scenario considering farmers' cropping and irrigation patterns. Farmers' willingness to undertake all irrigation and drainage costs, including the two-component tariff, has been taken into account based on the subsidization schemes discussed above. The results of our estimation of the net present value of farmers' net benefits are presented in Table 18.

[63] It should be noted that property tax is not included in the costs of Georgian Amelioration due to the ambiguity of ongoing negotiations regarding property tax exemption.

Table 18. NPV of Net Benefits of Farmers (GEL)

Year	2016	2017	2018	2019	2020
NPV of Net Benefits	147,964,664	144,928,735	140,536,147	136,297,396	132,731,494

The major factor having a positive impact on these values is the increase in the reliability of services, which makes farmers' activities more profitable. As tariffs are set for five years, the decrease in the real value of the first component of the tariff also contributes to the increase in farmers' net benefits. An increase in contracting and payment/compliance rates significantly improves the number of hectares irrigated, as presented in Table 19.

Table 19. Irrigated Land Area in the Lower-Bound Scenario (GEL)

Years	2016	2017	2018	2019	2020
Total Command Area (ha) for 5 irrigation systems analyzed	35,600				
Total Command Area (ha) for drainage system	16,340				
Irrigated land area (ha)	9,234	10,579	12,016	13,544	15,164
Drained land area (ha)	8,497	9,436	10,376	11,315	12,255

To proxy the differences between irrigated/drained and non-treated land, we calculated the average return for marginal/small farmers (0.8 ha) and medium/large farmers (30 ha). The returns for farmers who irrigate/drain increases as fixed irrigation tariffs decrease in real terms. Table 20 shows the returns for farmers with and without irrigation.

Table 20. Returns for Farmers With and Without Irrigation (GEL)

Farmer/Treatment/Year	Not-irrigated	2016	2017	2018	2019	2020
Marginal/Small Farmer (0.8 ha)	1,883	2,943	2,968	2,993	3,018	3,042
Medium Large Farmer (30 ha)	70,608	110,370	111,299	112,228	113,157	114,086

GA. Revenues and costs for GA have been calculated for each command area separately. Therefore, the estimated total costs and revenues represent the simple sum of the results of the analysis for each command area. It should be noted that all costs aside from depreciation are kept constant in real terms. Consequently, depreciation increases due to the growth of the regulatory asset base that causes changes in GA's costs. The results of our estimates for GA's benefits, costs and net benefits are presented in Table 21.

Table 21. Benefits, Costs and Net Benefits of GA (GEL)

Region/Year	2015	2016	2017	2018	2019	2020
Benefits[64]	3,236,755	24,734,398	25,098,958	25,463,518	25,828,079	22,985,435
Costs	3,236,755	13,614,723	13,979,283	14,343,844	14,708,404	11,836,209
Net Benefits	-	11,119,675	11,119,675	11,119,675	11,119,675	11,149,226

As Table 21 shows, under a relatively low compliance rate, costs still significantly exceed revenues. However, GA's net benefits cannot become negative as the government subsidizes all of the company's losses. Furthermore, due to the increase in contracting over time, GA does not need subsidization and is acquiring a small profit. This underlines that service reliability is an essential factor for the company's financial success because of its impact on the compliance/payment rate and contracting.

Government. Estimates of government costs represent the company's losses, farmers' subsidies and investments in reliability. While benefits are acquired only through taxes to GA. Because GA is not making any profits in the lower-bound scenario, no benefits are expected for the government. Table 22 presents the government's costs and benefits.

Table 22 Government Benefits and Costs in the Lower-Bound Scenario (GEL)

	2015	2016	2017	2018	2019	2020
Benefits	-	-	-	-	-	5,215
Costs[65]	3,236,755	21,757,701	21,419,349	21,137,759	20,909,908	17,530,903
Net Benefits	-3,236,755	-21,757,701	-21,419,349	-21,137,759	-20,909,908	-17,525,688

The NPV of the net benefits for all considered stakeholders are presented below (Table 23). As expected, it is positive for farmers, negative for government and positive for GA considering benefits received from government investment and increase in contracting and compliance rate.

Table 23. NPV of Net Benefits for Stakeholders (GEL)

NPV Farmers	702,458,436
NPV GA	43,560,134
NPV Government	-84,274,617
Total NPV	661,743,953

[64] GA's benefits include government investments that are reflected in an increase of the company's assets and direct state subsidies to cover the company's excess costs over revenues.

[65] Government costs include investments in the company's assets to increase service reliability and direct subsidies to GA to balance its excess costs over benefits.

OPTION 3: UPPER-BOUND TARIFFS ARE INTRODUCED (UPPER-BOUND SCENARIO)

We consider costs and benefits for the following stakeholders: GA, farmers and the government.

OPTION 3: COSTS

Farmers. The costs of irrigation include:
(a) a three-component tariff under the new regulations;
(b) investment costs;
(c) variable costs;
(d) amortization (see (b), (c) and (d) in Table 1, Appendix 5).

As in the case of the previous option, the amount paid by the farmers' for the first (variable) component depends on how much water is consumed (relative to the flooding). The second and third components of the tariff are subsidized as described in above section about policy options. Water consumption will depend on the crop cultivated and the irrigation technology adopted.

Investment costs and other costs associated with irrigation and drainage are imputed exactly as in the previous option.

GA. As in previous options, costs of GA include operative, maintenance (i.e. ongoing, periodic, surface and emergency rehabilitation of infrastructure), administrative (i.e. expenses to sustain a head office and regional branches) costs, depreciation and profit tax (see Table 2, Appendix 5)[66]. All costs, aside from depreciation, are divided into two equal parts and accrued in beginning and the end of the period.

Government. The government costs include direct subsidies to farmers on the first and second (fixed) components of the tariff. Therefore, in this section the government pays GA a return on invested capital. Government covers the costs of investments in reliability.

OPTION 3: Benefits

Farmers. The benefits to farmers are the average return per ha depending on the crop type and irrigation choice (i.e. (i) no irrigation, (ii) flood irrigation, (iii) irrigation with optimal technology). For drainage, average returns are calculated for treatment and without.

GA. The benefits to GA include operating revenues from the provision of irrigation services to farmers. This consists of government subsidies on the second and third (fixed) components of the tariff that are directly paid to the company on the total command area. In addition, revenues are generated from farmers paying the first (variable) component of the tariff based on their expected consumption, estimated on the basis of the crop cultivated and the irrigation technology adopted. In addition, GA receives benefits from government investments in reliability.

Government. The benefits to the government include profit and property taxes. Government revenues do not include an increase in profit tax (CIT) from farmers as most large operators that are subject to CIT already use optimal irrigation.

OPTION 3: RESULTS

Farmers. We estimated the possible irrigated land under the upper-bound scenario considering farmers' cropping and irrigation patterns. Farmers' willingness to undertake all irrigation and drainage costs, including the three-component tariff, has been taken into account based on the

[66] It should be noted that property tax is not included in the costs of Georgian Amelioration due to the ambiguity of ongoing negotiations regarding property tax exemption.

subsidization schemes discussed above. The results of our estimation of the NPV of the net benefits for farmers are presented in Table 24.

Table 24. NPV of Net Benefits for Farmers (GEL)

Region/Year	2016	2017	2018	2019	2020
NPV of Net Benefits	147,964,664	144,026,228	138,955,313	34,220,648	30,306,399

The net benefits for farmers in policy option 3 are smaller than in option 2, but are similar to option 1. The major factor having a positive impact on these values is the increase in the reliability of services, which makes farmers' activities more profitable. As tariffs are set for five years, the decrease in the real value of the first component of the tariff also contributes to the increase in farmers' net benefits. In contrast, the higher fixed tariff payment per ha due to a decrease in government subsidies brings farmers' net benefits for policy option 3 below those of both options 1 and 2. The increase in total hectares irrigated in this policy option are as presented in Table 25.

