THE REPUBLIC OF AZERBAIJAN

TECHNOLOGY NEEDS ASSESSMENT FOR CLIMATE CHANGE MITIGATION AND ADAPTATION

SUMMARY REPORT

March 2013

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PREFACE

The identification and prioritization of greenhouse gas mitigation and climate change adaptation technologies, as well assessing barriers for technology deployment and developing measures for overcoming those barriers are important steps for Azerbaijan in developing its low carbon and climate resilient strategy.

The global "Technology Needs Assessment" project was funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Program (UNEP) and coordinated by Ministry of Ecology and Natural Resources of Azerbaijan Republic in close collaboration with all relevant ministries, agencies, institutions, non-governmental organizations, private sector and independent experts.

The methodology proposed by the UNEP Risoe Center for conducting the prioritization phase of the Technology Needs Assessment, barriers analysis and preparation of Technological Action Plans has been adjusted to meet Azerbaijan's county-specific circumstances. This involved a preliminary overview of the technological options and resources, institutional arrangements and stakeholder engagement, as well as establishing criteria for selecting mitigation and adaptation technologies, defining and selecting the priority sectors and technologies, identification of main barriers in technology deployment, measures to overcome identified barriers and preparation of concrete actions, as well proposing initial project ideas.

National experts involved to the project, working closely with local stakeholders, have provided significant assessments during the prioritization of climate technologies, taking into account its contribution to the country's development priorities and GHG emission reduction potential. The selected technologies applied to two prioritized mitigation sectors: alternative energy sources and the commercial/residential demand, and will lead to significant decrease in greenhouse emissions. Adaption-side technologies prioritized and analyzed during the TNA process covered the water and agriculture sectors.

The same stakeholder driven process has been followed during assessment of barriers for technology deployment, identification of measures to overcome those barriers and development of project ideas to demonstrate effective practices. Current programmes and initiatives of relevant state ministries, agencies and institutions related to prioritized technologies have been taken into account during preparation of the technology action plan.

The Ministry of Ecology and Natural Resources strongly believes that the TNA assessments on greenhouse mitigation and climate adaptation technologies will contribute to the deployment of low carbon technologies in the country, and that the identified actions will be followed and implemented by respective institutions.

We hope that the TNA/TAP reports on climate change developed under "The Global Technology Needs Assessment" project will serve as a roadmap for Azerbaijan in fulfilling its obligations under the UNFCCC. Further, the TNA process makes an important contribution to the implementation of countries' sustainable development strategies and, in general, for development of a "green economy" by increasing energy efficiency, the application of renewable energy sources and raising awareness in this field.

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Minister of Ecology and Natural Resources

March 2013

ACKNOWLEDGMENTS

Azerbaijan ratified the UNFCCC in 1995 and its Kyoto Protocol in 2000. Notwithstanding that Azerbaijan has not taken any quantitative obligations to be included in the Non-Annex I group, since the ratification of the convention a wide range of mitigation activities have been implemented in the country. These activities include the use of renewable energy sources, application of more efficient technologies in the energy sector, increase of forest areas and use of gas instead of black oil at thermal power stations.

The proposed methodology for conducting the prioritization phase of the Technology Needs Assessment (TNA), as well during preparation of Technological Action Plans (TAP) has been adjusted to country-specific circumstances. This involved a preliminary overview of the technological options and resources, institutional arrangements and stakeholder engagement, as well as establishing criteria for selecting mitigation and adaptation technologies, defining and selecting the priority sectors and technologies, analysis of barriers, identification of measures to overcome identified barriers, as well selection of project ideas.

The TNA/TAP mitigation and adaption reports were developed by the group of experts lead by mitigation/adaptation team leaders, under the coordination of TNA National Coordinator. All reports are the outcome of a stakeholder-driven assessment to identify and evaluate mitigation/adaptation technologies that will reduce GHG emission within national development objectives and increase adaptive capacity.

The team of experts involved in the assessment of currently available data during the stakeholder consultation process has done a great job. Thanks and appreciation should be extended to the Ministry of Ecology and Natural Resources of Azerbaijan that supported this assessment at all stages of implementation.

Special thanks go to all ministries, governmental agencies, private sector organizations and involved NGOs that provided significant support for obtaining relevant data and expert views during report development, as well as to the UNFCCC national focal point in Azerbaijan who has provided valuable advice and suggestions for improvement of the report.[1]

[1] This summary report is an output of the Technology Needs Assessment project, funded by the Global Environment Facility (GEF) and implemented by the United Nations Environment Programme (UNEP) and the UNEP-Risoe Centre (URC) in collaboration with the Asian Institute for Technology (AIT), for the benefit of the participating countries. The present report is the output of a fully country-led process and the views and information contained herein are a product of the National TNA team, led by the Ministry of Ecology and Natural Resources of the Republic of Azerbaijan