Table 25. Irrigated land Area in the Upper-Bound Scenario

Years	2016	2017	2018	2019	2020
Total Command Area (ha) for 5 irrigation systems analyzed	35,600				
Total Command Area (ha) for drainage system	16,340				
Irrigated land area (ha)	9,234	10,579	12,016	13,544	15,164
Drained land area (ha)	8,497	9,436	10,376	11,315	12,255

To proxy the differences between irrigated/drained and non-treated land, we calculated the average return for marginal/small farmers (0.8 ha) and medium/large farmers (30 ha). The returns for farmers who irrigate/drain increases as fixed irrigation tariffs decrease in real terms. Table 26 shows the real returns for farmers with and without irrigation for policy option 3.

Table 26. Real Returns for Farmers With and Without Irrigation (GEL)

Farmer/Treatment/Year	Not-irrigated	2016	2017	2018	2019	2020
Marginal/Small Farmer (0.8 ha)	1,671	2,959	2,979	3,000	3,021	3,041
Medium Large Farmer (30 ha)	62,644	110,955	111,730	112,504	113,278	114,052

GA. Revenues and costs for GA have been calculated for each command area separately. Therefore, the estimated total costs and revenues represent the simple sum of the results of the analysis for each command area. It should be noted that all costs aside from depreciation are kept constant in real terms. Consequently, depreciation increases due to the growth of the regulatory asset base that causes changes in GA's costs. The results of our estimates for GA's benefits, costs and net benefits are presented in Table 27.

Table 27. Costs and Benefits of GA (GEL)

Region/Year	2015	2016	2017	2018	2019	2020
Benefits[67]	3,236,755	43,022,135	41,978,580	40,986,301	40,042,234	38,658,012
Costs	3,236,755	13,614,723	13,979,283	14,343,844	14,708,404	11,836,209
Net Benefits	-	29,407,411	27,999,297	26,642,457	25,333,830	26,821,803

As Table 27 shows, even under relatively low compliance rates as compared to option 2, the company's benefits exceed the costs and thus there is no need for any direct subsidy from the government. Increasing the contracting rate is still an important factor in driving an increase in the company's net benefits.

Government. Estimates of government costs represent company's losses, farmers' subsidies and investments in reliability. While the benefits are acquired only through taxes to GA, in the upper-bound scenario the company pays the government profit tax as expected. Government costs and benefits thus consist of direct subsidies to farmers and revenues from profit tax, as presented in Table 28.

Table 28 Government Costs and Benefits in the Upper-Bound Scenario

Year	2015	2016	2017	2018	2019	2020
Benefits	-	3,227,248	2,978,757	2,739,315	2,508,380	2,770,964
Costs[68]	3,236,755	43,272,686	40,210,494	37,367,031	34,728,408	32,281,564
Net Benefits	-3,236,755	-40,045,438	-37,231,737	-34,627,716	-32,220,027	-29,510,600

The NPV of the net benefits for all considered stakeholders are presented below (Table 29). As expected, it is positive for farmers, negative for government and positive for GA.

Table 29. NPV of Net Benefits for Stakeholders (GEL)

NPV Farmers	695,473,251
NPV GA	107,194,564
NPV Government	-140,923,862
Total NPV	661,743,953

[67] GA's benefits include government investments that are reflected in an increase of the company's assets and direct state subsidies to cover the company's excess costs over revenues.

[68] Government costs include investments in the company's assets to increase service reliability.

6.4. SUMMARY OF COST-BENEFIT ANALYSIS

The net benefits for the different agents significantly differ between the options. **For farmers,** the net benefits are highest in option 2, while they are slightly lower for policy option 3. Assuming intervention in the sector is limited to covering GA's losses, the **government** is better off in option 1, although farmers' net benefits are lowest in that option. **In the event that the government decides to implement the tariff policy and undertake investment, its net benefits will be highest in option 2**. From the perspective of **GA, policy option 3 generates the highest net benefits for the company**. However, it should be noted that additional GA revenues are primarily paid with government subsidies to farmers.

Some impacts are not captured within the CBA model:

- Positive effects in the agricultural value chain, including transportation, sorting/grading, processing, storage, packing/packaging, food processing and branding industries;
- A positive impact on the country's food security;
- The opportunity cost of government spending;
- Loss of competitiveness due to high water tariffs;
- The social costs of the reform.

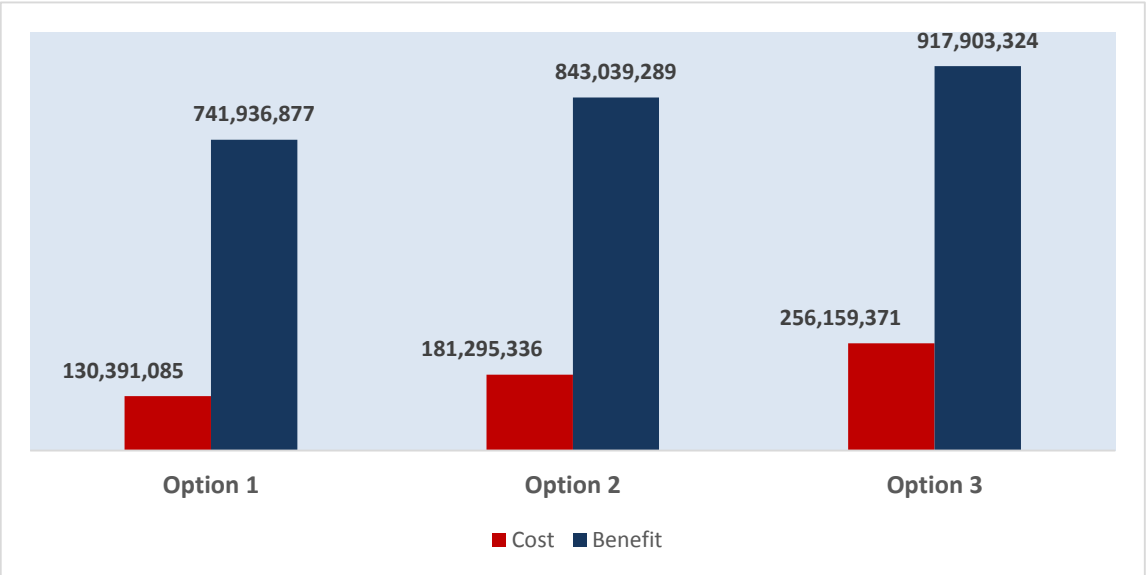
More details are provided in the table below:

Table 30. Summary of Costs and Benefits (GEL)

	OPTION 1	OPTION 2	OPTION 3
Benefits (NPV)	741,936,877	843,039,289	917,903,324
Costs (NPV)	130,391,085	181,295,336	256,159,371
Benefits – Costs (NPV) for farmers	662,458,021	702,458,436	695,473,251
Benefits – Costs (NPV) for GA	-	43,560,134	107,194,564
Benefits – Costs (NPV) for the Government	-50,912,230	-84,274,617	-140,923,862
Quantified but not monetized impacts	N/A	N/A	N/A
Qualitative impacts (if quantitative not possible)	Minor increase in productivity and support to the domestic agricultural value	Increase in productivity of the domestic agricultural value chain.	Increase in productivity of the domestic agricultural value chain (potentially moderated by the reduction in farmers'

	chain (lack of reliability). Possible efficiency losses due to the high opportunity cost of taxpayers' money. Lowest negative impact on most vulnerable farmers. Lowest negative impact on the production costs of farmers.	Lowest possible efficiency losses among options due to the high opportunity cost of taxpayers' money. Each GEL invested in the sector brings the highest benefits to the farmers. Possible improvement in the allocation of land and water resources. Risk of a loss of competitiveness in the agricultural sector due to the increase in irrigation tariffs. Risk of depressing the land market. Greatest incentive to improve the efficiency of operations for GA.	savings with respect to option 2). Highest possible efficiency losses among options due to the high opportunity cost of taxpayers' money. Highest risk of loss of competitiveness in the agricultural sector due to excessively high irrigation tariffs. Highest risk of depressing the land market.

Figure 2. Comparison of Costs and Benefits of Policy Options (NPV, GEL)



UNCERTAINTIES

Since the costs and benefits of stakeholders depend on our assumptions, there are uncertainties that might affect the costs and benefits if the parameters change.

One of the most important parameters is the compliance/payment rate. If the compliance rate ends up being lower than considered in the CBA model, farmers will receive lower benefits and the company might also incur financial losses in options 2 & 3. Farmers' demand for irrigation/drainage

services depends on agricultural product prices, which we assumed would be the same as in 2015 over the next five years. This, however, is not guaranteed. With increased productivity and a slow increase in market demand, prices might not increase sufficiently to allow farmers to remain competitive and maintain their margins, despite the increase in water costs.

This is likely to be a substantial issue, especially for option 3, in which the cost of irrigation per ha would grow greatly, risking damage to the competitiveness of Georgian farms and depressing land prices. This, in turn, might lead to lower compliance rates and lower demand for GA services. In the event of price drops of primary agricultural products, this scenario cannot be easily dismissed.

Sensitivity Analysis

Sensitivity analysis was done in order to check the robustness of the results with regard to changing parameters. The following scenarios were considered in the framework of sensitivity analysis:

- A different compliance rate (increased to 100% for options 2 & 3 and increasing to 75% for option 1)
- Different contracting efficiencies (constant with the current level and gradually increasing at different levels)
- A lower and higher discount rate (6.7% and 10.7%)
- Changing productivity levels (increased by 25% and decreased by 25%)
- A faster phasing out of the subsidies on the fixed component of the tariff (annual decrease in direct subsidies to farmers by 5%, 10%, 20%, 25%)

The sensitivity analyses show that options 2 and 3 are preferable to the status quo if the total NPV of net benefits are considered, mostly because of the investments in reliability (which do not take place in the status quo). The NPV for option 1 results in the highest net benefits for farmers if the compliance rate increases to 75%. Moreover, if the government decides to invest in service reliability without introducing the new tariffs (which we call option 1*) total NPV becomes the highest.

The discount rate does not have a significant effect on the final results. Productivity level changes do not change the ranking of the options.

The CBA model shows that the key variables impacting both total and farmers' net benefits are contracting and compliance/payment rates (related to reliability and the total tariff amount).

7. COMPARING THE OPTIONS

In order to see the magnitude of costs and benefits at the level of the entire country we extrapolated the CBA results based on the share of the six analyzed schemes in the total command area.[69] Table 31 shows the results for the major options 1, 2 and 3 (as well as for the modification of option 1 – option 1*).

Option 1*:

In order to see the impact of government investment in the status quo, we introduced an additional scenario – option 1*. This option differs from the status quo in following way:

(a) The government investment 25 mln GEL annually in the rehabilitation of the existing amelioration infrastructure;

(b) As a result of this government investment in existing infrastructure, compliance and contracting rates increase to the same level as in options 2 and 3 (and are not constant as in option 1).

Table 31. Summary of Cost-Benefit Analysis (mln GEL)

INDICATORS	OPTION 1 (Status Quo)	OPTION 2 (Lower Bound)	OPTION 3 (Upper Bound)	*OPTION 1* (Status Quo with investments in reliability)*
NPV of Farmers (GEL)	1,489,382,661	1,579,314,282	1,563,609,721	1,604,441,396
NPV of GA (GEL)	-	97,934,823	241,002,026	97,891,131
NPV of the Government (GEL)	-114,464,298	-189,471,860	-316,834,502	-216,502,110

Main Options:

Customers (farmers) generate the highest benefits under option 2 the lower-bound scenario. Due to investments in reliability and the increased quality of service, more farmers use amelioration services. Regardless of the increased tariff, farmers benefit from increased reliability and more of them choose to irrigate/drain their land. Thus, the negative impact of the increase in the tariff is offset by the benefits of irrigation. In addition, it has to be noted that this will only happen if there is a sufficient increase in the quality and reliability of service. Furthermore, option 1*, the theoretical example of the status quo with government investment, gives farmers the highest benefits among the options. Comparing farmers' benefits in option 1 and option 1* gives a clear picture of the importance of reliability investments.

GA is better off in option 3 as it is getting a rate of return on capital. It has to be noted that the additional component of the tariff in Option 3 (the rate of return on capital) significantly increases the total amount to be paid. Therefore, most of the company's profits will be paid by its shareholder

[69] Extrapolation of results was done based on the share of the analyzed command area in the total command area of GA around the country. The share analyzed in the six systems was 44% of the total, thus all results were multiplied by 100/44=2.3.

– the government. This policy option can be taken into consideration in the long term, when the government manages to cancel the subsidization of farmers and the company becomes attractive for private investors. In the case that the company manages to increase contracting in line with the improvements in compliance/payment rates, it can receive modest benefits. It should also be noted that too early adoption of option 3 carries substantial risk that excessively high tariff levels will reduce contracting and collection efficiency.

The Government spends the least in policy option 2 and gets maximum effect. Improvements in reliability and efficiency make government spending in the sector significantly more efficient. Interestingly, in the theoretical option 1* (where the government invests and keeps the status quo tariffs) government spending has to be higher than in option 2, thereby underling the efficiency of policy option 2.

In addition to **NPV**, we used the following criteria for comparing the three policy options.

1. **Effectiveness 1.** This criterion evaluates the contribution of the policy option to supporting the development of a reliable water supply through the renovation and rehabilitation of infrastructure (achieving general objective 1). More specifically, it evaluates the capability of the policy option to lead to:

    a) Construction, renovation and rehabilitation of amelioration infrastructure to ensure service reliability and minimize water losses.

2. **Effectiveness 2.** This criterion evaluates the contribution of the policy option to ensure financial sustainability of the amelioration SPs (achieving general objective 2). More specifically, it evaluates the capability of the policy option to:

    a) Cover costs of providing the service without direct subsidy to the SP – either covering O&M costs or including capital expenses;

    b) Development of the tariff methodology, ensuring tariff transparency, management accountability, and the creation of billing and accounting systems for the proper management of GA;

    c) Encourage wise investment decisions from the government to maximize economic effects.

3. **Effectiveness 3.** Ensuring the efficient allocation of water across alternative uses:

    a) Provide incentives for the efficient use of limited water resources;

    b) Foster awareness about the real opportunity cost of water used for irrigation.

4. **Effectiveness 4.** Increasing the competitiveness of Georgia's agricultural sector by providing reliable irrigation and drainage services at reasonable prices:

    a) Foster awareness of Georgian farmers about the use of more drip and sprinkle irrigation systems to increase crop yields per ha;

    b) Ensure a high quality irrigation service to increase the confidence of farmers to switch to higher value crop production;

    c) Protect farmers from paying excessively high water prices.

- **Feasibility/Ease of implementation**. This criterion assesses how easy it is to realize the policy option. This includes the increased compliance rate, the possible scarcity of resources, and adequate quality (e.g., scarcity of financial resources, capacity of program managers, volume of water needed during the drought seasons) to cope with a complex program and successfully implement the policy reform.