ABBREVIATIONS

AIOC	Azerbaijan International Operating Company
AFOLU	Agriculture, Forestry and Land Use
AIT	Asian Institute of Technology
CDM	Clean Development Mechanism
IEA	International Energy Agency
ICA	Implementing Credit Agency
IFAD	International Fund for Agricultural Development
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Process and Product Use
EST	Environmentally Sound Technology
EST	Environmentally Sound Technology
GEF	Global Environmental Facility
GHG	Greenhouse gas
GISS	Goddard Institute for Space Studies
GFDL	Geophysical Fluid Dynamics Laboratory
HPS	Hydro-Power Stations
NGO	Non-governmental Organization
MEC	Ministry of Emergency Cases
MED	Ministry of Economic Development
MIE	Ministry of Industry and Energy
MoE	Ministry of Education
MENR	Ministry of Ecology and Natural Resources
MCDA	Multi Criteria Decision Analysis
MoA	Ministry of Agriculture
OSCE	Organization of Security and Cooperation of Europe
OSC	Open Stock Company
PRECIS	Providing Regional Climates for Impact Studies
PSA	Production Sharing Agreement
PSC	Project Steering Committee
RE	Renewable Energy

SCARES	State Company on Alternative and Renewable Energy Sources
SFSE	State Fund for Support to Entrepreneurship under MED
SHP	Small Hydro-Power
SWRA	State Water Resources Agency
TAP	Technological Action Plan
TNA	Technological Needs Assessment
TFS	Technological Fact Sheets
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
URC	UNEP Risoe Center
WB	World Bank
WMO	World Meteorological Organization
WP	Work Plan

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I. Introduction

In recent years the economy of Azerbaijan has been growing quickly. New technologies are used in the development of various sectors of economy, which prevent a rapid increase in the amount of emissions of greenhouse gases into the atmosphere. Rapid development of all sectors of economy in recent years has resulted in an increasingly adverse effect of human activities on the environment and overexploitation of natural resources.

However, in Azerbaijan, government pays great attention to issues of environmental protection and sustainable use of natural resources. Policies in particular sectors, such as economy, energy and environmental protection, have significant influence on climate change mitigation issues. In addition, the country successfully implements various actions on the abatement of climate change effects.

Azerbaijan ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1995, thereby becoming a Non-Annex I Party to the UNFCCC. The country is not included in the Annex I group under the Convention and has not taken any quantitative obligations in accordance with the Kyoto protocol. Therefore, the country may only participate in the Clean Development Mechanism of the Kyoto protocol.

Notwithstanding that Azerbaijan has not taken any quantitative obligations, it has implemented a wide range of activities in terms of mitigation, such as use of renewable energy sources, application of more efficient technologies in the energy sector, increase of forest areas, use of gas instead of black oil at thermal electric stations and so on.

Technology needs assessment is a first step in technology transfer framework, which also includes technological information, enabling environment, capacity building and mechanisms for technology transfer. Technology needs assessment is accomplished by applying methodology proposed by the UNFCCC and other relevant institutions, such as GEF and Climate Technology Initiative. The applied methodology has been adjusted to country-specific circumstances and Azerbaijan's TNA exercise has been conducted through the following activities: preliminary overview of options and resources; institutional arrangements and stakeholder engagement; establishing criteria for selecting mitigation measures priorities; defining priority sectors and sub-sectors; selecting priority measures and sectors; in-depth analyses, assessment and stakeholder consultation; selection of high priority actions for further development and implementation.

The purpose of the current TNA Project is prioritization of sectors, in compliance with the country's development priorities, and the evaluation and selection of priority climate change mitigation and adaptation measures under prioritized sectors, as well analyzing barriers for deployment and diffusion of prioritized technologies, preparation of TAP identifying major actions for technology deployment and development of project ideas for enhancing application of prioritized technologies.

According to the Intergovernmental Panel on Climate Change Special Report (IPCC), the term "technology transfer" is defined as a broad set of processes covering the flows of know-how, experience and equipment for mitigating and adapting to climate change amongst different stakeholders such as government, private sector entities, financial institutions, non-governmental organizations (NGOs) and research/education institutions. It comprises the process of learning to understand, utilize and replicate the technology, including the capacity to choose it, adapt it to local conditions, and integrate it with indigenous technologies. Technology for mitigating and adapting to climate change should be environmentally sound technology and should support sustainable development.

Main criteria for selecting mitigation and adaptation measures were identified by their relevance to the country's development priorities, potential contribution to reduction of vulnerability to climate change and GHG reduction potential. Relevance to development priorities defines the climate change mitigation and adaptation technologies that offer the greatest value to the country in meeting its current national development priorities. GHG reduction potential defines technologies that will make the biggest contributions

to the country's efforts in mitigating greenhouse gas emissions. Potential to reduction of vulnerability to climate change defines technologies that will make significant contribution to adaptive potential of the country in light of climate change.