- **Minimization of risks associated with the reform**. This criterion evaluates the capacity of the option to minimize the undesired negative impacts of the reform not monetized in the CBA. The reform might be associated with the undesired social and economic effects discussed above; the company may still suffer losses due to low payment rates; implementing the discount scheme on the second component of the tariff may be problematic from an administrative standpoint; the tariff might become a burden for the farmers after subsides from the government are abolished; and the company might not be privatized, even in the upper-bound tariff scenario.
- **Maximization of potential benefits associated with the reform.** This criterion evaluates the capacity of the option to maximize the positive impacts of using optimal irrigation technologies. The positive externalities generated by the reform, such as increasing the awareness of farmers about the benefits of modern technologies of irrigation. In turn, better irrigation will improve agricultural productivity and competitiveness, decreasing the country's food dependence and improving its food security.

7.1. SUMMARY OF OPTIONS

Table 32. Comparison of Options Using Multi-Criteria Analysis

EVALUATION CRITERIA	OPTION 1 (Status Quo)	OPTION 2 (Lower Bound)	OPTION 3 (Upper Bound)	OPTION 1* (Status Quo with investments in reliability)
NPV of Farmers (GEL)	1,489,382,661	1,579,314,282	1,563,609,721	1,604,441,396
NPV of GA (GEL)	-	97,934,823	241,002,026	97,891,131
NPV of the Government (GEL)	-114,464,298	-189,471,860	-316,834,502	-216,502,110
Effectiveness 1	-	+ +	+	+
Effectiveness 2	- - -	+ +	+ + +	- - -
Effectiveness 3	- - -	+ +	+ +	-
Effectiveness 4	-	+ + +	+	+ +
Feasibility / Ease of implementation	N/A	-	-	+ +
Minimization of risks associated with the reform	N/A	+ +	+	+ + +
Maximization of potential benefits associated with the reform	N/A	+ +	+	+

Note: Options 1, 2 and 3 were the options initially analyzed. Option 1 is an additional option introduced in order to allow the impact of the introduction of a new tariff methodology to be distinguished from that of investing in reliability. A detailed explanation of the results of the multi-criteria analysis is given in Appendix 6.*

7.2. SUMMARY OF MULTI-CRITERIA ANALYSIS

Options 2 and 3 address the general objectives in the following way:

1. **General objective 1: Develop a reliable water supply through renovation and rehabilitation of infrastructure.**

   We gave a slightly higher score to Option 2. While it is true that the investment in reliability are going to be the same in both options, the service providers have arguably a stronger incentive to ensure service supply reliability under the lower-bound scenario. Under option 3 most of their revenues are generated from a fixed component that does not depend on the quality of service provided, which makes it much easier for the company to cover its costs even at lower levels of contracting efficiency and compliance.

2. **General objective 2: Ensure the financial sustainability of amelioration SPs (eliminate dependency from government subsidies)**

   A slightly higher score is given to Option 3 compared to Option 2. While still extremely dependent from (now indirect) public subsidies, the service provider under policy option 3 can potentially become profitable in the very first year of tariff policy implementation and can cover a greater fraction of its costs with the money paid by farmers.

3. **General objective 3. Ensure an efficient allocation of water across alternative uses**

   Similar scores are given to policy options 2 and 3. As investment in reliability is identical, and the variable component of the tariff does not change, farmers have similar motivations to install water-saving irrigation technologies in the two policy options. However, it should be noted that the higher tariffs under option 3 bear the risk that farmers will have less disposable income to invest in modern irrigation. In this case, especially in the presence of limited access to credit and the high cost of capital, water savings might be smaller in option 3. Neither of the two options receives the highest score because at this stage water metering is unfeasible.

4. **General objective 4. Increase the competitiveness of Georgia's agricultural sector by providing reliable irrigation and drainage services at reasonable prices**

   Here the highest score is given to policy option 2. This option gives farmers incentives to irrigate with better technologies, while increasing their production costs the least. It is important to note that at the current values of the tariffs (and in the absence of public subsidies to farmers), option 3 would lead to water-related costs that are well above those of neighboring countries. This could depress the land market and reduce incentives to engage in agricultural activities, even for the potentially most productive farmers.

   The concerns raised above are based on the observation that, while the values of the ***lower-bound tariff*** utilized in this analysis ***are close to the irrigation pricing patterns of neighboring countries*** (primary competitors in agricultural produce), the ***upper-bound prices are way above the tariffs of these countries***. This means that adopting an upper-bound tariff in these conditions might put local producers at a significant cost-disadvantage with respect to their close competitors.

There might be some constraints in the implementation of the new irrigation/drainage tariff methodology:

a) Applying the rebate suggested by Georgian Amelioration could be problematic, as water metering is too costly and it is assumed that it will not be installed for farmers in the near future;

b) At this stage, the government priority is increasing irrigable land (the command area) (Agricultural Strategy 2015-2020). If this policy is not supplemented, or accompanied with consequent investments in increasing the capability of existing infrastructure, the

implementation of the tariff methodology will either fail, or significantly decrease farmers' benefits from irrigation (and farmers' incentives to request GA services);

c) Improvements in the company's administrative and financial management is essential for transparent tariff calculations in the cases of both regulation by law and by a supervisory body. Moreover, without a comprehensive financial audit calculating the tariff levels for separate command areas poses a transparency challenge for the company;

d) The minimization of costs and the maximization of the benefits of the reforms are associated with the existence of well-functioning financial and land markets. The first step to the creation of an efficient land market is the registration of all farm land.

In order to minimize potential risks and maximize the benefits associated with the reform, it is crucial that the government commits to financing investments in reliability (as identified by GA on the basis of its experience), monitoring GA activities, commissioning a thorough auditing of the accounts of the company, and creating a strong and qualified regulatory authority. It is also important that, while deciding the level of subsidies to provide, the government keeps under consideration the impact that an excessively high tariff might have on the competitiveness of the agricultural sector. Overall, based on our analysis, it appears that in the short/medium term of the next five years, option 2 is substantially better in terms of minimizing potential risks and maximizing the potential benefits associated with the reform.

7.3. OVERVIEW OF INVESTMENT NEEDS IN THE AMELIORATION SECTOR AND THE IMPACT OF THE PROPOSED OPTIONS ON THE STATE BUDGET

One of the questions raised by some stakeholders was how the different options would impact the government budget in the next 5 years if one included also the investments necessary to expand the command area. In response, we have produced Table 33.
In Table 33 we calculated the Present Value (PV) of the total expected government spending in the Amelioration sector during the next 5 years. Government spending in the Amelioration sector in the coming 5 years will result from the sum of two main components: 1) Government direct contribution to the investments needed to expand the area potentially serviced, and 2) Government expenditures associated with the "ordinary functioning" of the sector under each of the proposed options[70].
We have excluded option 1 from this table as it is not comparable with the other options in terms of required future investment and it is anyway inferior to all others in terms of net benefits. Data about the estimated investment required in amelioration infrastructure were provided by GA.

Table 33. Government Spending on Amelioration Sector under the Analyzed Options (Present Value, in MLN GEL).

		Option 1*	Option 2	Option 3
1	**Additional investment required to expand the area potentially serviced[71]**	267	267	267
2	GA excess resources generated in the next 5 years, under different tariffs (from RIA)	0	0.043	144
3	**Required direct Government Investment in the sector[72] [1-2]**	**267**	**267**	**123**
4	Other ("ordinary") Government expenditures in the Ameliorations sector in the next five years [estimated budgetary impact of the different options – from RIA (excluding investment in increase of command area)]	216	189	317
5	**Total Government expenditure in Amelioration sector (5 year horizon)**	**483**	**456**	**440**
6	**Farmers' additional payments (with respect to status quo)**	**0**	**25**	**41**

In row 1 of Table 2 we report GA estimates of the financial resources required over the next 5 years in order to expand the potentially serviced area to the desired level (267 mln GEL[73]).

In row 2 we report the excess resources (revenues exceeding the operation and maintenance costs) that GA should be able to generate during the coming 5 years under each option. These resources could potentially be used by GA to partially finance the above mentioned investments. Only in Option 3 GA contribution could be significant, provided that: 1) compliance and contracting rates do not decline with respect to the other option; 2) GA manages to collect the fixed component of the tariff from the farmers who do not sign a contract with it, without a significant increase in

70 We are aware of the fact that these are just approximate figures (RIA estimates, for example, refer to the impact of the alternative options keeping the command area fixed) and we emphasize that Table 2 is just illustrative.

71 Estimates provided by Georgian Amelioration i.e. the investment needed to increase existing command area.

72 Conditional on GA reinvesting in the amelioration infrastructure ALL its NET Benefits – excluding contributions in kind

73 This amount is the NPV of the required investments over the next 5 years.

collection costs; 3) GA agrees to use all its profits to finance the development of the amelioration infrastructure.

Subtracting from the financial needs of the sector GA's potential contribution we can identify the amount Government should finance directly under all three options (row 3). Option 3 clearly requires (if all above mentioned assumptions are satisfied) a substantially lower direct investment from the Government.

Determining the total impact on the Government budget associated with each of the analyzed options over the next 5 years requires adding to the Government contribution to future investments the other expenditures - relative to the amelioration sector - that will also be financed by the Government under the three options in the same period. These expenditures, estimated during the RIA process, are indicated in row 4.

Once investment and other expenditures are summed (row 5), the differences between the budget impacts of the three options under analysis are greatly reduced. In fact, most of the apparent reduction in Government investment expenditures in option 3 is offset by the increased amounts paid by the Government to GA as "subsidy to farmers".

Basically, the only real benefit the government budget will receive in the coming 5 years from the introduction of Option 3 will be due to the shifting of part of the investment costs to increase the command area on the farmers (row 6).

It is also important to note that the gains for the government budget will not necessarily extend beyond the 5th year. This is due to the fact that, when most of the required investments to increase command area will have taken place, Option 3 – as it can be easily deduced observing rows 4 and 6 – will be imposing a substantially higher costs both to the government (until subsidies will have been phased out) and to farmers.

8. MONITORING AND EVALUATION PLAN

In this section, we suggest a rough plan for the monitoring and evaluation of the agricultural amelioration system in Georgia. Table 34 summarizes a variety of data that could be collected and indicators that could be employed in order to make evaluating the success (or failure) of the new policy option easier.

Table 34 Indicators of Progress Towards Meeting the Objectives

INDICATOR	FREQUENCY OF EVALUATION	RESPONSIBILITY FOR MONITORING
Amount of irrigated/drained land (ha); Share of farmers using irrigation/drainage (%); Number of contracts signed; Compliance/payment rate (%).	Yearly	GA and MoA
Subsidy level (%); Amount of tariff rate on irrigation; Amount of tariff rate on drainage.	Yearly	GA and MoA
Change in the share of companies'/farmers' profits coming from more reliable irrigation/drainage (%); Change in the share of companies'/farmers' profits coming from the installment of optimal irrigation systems (%). Average share of irrigation/drainage costs in total costs per ha (%).	Farmer's survey in every 5 years.	GeoStat with the help of Farmers' Associations (e.g. GFA)
Collection of data about all crops from all regions/municipalities in a centralized dataset;	Yearly	Geostat, GA and MoA
Increase in agricultural output on irrigated/drained land (%); Increase in the average value of agricultural output on irrigated/drained land (%); Increase in the yield per hectare on irrigated/drained land (%).	Yearly	Geostat, Farmers' Associations (e.g. GFA) and agro businesses
Amount of investments in optimal irrigation technologies.	Yearly	GA, MoA, Farmers' Associations (e.g. GFA) and agro businesses
Amount of land as a collateral (ha); Increased price of land because of better irrigation/drainage as support for collateral.	Yearly	Banks and MFIs
Number of guidelines developed; Number of agronomists/farmers trained on optimal technology of irrigation and the possibility of growing more profitable crops.	Yearly	GA and MoA

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10. APPENDICES

10.1. APPENDIX 1

SUMMARY OF THE FOCUS GROUP

1. Meeting Date: 26 November 2015

Location: Marneuli Municipality

Focus Group participants: four farmers.

Moderators – Levan Pavlenishvili (ISET-PI), Maka Chitanava (ISET-PI).

Focus group setup: (i) greenhouse owner, (ii) 13 ha, (iii) 10 ha; (iv) 55 ha, primarily producing vegetables and fruits.

Current problems of farmers who are GA customers:

- In the Marneuli municipality most farmers primarily produce vegetables, thus having peak demand at a similar period creating shortages. Additional water resources are needed, as well as more irrigation infrastructure, as most of the productive land in the region is not irrigated (approx. 21%);
- Water shortages are typical in hot summer seasons during peak demand;
- A major problem is water debit. The current water supply is not sufficient for all farmers. Specifically, the irrigation water supply is not sufficient for farmers along the lower parts of the channel;
- In many places the channels are not clean, thus creating inefficiencies;
- Lack of information sharing from GA: hail destroyed the onion crop of one of the farmers, so he did not use the irrigation service. As the farmer had a contract with GA he received an irrigation bill that he refused to pay as he had not used the service. The company's argument was that he had to notify them within 10 days of the event, but he did not know that.. At this stage the farmer still refuses to pay the fine based on his service contract;
- The system has many leakages that cause inefficiencies;
- Most of the farmers said that 75 GEL is not too a big payment and does not make a large share of their total farming costs (approx. 2-3% for a farmer with 55 ha), however the problem with farmers' mentality is clear. Most farmers do not understand why they should pay for water in "Georgia which is rich with this resource";
- For the other two farmers (13 and 10 ha) irrigation costs in varied between 7.5-6.25% of total costs (i.e. 1,000-1,200 GEL);
- Losses: due to low supply of water, in a previous year, 70% of the harvest was lost, which amounted to 700-800 GEL per ha.
- Despite the fact that all farmers pay the same 75 GEL per ha, farmers positioned on the first lines benefit the most, and those on the last lines suffer from an insufficient amount of water. Due to this problem, farmers on the last lines could only grow crops with lower water demand. The first lines have a broader range of crops.

General problems of all farmers:

- Drought is not included in insurance, which creates a huge problem;
- Farmers who are not in the irrigation system have to grow comparably low value crops like wheat, that require less water;
- In Soviet period, around 33,000 ha was irrigated, while at this stage only 7,000 ha have an available water supply. Thus, the production of major cultures such as vegetables has significantly decreased in volume.

Positives:

- during the last two years the quality of water has improved.

Expectations:

- Farmers do not like idea of increased prices!
- Even the owner of the largest farm said that if there was an increase of prices to 900 GEL, he would leave Georgia.
- Farmers may switch to other crops if the irrigation service is stabilized in terms of timing and amount.

2. Meeting Date: 26 November 2015

Location: Akhmeta

Focus Group participants: nine farmers.

Moderators – Levan Pavlenishvili (ISET-PI), Maka Chitanava (ISET-PI),

Focus Group setup: (i) most of the farmers have small amount of land up to 10 ha plots; (ii) different cultures: grapes, maze, wheat with an emphasis on less water intensive cultures.