Azerbaijan has already identified development priorities as part of national development strategies, poverty reduction strategies and sector policies. These strategies are reflected in long-term State Programs such as 'State Program on Social-Economic Development of Regions of Azerbaijan Republic (2009-2013)', 'State Program of Poverty Reduction and Sustainable Development of the Republic of the Azerbaijan (2008-2015)', 'State Program of Ensuring Reliable Population in the Republic of Azerbaijan in food provision (2008-2015)', 'State Program on Renewable and Alternative Sources of Energy (2008–2015)', 'State Program for the Development of Fuel Energy Complex (2005–2015)', 'State Program on Development of Vine-growing activities' and "Azerbaijan 2020 – glance to future' development concept.

The TNA process analyzed mitigation and adaptation measures with implementation potential for 2030, based on identified measures in the Second National Communication of the Azerbaijan Republic to the UNFCCC, as well as current governmental strategy and policy related to climate change mitigation and adaptation.

Current sectoral development programmes and action plans have been taking into account during organization of TAP process. TAP process was organized in stakeholder consultation process by involving all respective state and non-state organizations, as well private sector representatives and individual experts.

II. Institutional arrangement for the TNA and stakeholder involvement

2.1. Overview

The Ministry of Ecology and National Resources (MENR) is the main national institution guiding environmental policy in Azerbaijan. MENR plays the role of coordinating body at the UNFCCC in Azerbaijan and has a leading role in preparation of National Communications.

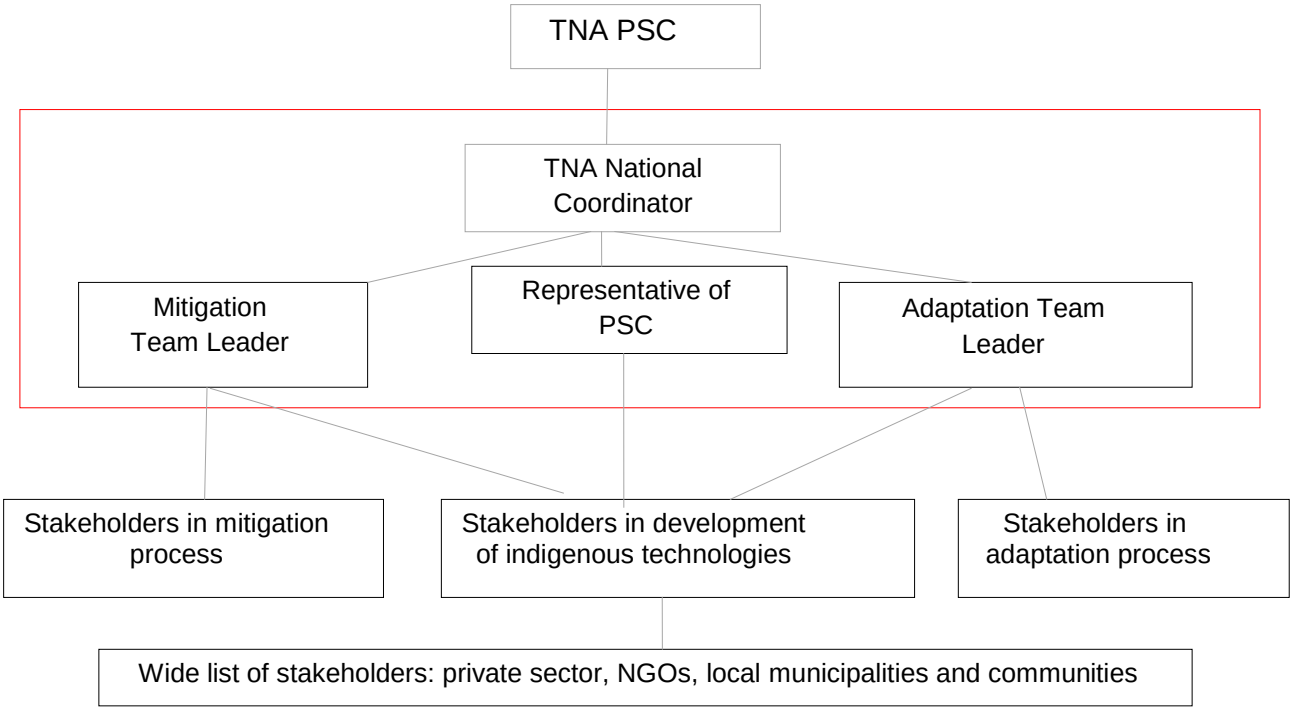
The State Commission on Climate Change that has been entrusted to coordinate implementation of commitments made under the UNFCCC was established in Azerbaijan by the Presidential Decree of 30 April 1997. It is composed of representatives of 18 ministries and other governmental institutions, including Ministry of Ecology and Natural Resources, Ministry of Agriculture, Ministry of Economic Development, Ministry of Industry and Energy, SOCAR, National Scientific Academy of Azerbaijan and so on.

2.2. Institutional arrangement for Azerbaijan TNA project

A Memorandum of Understanding was signed between the MENR and UNEP Riso Centre in Denmark on 18 July 2011 for the implementation of TNA project in Azerbaijan. After this, the TNA National coordinator was appointed and the Project Steering Committee (PSC) was established. Main responsibilities of the PSC are to monitor the project implementation, give strategic guidance to the team and make prioritization of sectors for adaptation and mitigation. The first PSC meeting was held in March 2011.

The diagram of TNA national team structure is provided in figure 1. The national team consists of two groups: Adaptation and Mitigation were lead by The Adaptation Team Leader and Mitigation Team Leader.

National coordination and participation



III. The main results of the project

A. Climate change mitigation technology

A1. Technology need assessment for climate change mitigation

A1.1.Criteria and process of sector prioritization

Following the TNA handbook, as a first step in the sector prioritization process, sectors and sub-sectors with GHG relevance have been obtained from Second National Communication and other relevant reports. The country's development priorities have been clustered under economic, social and environmental priorities. After the consideration and identification of the development priorities, the identified sectors from the GHG inventory were listed according to their emission share.

Table 1: Summarized GHG inventory in Azerbaijan

GHG Source and Sink Categories	Emissions 2005 (Gg CO_2 eq.)
Energy	41003
IPPU	839
AFOLU	5186
Waste	3607
Total	**50635**
CO_2 removal	**3500**
Net emission	**47135**

Based on the identified economic, social and environmental development priorities, results of the inventory of GHG by sectors and calculated GHG emissions forecasted to the year 2030, and potential mitigating effect on climate change by sector, the experts have evaluated the sectors using the following evaluation scheme:

0 — no benefit
1 — faintly desirable
2 — fairly desirable
3 — moderately desirable
4 — very desirable
5 — extremely desirable

As a result, the national team and stakeholders have identified the performance matrix below for prioritizing using MCA method and based on economic, social and environmental priorities and potential in GHG reduction.

Table 2: Cumulative score clustered under development priorities and GHG reduction potential

Energy Sub-sector	Development priorities	GHG reduction potential
Energy production	14	4
Oil and gas production	14	4
Transport	11	4
Commercial and residential sector	14	5
Alternative energy sources	14	5

As it can be seen from the above table, alternative energy sources and commercial and residential sectors falling under the Energy category have higher scores for prioritization. Intensive debates were held on selection from two sectors: oil and gas production and commercial and residential sector. These sectors are

included in the energy category, which itself generates 90% of GHG emissions. Analyses of information from the Initial and Second Communications show that emissions from the commercial and residential sector are higher than the oil and gas production sector. Moreover, the commercial and residential sector is becoming increasingly important as the country's population and economy grows year-by-year. Therefore, after a number of discussions, and according to the provided evaluation, the following have been identified as priority sectors for mitigation:

- Alternative energy sources
- Commercial and residential sector

The experts provided assessments for justification of the scores given for potential improvements and contribution to development priorities in each sub-sector.

It should be mentioned that, last speech of President of Azerbaijan Republic at the conference held on 12 February 2012 dedicated to the results of the 'State Program on Socio-economic Development of the Regions 2009-2013' justifies right decision of prioritization of alternative energy sources sector. It his last speech, President of Azerbaijan Republic stated that: "…but I consider that it is important creation of renewable energy sources and enhance its application. For of all it will create additional financial sources for us. On the other hand, I consider that development of new and application of renewable technologies, creation of "green energy" will be our contribution to the solving global ecological problems in the world.

For the commercial and residential sector, **Economic development priorities**: this sub-sector is in-line with the country's economic development priorities, as the construction sector is rapidly developing in the country with the involvement of private sector. As well, population of the country, mainly urban population, increases year-by-year.

- **Social development priorities**: improves living conditions of population.

- **Environmental development priorities**: according to the most recent data from the Second National Communication, rapid increase in GHG emissions from this sector is expected for 2030. Application of new environmentally sound technologies, such as energy efficiency bulbs, heating technologies, building management structures and so on, may lead to high reduction in GHG emissions.

- For alternative energy sources sub-sector, **Economic development priorities**: currently, 10% of energy production is provided by alternative energy sources, such as hydro-power and wind energy. It is well suited to the country's economic development priorities and energy policy.

- **Social development priorities**: use of alternative energy sources provides sustainable and qualitative energy supply for both commercial sector and population. It also improves energy supply in remote areas.

- **Environmental development priorities**: this sub-sector does not contribute GHG emissions. Its negligible negative impacts, such as noise and danger to biodiversity (e.g. wind power stations negatively affect bird migration), may be prevented by the application of proper technology and selection of location areas.