- Infrastructure is deteriorated, most of the water gates have been stolen, the main channel has leaks in many places, thus leading to an inefficient use of resources;
- As the amount of water is insufficient, there are many cases of conflicts between farmers as those without enough water try to block supply to those in the lower parts of the channel;
- Rehabilitation of infrastructure is key, not only for the more efficient supply of water, but also for ensuring allocation to all consumers;
- The current infrastructure is built to supply large plots of land (that were previously under *Kolkhoz* ownership), however after privatization those large plots were divided in 1-5 ha parts, and the supply infrastructure became insufficient. Should the government intend to rehabilitate old infrastructure, it will need to increase the amount of distribution channels;
- Under the current situation, farmers make temporary distribution channels between the land plots, which increases their irrigation costs. So the actual price for the farmers to irrigate is much higher than 75 GEL;
- In some places around the region, where distribution channels are in good condition, the main channels have deteriorated and there is a huge waste of water;
- One farmer did not manage to use the water and was thus unable to irrigate, however payment was still requested for the service;
- Farmers close to the main channel frequently try to take water from the open channel, causing inefficiencies;
- There is a clear lack of monitoring from the company's side;
- Communication with farmers to assess their needs for the infrastructure rehabilitation process is clear;
- For most locations in the region, farmers in the upper parts of the channel have water, while those in the lower parts do not;
- All farmers said that the 75 GEL tariff is only a very small portion of the total costs of crops;
- Farmers are willing to pay an increased price for water, but ONLY with the guarantee of timely and sufficient supply;
- Some of the farmers said that differentiating prices among the different land plots is key;
- A number of farmers mentioned unavailability of cash at a specific time as a reason for not paying irrigation bill.

- Losses per ha due to the unavailability of water reached around 1,000 GEL. One farmer expected 4 tons of maize per ha, but gathered only 200 kg;
- A total of 6.5 million GEL was spent on the subsidization of agriculture in the municipality in 2015. Spending at least 1 million GEL on irrigation would solve a lot of inefficiencies;
- Due to water unavailability, farmers try to plant fewer water demanding cultures. In the case of an improved water supply, more farmers will switch to vegetables and higher value cultures;
- There is a clear need for additional water capacity and more distribution infrastructure among smaller land plots;
- Farmers mention that irrigation is the number one problem for them and they would actually prefer to have good quality irrigation instead of other agricultural state subsidies. If they do not have water, all subsidies given to them to pawn etc. are wasteful;
- With the current service quality framers' level of trust towards GA is very low. They will not pay the increase price unless they do not first see increased quality.

3. **Meeting Date: 5 December 2015**

Location: Senaki Municipality, Akhalsofeli village (representatives from Akhalsofeli and Teklati villages)

Focus Group participants: 10 farmers, including the Senaki RICC representative and the heads of both villages.

Moderator – Irakli Kochlamazashvili (ISET-PI)

Focus group setup: (i) most of the farmers are small- and medium-size (up to 10 ha of land); (ii) today, the main agriculture in those villages is livestock, maize and soybeans.

Drainage:

The drainage system was restored in spring 2015; the work lasted about two months, and the village population thinks that GA did a great job in terms of quality. Up to 20 km of drainage canals were restored near Teklati village. Only 4 km are left that require restoration, and they are asking that the canals in that territory are cleaned up as well. The main drainage collector is about 8 meters wide and 5-6 meters deep.

"These canals were not cleaned for 25-30 years. This is the first time they have cleaned the major canals. We think that this will have an effect on next years' harvest" – said the farmers.

One recommendation from the villagers would be to conduct restoration operations during the off-agro periods, such as in the late fall or during winter. Also, the inter/minor canals still need restoration.

Flooding problems mainly occur in the spring, when there is too much rain. Losses are about 25-30% due to floods in the case of maize harvests. If the drainage canals were functional, the farmers could harvest better products as well.

Because of the flooding and non-functional proper drainage canals, they could not grow other agro cultures, for instance **hazelnuts**, which has very good potential and it is a high value product. During Soviet times, while the drainage system was operational, there were hazelnut plantations on those areas.

"The pasturelands are also flooded, which impacts the productivity of cows (milk, meat)" – said the farmers.

"If all systems are not restored and properly connected to main collectors, only several places could solve flooding problem, while if flood waters cannot drain from the area, it will come back and flood the same areas again" – they said.

Drainage tariff:

When it comes to drainage tariffs, most of the farmers thought that peasants would not be able (or at least willing) to pay, but if they see the positive effect of a cleaned drainage system, they might be more willing to pay.

One head of a village knew about the tariff (40 GEL/ha). She thinks that farmers are asking too much of the government, while they do not do anything. The problem is also the farmers/peasants. Good workers, have good agriculture and a decent income, while others are lazy and do not work hard. They tried to clean up one canal by themselves, and one family needed to contribute 15-20 GEL, but that money was barely collected.

Peasants are digging/cleaning their own drainage systems around their farmsteads, but they cannot do the same for the plots outside of their property because it is expensive and only makes sense if everybody does so in order to restore the whole system. However, there are some farmers who have restored their own drainage canals around their land plots.

Some big farmers have started appearing in the territories of those two villages. They are mainly foreigners and plan to plant hazelnut trees and have plantations here. One Czech investor bought (or leased) 30 ha of land and is going to plant a hazelnut plantation.

“If the drainage system is fully restored, most of the farmers can grow hazelnuts, which has high potential and high value added, especially in Samegrelo” – said the farmers.

If the drainage system is restored, the following agro culture could be grown here: hazelnuts, melons and watermelons. Bay leaves is another promising agro culture that has high value added. Today, 1 kg of bay leaves costs 4.5 GEL. The price of hazelnuts are 6.2 GEL today. The maize harvest obtained on 1 ha of land here is 4-4.5 tons (of grain).

Soybean harvester combines are quite expensive to hire from Abasha’s “*Meqanizatori*” and the farmers avoid growing soybeans for that reason.

People think that once the drainage canals are restored/cleaned, the canals will not have any operational costs (repairs etc.) for up to 10 years(!).

They are happy with GA and believe the communication with them is good. There are two regional GA offices, one in Abasha and the other in Khobi.

Irrigation:

As for irrigation, they barely need it in Samegrelo. For instance, last summer was very dry and irrigation would have been good for the agro cultures. There are many wells in those territories left from Soviet times, and if one uses those properly during the drought period, the irrigation problem can be solved. However, the irrigation infrastructure is still underdeveloped and is missing in most cases.

10.2. APPENDIX 2

FARMERS' SURVEY QUESTIONNAIRE

1. In which municipality is your land plot located?
2. What are your primary cultivated cultures?
    a. Vegetables
    b. Orchards
    c. Vineyards
    d. Berries
    e. Potatoes
3. How many ha of land do you own?
4. Do you need the irrigation/drainage service?
    a. Irrigation
    b. Drainage
    c. Irrigation and Drainage
    d. None
5. Do you have a contract with Georgian Amelioration for irrigation/drainage services?
    a. Yes
    b. No
6. If you do not have contract with Georgian Amelioration, what is the reason?
    a. Bad quality irrigation/drainage in past years
    b. Infrastructure near the land plot is deteriorated
    c. No infrastructure near the land plot
7. Do you use alternative methods of irrigation?
    a. Well
    b. Pumping from the river
    c. Drinking water
    d. Other
    e. Do not use
8. Would you sign a contract with Georgian Amelioration if the service was reliable?
    a. Yes
    b. No

9. What do you think about current irrigation/drainage tariff? (in eastern Georgia 75 GEL and in western Georgia 45 GEL for irrigation and 40 GEL for drainage)
    a. Very high
    b. High
    c. Acceptable
    d. Low
    e. Insignificant
10. Could you tell us what share of your revenues you lose due to drought or floods that are caused by an unreliable irrigation/drainage service?
    a. Less than 25%
    b. 25-50%
    c. 50-75%
    d. 75-100%
    e. Did not have a similar problem
11. Eastern Georgia: How much would you pay for a reliable irrigation service?
    a. GEL 100-200 ha
    b. GEL 200-300 ha
    c. GEL 300-400 ha
    d. GEL 400-500 ha
    e. GEL 500-600 ha
12. Western Georgia: How much would you pay for a reliable irrigation service?
    a. GEL 50-100 ha
    b. GEL 100-150 ha
    c. GEL 200-250 ha
    d. GEL 250-300 ha
    e. GEL 300-350 ha
13. How much would you pay for a reliable drainage service?
    a. GEL 80-120 ha
    b. GEL 120-160 ha
    c. GEL 160-200 ha
14. Would you change your currently cultivated crop if there was a reliable irrigation/drainage service?
    a. Yes

   b. Yes, with a higher value culture
   c. No
   d. No, I already cultivate the highest value culture possible