A1.2.Results of technology prioritization

The mitigation expert has provided assessment of current national priorities identified in national strategic programs, sector policies, action plans and other documents, including the Second National Communication. As a result of intensive discussions with the stakeholders group, the following possible technologies have been listed for alternative energy sources sector:

Table 3: Possible mitigation technologies for alternative energy sources and commercial/residential sectors:

Sector	Sub-sector	Technology	Scale of application	Medium/ long term availability
Alternative energy sources	Solar energy	Passive solar energy (hot water) and solar photovoltaic (electricity)	Small-scale	Long-term
	Wind energy	Grid-connected wind power	Large-scale	Long-term
	Small hydro-power	**a)** HPPs located on the irrigation canals **b)** HPPs located on mountain rivers	Small-scale	Medium-term
	Bioenergy	**a)** The biomass use in thermal energy production **b)** The use of the organic residues in the obtaining of biogas by anaerobic fermenting	Small-scale	Long-term
	Thermal energy	Using the geothermal energy of national hot spring water	Small-scale	Long-term
Commercial/ residential sector		Installation of control and measuring equipment while the energy and natural gas are distributed	Small-scale	Medium-term
		High efficiency lighting systems	Medium-scale	Long-term
		Heating pumps	Small-scale	Medium-term
		Heating systems using solar energy	Small-scale	Long-term
		Efficient ventilation and air conditioning systems	Small-scale	Long-term
		Building energy management structures	Large-scale	Long-term
		Biogas for cooking and electricity and efficient stoves	Small-scale	Long-term

Based on stakeholder consultations the following sets of criteria were defined to prioritize technologies for alternative energy sources and commercial/residential sectors under costs and benefits:

- Costs: Capital Costs (Infrastructure, etc.), O & M Costs, Cost effectiveness for mitigation;

- Benefits: Reduced air pollution, GHG emission reduction by 2030, Sustainable energy supply, Increased income due to lower energy costs, Balance of Payment (BoP), New employment opportunities

The performance of the technology, or measure on the criteria, was assessed considering the information already collated in the technological fact sheets, option page, available country knowledge and relevant experts input. The mitigation expert has prepared technological fact sheets for all listed technologies using available sources of information, including ClimateTechWiki. All stakeholders involved in the process were familiarized with the prepared technological fact sheets.

Next, the technologies were scored on a scale of 0-100 by the stakeholder group, which consisted of 11 experts. Each expert scored the listed technologies against identified criteria, giving a score of 0 to the lowest priority technology, a score of 100 to the highest priority technology, and appropriate scores to all others. For instance, if hydro-power stations at mountain rivers is the least preferred technology within the contribution to the country's development priorities criteria, the experts have given a 0 score to that technology. Conversely, if mechanical wind energy conservation technology is the most preferred technology within another criteria, the experts have given a 100 score to that technology. Then, the average score given to a particular technology within one criterion is calculated. The same process is followed for scores given to all technologies.

After scoring each technology within the identified criteria and determining the most and least preferred technologies within each criterion, the next step was calculating swing weight. After calculating the swing weight, weights of each criterion were determined. This was started by giving 100 to the criteria which have shown the greatest swing in value. Since GHG emission reduction by 2030 criterion has shown the greatest swing, it was given a weight of 100 and the other criteria were weighted relative to this.

After the weights are assigned to the criteria, this weight is normalized. By using these weights, correct final relative values of these alternatives are obtained. Normalization indicated relative importance. The overall weighted score was then calculated by combining the weights and scores of the most preferred technologies.

The results of the technology prioritization process have been presented at the TNA Committee meeting for further review, discussions and endorsement. Sensitivity analysis was conducted on assessment results to evaluate the robustness of the results relative to the weights and scores applied and other uncertainties.

At the final stage, the cost information of prioritized technologies was combined with benefit assessments for cost-benefit ratios.

To sum up, after conducting prioritization of technologies process using MCDA tool, for the alternative energy sources and commercial/residential sector the following technologies have been prioritized:

For alternative energy sources sector:

1) Grid-connected wind power

Wind power is a more preferable energy source than solar, hydro, geothermal and biomass due to its cost, environmental soundness and unlimited availability.

Practice shows that many of the regions in Azerbaijan have great potential for application of wind power facilities. Calculations suggest that Azerbaijan has about 800 MW of annual wind power capacities due to its geographical location, nature and economic infrastructure. This reserve means 2.4 billion kWh of electricity, according to rough calculations. This would imply the possibility of saving up to 1 MT of conditional fuel and, more importantly, the prevention of emitting large quantities of wastes including ozone-cracking carbon dioxide.

In Azerbaijan there are favorable climatic conditions for the development of wind energy production. Wind speeds of 3-5 m/sec are prevalent in the foothills and lowlands of the country. Wind speeds in coastal regions vary between 6 and 8-20 m/sec. In the Absheron Peninsula – aside from the predominant north wind – northwest and south winds are observed. The probability of wind speed gradient between 9 and 20 m/sec is 30%.

2) Passive solar energy (hot water) and solar photovoltaic (electricity)

The climate condition of Azerbaijan creates great opportunities for production of electric and heat energy using solar power. The number of annual sunshine hours in Azerbaijan is 2400-3200 hours. Development of solar power can partially solve energy problems in many regions of the country. Several developed countries have recently started to widely apply Photovoltaic Programs (PVP). Azerbaijan's involvement in this program can play an important role in the application of such types of energy systems.

The use of solar energy is considered logical in the regions with entering solar radiation of over 120 kW-hour/m^3 per year. In many regions of Azerbaijan the volume of entering solar radiation makes up 1600-1800 kW-hour/m^3, while the average annual duration of solar radiance is 2200-2600 hours with a radiation level of 3-6 kW/m^3. These figures show that the practical use of solar energy is economically justified for the country, as the location and proximity of solar stations to the "energy source" make it more efficient and economically viable

3) Small hydro-powers on Mountain Rivers

The generation capacity of hydro-power plants within Azerbaijan's overall power system is presently 17.8%. Approximately 2.4 billion kWh of total electricity generated in 2003 was produced by hydro-power plants, which constituted 11.4% of overall electricity generation.

Currently, there are some hydro-power potentials in the country that are still undeveloped. Research related to this area showed that the overall hydro-power potential of rivers in Azerbaijan Republic equals 40 billion kWh. The technically feasible potential totals 16 billion kWh, 5 billion kWh of which is related to small hydro-power plants.

Construction of hydro-power plants has an important role in resolution of country-level issues such as regulation of floodwaters, environmentally sound electricity generation and creation of new irrigation systems. It is possible to locate dozens of small hydro-power plants on rivers and water facilities, and these plants can generate up to 3.2 billion kWh annually.

For commercial/residential sector:

1) High efficiency lighting systems

High efficiency lighting systems generate savings in energy costs over their lifetime and provide a reliable lighting service. They also create jobs in manufacturing and retail. As electricity supply is still limited in many developing countries, reducing demand by providing more efficient lighting is a positive step for their economies. It also contributes to security of energy supply as they make a significant contribution to the reduction in electricity demand.

2) Heat pumps

Heat pumps can improve security of energy supply by reducing energy demand, and the small amount of electricity used can also be supplied by renewable energy generation. There are large savings in operating costs compared to conventional heating or cooling systems, although the upfront capital costs are higher.

Rough estimates provided for the capital city of Baku show that rehabilitation of heating and hot water supply systems would provide the annual saving of 383 thousand CFT of fuel and the reduction of 600 thousand tons of CO2 emissions, on average.

3) Biogas for cooking and electricity and efficient stoves

Biogas technology helps improve the livelihoods of poor rural people and contributes to the reduction of greenhouse gas emissions. The use of biogas helps minimize carbon emissions caused by burning fuel wood and by the natural decomposition of organic waste. This alternative form of energy also reduces the use of fossil energy. It helps improve sanitation conditions as cattle dung is no longer burned to generate power but is channeled into biogas digesters. Biogas plants also produce organic waste that is dried and used as fertilizer.

Biogas for cooking, electricity and use of efficient stoves is mainly suitable for application in rural areas--mostly remote areas with no gas supply, dependant on wood resources. It will lead to less harm to forest resources and reduce subsequent GHG emissions.

In Azerbaijan, there is a huge potential for application of biogas in rural areas, particularly in remote communities still not supplied with gas. Along with social benefits, application of biogas reduces the amount of GHG emission.

Lastly, sensitivity analysis was conducted on assessment results to evaluate the robustness of the results relative to the weights and scores applied and other uncertainties. Analysis provided by experts proved that the top three prioritized technology measures for the commercial and residential sector are priority mitigation technologies according to all the experts. Analysis showed that, for most technologies, expert judgments did not vary significantly.

Prioritized mitigation technologies

Grid connected wind power

Passive solar and solar photovoltaic

Small hydro powers

High efficiency lightning systems

Biogas for heating/cooking

Heat pumps

A2. Technology Action Plans

A2.1. Analyzing barriers to application of climate change mitigation technologies

Identifying barriers is the process of determining the reasons that hinder the transfer and diffusion of technologies. These include the identification of any missing measures that could have sustained the diffusion.

For the organization of the barrier analysis process, a sectoral/technology working group representing relevant stakeholders was formed. National consultants have applied a participatory approach for barrier analysis and identification of enabling measures in alternative energy sources and commercial/residential sub-sectors.

As an initial step in the process of barrier analysis, a desk study of policy papers and other pertinent documents was conducted in order to identify the primary reasons why the technology is not currently applied widely, and why neither the private nor public sectors have invested significantly in it. Next, a consultation process was conducted with stakeholders through direct interviews and questionnaires.