15. What is your annual income from farming? (GEL)
16. What is your approximate return per ha? (GEL)
17. What is your approximate total irrigation cost? (GEL)
18. What is your approximate total per ha irrigation cost? (GEL)
19. What is your approximate total annual cultivation cost? (GEL)
20. If your return from farming were to increase by 1,000 GEL per ha, how would you spend it?
    a. Personal spending (household electronics, cars, clothes, etc.)
    b. Improve irrigation technology
    c. Register the land

10.3. APPENDIX 3

#	Name of the system	Municipalities, region	Area covered[74] (Ha)	Contracted efficiency[75]
1	Mtkvari-Jandara	Gardabani, Kvemo Kartli	8,500	77%
2	Tashiskari-Saltvisi	Khashuri & Kareli, Shida Kartli	8,400	50%
3	Kvemo Alazani	Gurjaani & Sighnaghi, Kakheti	6,000	67%
4	Kvemo Samgori	Sagarejo, Kakheti	6,400	67%
5	Kvirila-Tskhenistkali	Imereti	6,300	17%
6	Khobi-Enguri Pool	Samegrelo	16,340	n/a
		Sum	**51,940**	

Source: GA

[74] As of September 2015.
[75] As of September 2015.

10.4. APPENDIX 4

Table 1. Financial crop budgets for eight crops by farm size

Crop	Gross margin per ha w/ irrigation flooding	Gross margin per ha w/out irrigation	Gross margin per ha w/ optimal irrigation technology	Increase in gross margin per ha w/ optimal irrigation technology
Hazelnuts L/S	10,500	5,600	21,000	200%
Vegetables L	6,967	4,138	13,934	200%
Potatoes L	5,336	2,507	8,004	150%
Potatoes S	5,402	3,248	8,103	150%
Vegetables S	5,460	3,683	10,920	200%
Vineyards L	3,803	2,201	5,324	140%
Orchards S	5,216	3,936	6,520	125%
Orchards L	5,134	3,905	6,418	125%
Vineyards S	3,481	2,494	4,873	140%
Beans S	1,239	811	1,549	125%
Beans L	1,337	858	1,671	125%
Maize S	921	594	1,842	200%
Wheat S	738	451	1,107	150%
Wheat L	623	357	935	150%
Maize L	785	521	1,570	200%

Table 2. Percentage of farmers using modern irrigation by each period of analysis (by crop type and farm size)

Crop/Period	0	1	2	3	4
Hazelnuts L/S[76]	31%	34%	37%	39%	42%
Vegetables L	10%	13%	15%	18%	20%
Potatoes L	0%	1%	1%	2%	2%
Potatoes S	5%	5%	5%	5%	5%
Vegetables S	5%	6%	6%	7%	7%
Vineyards L	10%	20%	30%	40%	50%
Orchards S	5%	6%	8%	9%	10%
Orchards L	35%	39%	43%	46%	50%
Vineyards S	5%	6%	8%	9%	10%
Beans S	5%	8%	10%	13%	15%
Beans L	20%	24%	28%	31%	35%
Maize S	5%	6%	8%	9%	10%
Wheat S	0%	1%	3%	4%	5%
Wheat L	1%	2%	2%	3%	3%
Maize L	1%	2%	2%	3%	3%

[76] L & S stand for large and small farms respectively.

Table 3. Farmers' water use by eight major crops for different irrigation methods

Crop	Water consumption with optimal technology	Water consumption with flooding
Hazelnuts L/S	6,337	19,010
Vegetables L	3,003	9,010
Potatoes L	4,114	12,343
Potatoes S	4,937	12,343
Vegetables S	3,003	9,010
Vineyards L	5,226	15,677
Orchards S	5,226	15,677
Orchards L	5,226	15,677
Vineyards S	5,226	15,677
Beans S	1,892	5,677
Beans L	1,892	5,677
Maize S	6,271	15,677
Wheat S	3,604	9,010
Wheat L	3,003	9,010
Maize L	5,226	15,677

10.5. APPENDIX 5

Table 1. Farmers' Irrigation Costs

Investment	Real interests	Amortization	Other variable costs	Yearly irrigation costs	Investment flooding	Real interest flooding	Amortization	Yearly irrigation costs
4,803	403	1,009	228	1,640	333	28	333	360
1,921	161	1,441	108	1,710	375	31	375	406
9,007	755	1,082	247	2,083	375	31	375	406
6,004	921	721	415	2,057	290	44	290	334
1,921	295	1,441	108	1,844	290	44	290	334
4,803	403	1,009	188	1,600	375	31	375	406
4,803	737	1,009	188	1,934	290	44	290	334
6,004	921	721	303	1,945	290	44	290	334
9,007	755	1,082	180	2,017	375	31	375	406
9,007	755	1,082	314	2,150	375	31	375	406

Table 2. GA's Costs

	Mtkvari-Jandara	Tashiskari-Saltvisi	Kvemo Alazani	Kvemo Samgori	Kvirila-Tskhenistkali	Khobi-Enguri Pool
Operative	128,400	306,800	105,600	94,400	188,720	82,400
Maintenance	107,332	215,598	286,205	410,581	482,336	169,211
Administrative	391,971	789,390	621,679	637,344	856,611	598,933
Depreciation	504,877	1,395,915	1,063,407	1,114,450	1,786,862	1,275,702

10.6. APPENDIX 6

Table 1. Effectiveness 1: *achieving general objective 1. Develop a reliable water supply through the renovation and rehabilitation of infrastructure*

	Specific Objective	Indicator	Option 1	Option 2	Option 3	Option 1*
a)	Construction, renovation and rehabilitation of amelioration infrastructure to ensure service reliability and minimize water losses.	1. Increase of investments on main channels (GEL) 2. Increase in command area (%) 3. Increase in collection efficiency (%) 4. Increase in number of contracts and contracting efficiency (%) 5. Number and capacity of new reservoirs	This policy option envisages investment only in increasing the command area, which can have a negative effect on service reliability given the water shortages in a number of systems. The command area might increase, but given no investment in service reliability there is no basis for improvements in collection and contracting efficiency. As this option envisages investment only in increasing the command area, reservoirs will not be built.	Consultation of stakeholders shows that in addition to the implementation of the new tariff methodology, the reform package includes an annual investment of 25 mln GEL in service reliability. This creates a basis for improvements in collection efficiency and contracting. If the above mentioned investment is supplemented with the construction of new reservoirs, the increase of the command area will be effective.	The impacts of this investment are assumed to be similar to those of option 2.	This theoretical option shows the impact of investment on the status quo tariff setup. The impacts are assumed to be similar to options 2 and 3.
	Evaluation		-	+ +	+	

Table 2. Effectiveness 2: *achieving general objective 2. Ensure the financial sustainability of amelioration SPs (eliminating dependency on direct government subsidies)*