After compiling a long list of barriers, a stakeholder workshop was organized in order to screen barriers and group them under different categories (information, social, technological, capacity building, economic/financial, policy/regulatory). Along with those categories of barriers, it should be mentioned that there are specific barriers for wide range technology deployment such as occupation of 20% of the territory of the country and huge number of internally displaced people prevailing 1 million person.

For identification of most important barriers, a simple method was applied grouping them into key and non-key barriers and criteria such as starter, crucial, important, less important and insignificant barriers.

Barriers related to technology implementation were identified in six categories:

- economic/financial barriers;
- policy/regulatory barriers;
- technology barriers;
- capacity building barriers;
- social barriers;
- environmental barriers.

For the identification of relevant measures, detailed analysis of current practices at national and international level was provided. National consultants have applied a participatory approach during the analysis by involving a wide range of stakeholders in the process. The same procedure was applied for identification of measures. Measures have been indentified based on grouped barriers. LPA analysis was applied to identification of measures process in order to get from problems to solution.

Barriers for prioritized technologies under alternative energy sources sub-sector could be summarized as follows:

Barriers	**Technologies**		
	Grid-connected wind power	**Passive solar energy and photovoltaic**	**Small hydro-powers at mountain rivers**
Economic/financial	- Low cost of electricity -Unfavorable tariff mechanisms - High cost of investment and infrastructure - Weak access to acceptable financial means - Weak fiscal support to R & D institutions	- No tariff mechanisms for generated electricity - High cost of investment and infrastructure - Long payback period - Weak access to acceptable financial means	- Insufficient state investment to the sector - High cost of investment and infrastructure - Weak access to acceptable financial means

Barriers	Technologies		
	Grid-connected wind power	**Passive solar energy and photovoltaic**	**Small hydro-powers at mountain rivers**
Policy/regulatory	- Weak regulations on consumer use of wind energy sources - Non-existence of regulations on enabling tax terms - Non-existence of wind atlas	- Weak regulations on consumer use of solar energy sources	- Low level of awareness of economic and ecological advantages
Technology	- Non-compliance of standards and certification procedures - Weak capacity of R & D institutions	- Non-compliance of standards and certification procedures - Weak capacity of R & D institutions - Inadequate working skills of technical service providers	- Out-dated technology - Weak research activities due to insufficient equipment - Weak capacity of R & D institutions
Information/capacity	- Weak capacity of technology application - Low level of awareness of economic and ecological advantages	- Weak capacity of technology application - Low level of awareness of economic and ecological advantages	- Low capacity of research intitutions - Low level of awareness of economic and ecological advantages
Environmental			- Poor environmental impact assessments
Social	- Unfamiliarity with new technology	- Unfamiliarity with new technology	

Barriers for prioritized technologies under commercial and residential sub-sector could be summarized as follows:

Barriers	Technologies		
	High efficiency lighting systems	**Heat pumps**	**Biogas for heating/cooking and efficient stoves**
Economic/financial	- Weak access to financial means - Dependence on import - No subsidy mechanism	- Insufficient public investments - Weak access to financial means - No local production (dependence on import)	- Weak access to financial means - No local production (dependence on import)
Policy/regulatory	- Weak regulatory and legislative framework - Lack of coordination among relevant institutions	- Weak regulatory and legislative framework - Non-existence of mechanism for customs regulations for stimulation of import of necessary technology	- Weak regulatory and legislative framework
Technology	- Weak technical capacity of R & D institutions and technical experts -Standards and certification procedures are not in place	- Weak technical capacity of R & D institutions and technical experts	- Weak technical capacity of R & D institutions and technical experts

Barriers	Technologies		
	High efficiency lighting systems	**Heat pumps**	**Biogas for heating/cooking and efficient stoves**
Information/capacity	- Weak access to information - Lack of capacity and awareness level of local authorities, communal units and residents on advantages of the technology	- Weak access to information - Lack of capacity and awareness level of local authorities, communal units and residents on advantages of the technology	- Weak access to information - Lack of capacity and awareness level of local authorities, communal units and residents on advantages of the technology
Environmental	- No organized waste management of used bulbs		
Social			- Local traditions (unfamiliarity with new technology)

A2.2. Action plans

Alternative energy sources sub-sector

Preliminary targets for technology transfer and diffusion

The Republic of Azerbaijan is a country with favorable opportunities for the use of alternative energy sources due to its geographical position and climate. Despite its rich oil and gas resources, which enable sufficient and affordable energy supply for the public and private sector, the country has developed a strict strategy for application and enhancing use of renewable energy sources.

In this regard, the government has adopted the State Program on Utilization of Alternative Energy Sources (2005 – 2013) and the National Strategy on the Use of Alternative Energy for the period 2012-2020, and established the State Agency on Renewable Energy Sources (renamed the State Company on Renewable Energy Sources according to Presidential decree dated 01.06.2012).