	Specific Objective	Indicator	Option 1	Option 2	Option 3	Option 1*
a)	Cover costs of providing the service without direct subsidies to SPs – either covering O&M costs or including capital expenses.	1. Generated revenues – cost recovery value (GEL) 2. Rate of return on investment (%) 3. Contracting efficiency (%) 4. Collection efficiency (%)	4.5 mln GEL over five years from the chosen six systems. The company will not receive rate of return on capital. Contracting and collection efficiency are not expected to change.	61.4 mln GEL over five years from the chosen six systems. The government's rate of return on investment has potential to grow if investment in the reliability of the system is done properly. Contracting efficiency is assumed to increase in most systems, while collection efficiency is assumed to increase to 75% over five years.	163.3 mln GEL over five years from the chosen six systems. The government's rate of return on investment has potential to grow if investment in the reliability of the system is done properly. Contracting efficiency is assumed to increase in most systems, while collection efficiency is assumed to increase to 75% over five years. The company will break even in the very first year of the adoption of methodology and will receive a rate of return on capital.	5.5 mln GEL over five years from the chosen six systems. The company does not break even and is loss making.
	Evaluation		-	+	+ +	-
b)	Development of a tariff methodology ensuring tariff transparency, management accountability, and the creation of billing	1. Adapting the draft law 2. Tariffs set by GA (GEL) 3. Irrigated/drained area (ha)	The tariffs are too low to cover the company's expenses. The new tariff methodology is not adopted. The irrigated/drained area at the end of the fifth year will be 18,464 ha in the chosen six systems.	The new tariff methodology is adopted and price calculations are more transparent. Tariffs are large enough for the company to break even in five years. The irrigated/drained area at	The new tariff methodology is adopted and price calculations are more transparent. Tariffs are large enough for the company to break even in five years. The	The new tariff methodology is not adopted. Tariffs are too low to cover the company's increasing costs. The irrigated/drained area

	and accounting systems for proper management of GA.			the end of the fifth year will be 27,419 ha in the chosen six systems.	irrigated/drained area at the end of the fifth year will be 27,419 ha in the chosen six systems.	at the end of the fifth year will be 27,419 ha in the chosen six systems.
	Evaluation		-	+	+	-
c)	Encourage wise investment decisions from the government to maximize economic effects.	1. Average per ha water consumption 2. Increase in water availability (%) 3. Infrastructure investment (GEL)	Average per ha water consumption is not expected to change as reliability investments are not going to be made.	The new tariff methodology will create a monetary benchmark for the government and the company to make wiser investments. Investment in the reliability of infrastructure is expected to be 25 mln GEL annually over five years. The average water consumption per ha is expected to decrease due to the larger scale adoption of modern irrigation technologies (as compared to option 1). Water availability will increase due to the more efficient allocation of the resource.	The new tariff methodology will create a monetary benchmark for the government and the company to make wiser investments. Investment in the reliability of infrastructure is expected to be 25 mln GEL annually over five years. The average water consumption per ha is expected to decrease due to larger scale adoption of modern irrigation technologies (as compared to option 1). Water availability will increase due to the more efficient allocation of the resource.	The government invests 25 mln GEL over five years. However, due to the low incentives to operate efficiently, contracting efficiency and collection rates might be inflated.
	Evaluation		-		+	
	Total		- - -	+ +	+ + +	- - -

Table 3. Effectiveness 3: *achieving general objective 3. Ensure the efficient allocation of water across alternative uses*

	Specific Objective	Indicator	Option 1	Option 2	Option 3	Option 1*
a)	Provide incentives for the efficient use of limited water resources.	1. Share of farmers/land using optimal irrigation technology (%) 2. Average rebate on tariffs for using modern irrigation technologies (%)	The share of farmers using modern irrigation technology is expected to increase very modestly. No rebate is expected to be applied on the tariff.	The share of farmers using modern irrigation technologies will substantially increase over five years due to both more reliability and the rebate proposed by GA.	The share of farmers using modern irrigation technologies will substantially increase over five years due to both more reliability and the rebate proposed by GA. However, the increase in the share of farmers using modern irrigation technologies might be halted by a high increase in the fixed component of the tariff.	The share of farmers using modern irrigation technologies will substantially increase over five years due to more reliability. However, as the rebate cannot be applied, the pool of farmers with less awareness about modern irrigation systems might limit switching.
	Evaluation		-	+	+	-
b)	Foster awareness about the real opportunity cost of water for irrigation.	1. Contracting efficiency (%) 2. Collection efficiency (%)	Without an increase in reliability there is no basis for improvements in contracting efficacy and collection rates.	Contracting efficiency is assumed to increase with different levels in each of analyzed systems. Collection efficiency is expected to increase to 75%.	Contracting efficiency is assumed to increase at different levels in each of the analyzed systems. Collection efficiency is expected to increase to 75%.	Contracting efficiency is assumed to increase at different levels in each of the analyzed systems. Collection efficiency is expected to increase to 75%.
	Evaluation			+	+	
	Total		- - -	+ +	+ +	-

Table 4. Effectiveness 4: *achieving general objective 4. Increase the competitiveness of Georgia's agricultural sector by providing reliable irrigation and drainage services at reasonable prices*

	Specific Objective	Indicator	Option 1	Option 2	Option 3	Option 1*
a)	Foster awareness of Georgian farmers to use more drip and sprinkle irrigation systems to increase crop yields per ha.	1. Share of farmers/land using optimal irrigation technology (%) 2. Increase in crop yields	The share of farmers using modern irrigation technologies is expected to increase very modestly. Crop yields are thus not expected to increase significantly. Fewer farmers will switch to the higher value crops.	The share of farmers using modern irrigation technologies is expected to increase significantly, thus increasing crop yields. The availability of water will encourage farmers to switch to higher value crops.	The share of farmers using modern irrigation technologies is expected to increase significantly, thus increasing crop yields. However, a tariff that is too high can limit farmers' resources to install modern irrigation technologies and may decrease their competitiveness.	The same impacts are expected as in option 2, however those farmers who have lower awareness about modern irrigation technologies are less likely to improve irrigation.
	Evaluation		-	+ + +	+	++

Table 5. Other Criteria

Criteria	Option 1	Option 2	Option 3	Option 1*
Feasibility / Ease of implementation	Not applicable as the reform is not being implemented.	Problems of land registration is a primary challenge for the implementation of the tariff policy. The rebate scheme suggested by GA may also be hard to implement without a metering system. The second (fixed) component of the tariff can significantly decrease farmers' disposable income, thus decreasing their competitiveness and possibly causing protests.	Problems of land registration is a primary challenge for the implementation of the tariff policy. The rebate scheme suggested by GA may also be hard to implement without a metering system. The second and third (fixed) components of the tariff can significantly decrease farmers' disposable income, thus decreasing their competitiveness and possibly causing protests.	This theoretical example is easiest to implement as it envisages improvements in reliability without increasing the tariff. However, without the tariff policy, the incentives to invest wisely might be smaller than in options 2 and 3.
Evaluation	N/A	-	- -	+ +
Minimization of risks associated with the reform	Not applicable as the reform is not being implemented.	The relatively low tariff for farmers and the high reliability standards set towards GA under this option ensure the minimization of risks associated with reform. The option has proper incentives to ensure wise investments in the sector. Implementing the tariff policy and applying the rebate suggested by GA might also be problematic due to problems of land registration.	The right tariff for farmers and relatively lower standards for efficiency pose a challenge for the minimization of risks for reform implementation in this option. However, incentives for wiser investment decisions in infrastructure are accompanied in this option. Implementing the tariff policy and applying the rebate suggested by GA might also be problematic due to problems of land registration.	In this theoretical example it is assumed that investments in the sector will have the same impact on service reliability as in options 1 and 2. Furthermore, the risks associated with the implementation of the tariff policy do not apply.
Evaluation	N/A	+ +	+	+ + +
Maximization of the potential benefits associated with the reform	Not applicable as the reform is not being implemented.	High efficiency standards and relatively low tariffs for the farmers support the maximization of benefits in this option.	High tariff rates limit the impact of the positive effects of improved reliability and the tariff reform.	In this theoretical example there are no incentives for GA to improve service reliability, contracting and collection rates.
Evaluation	N/A	+ +	+	+

USAID Governing for Growth (G4G) in Georgia

Deloitte Consulting Overseas Projects LLP

Address: 85 Z. Paliashvili Street, Tbilisi

Phone: +995 322 240115 / 16

E-mail: info@g4g.ge