The objective of the State Program is to promote power generation from renewable and environmentally sound sources and utilize hydrocarbon energy sources more efficiently.

The major tasks of the State Program include:

- Define the potential of alternative (renewable) energy sources for electric power generation;
- Raise the efficiency of the country's utilization of energy sources by developing renewable energy sources;
- Ensure the opening of additional jobs with creation of new energy production sites;
- Given the existing total capacity of traditional energy sources in Azerbaijan, increase the energy capacities of alternative energy sources and, therefore, achieve the country's energy security.

Main identified targets of the country for the period of 2020 is indicated below.

- 20% share of renewable energy in electricity (10% in 2011: 9.8% hydro-power, 0.2% other renewable energy);
- 9.7% share of renewable energy in all energy consumption (2.3% in 2011).

SCARES has already began work on the application of alternative and renewable energy sources. It was established Gobustan Demonstration Station and Training Center, work continues on the construction of stations such as "Goychay-1" (3 MW) and "Balakian-1" (1.5 MW). The State Program plans to continue creating a number of large and small hydro-power plants in the country through to 2015, which will save more than 2 MTs of fuel and reduce about 10 MTs of carbon dioxide emissions. It is targeted to involve more than 550 million USD to the development of the alternative and renewable energy sector.

During the preparation of the TAP prioritized measures have been assessed taking into account their priorities, time scale, related stakeholders, key indicators for measuring implementation and funding resources. A TAP for each technology is provided in below table:

Table 4: Prioritization and characterization of technology acceleration measures for alternative energy sub-sector

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Sector: Alternative energy sources ***Technology: Grid connected wind power***									
Policy and regulatory									
1	Develop a package of recommendations for improvement of enabling environment, including subsidy mechanism and tax regulations, in order to stimulate private sector investment	High	- Create enabling environment for private sector initiatives	0-5 years	MIE, SCARES, NGOs, private sector	- New tax regulations related to sector	- Lengthy state procedures and bureaucracy leading to slow endorsements of proposed recommendations	State Funds, International Funds	$ 300,000
2	Develop a package of recommendations on tariff regulations for Tariff Council	High	- Set favorable tariff rates	0-5 years	MIE, SCARES, NGOs, private sector	- New package to stimulate private sector	- Lengthy state procedures and bureaucracy leading to slow endorsements of proposed recommendations	State Funds, International Funds	$ 200,000
3	Develop standards and certification process	High	- Put in place standards and certification procedures	0-5 years	MIE, SCARES, Standardization and Patent Agency under MED	- Standards and certification procedures in place	- Lengthy state procedures and bureaucracy leading to slow endorsements of proposed measures	State Funds	$ 100,000
Economic/financial									
4	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create easy access to affordable loans	0-5 years	MED, SCARES	- Easy access to funds created	- Low interest of financial institutions - Insufficient state funds	State Funds, International Funds	$ 100,000
Information/capacity building									
5	Technical support to R & D institutions	High	- Weak capacity of R & D institutions	5-10 years	SCARES, MED	- Improved capacity of R & D institutions	- No major risk	State Funds, International Funds	$ 500,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
6	Strengthen international research network programmes	Medium	- Lack of knowledge on best international practice	5-10 years	SCARES, NGOs, private sector	- National R & D institutions actively participate in international research network	- No major risk	State Funds, International Funds	$ 250,000
7	Organize specific capacity building programmes for private sector, local authorities and local communities	Medium	- Increase capacities on technology deployment	5-10 years	MoE, SCARES	- Increased capacity	- Weak collaboration of local authorities and local communities	State Funds, International Funds, Private funds	$ 800,000
8	Develop and conduct information campaigns on the advantages of applied technology	High	- Increase awareness level on economic/environmental advantages of technology	0-5 years	SCARES, NGOs	- Awareness level of consumers on renewable energy increase by 50%	- No major risks	State Funds, International Funds	$ 400,000
9	Organize study tours to Gobustan Demonstration Station	Medium	- Demonstrate practical application	0-5 years	SCARES, NGOs	- Practical knowledge increased	- Weak coordination by SCARES	State Funds, International Funds	$ 500,000
Other measures									
10	Donor coordination in order to enhance support to pilot project initiatives in the field of wind power energy	Medium	- Coordinate various donor initiatives - Demonstrate practical application of the technology	0-10 years	MED, SCARES	- Donor coordination meetings organized at least once a year	- Weak collaboration of related organizations	State Funds, International Funds	$ 950,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
11	Develop wind atlas	High	- Identify exact potential of wind energy	0-5 years	SCARES, National Academy of Sciences, MENR	- Wind atlas developed	- Weak collaboration between respective organizations	State Funds, International Funds	$ 750,000
Sector: Alternative energy sources ***Technology: Passive solar energy (hot water) and solar photovoltaic***									
Policy and regulatory									
1	Develop a package of recommendations for improvement of enabling environment, including subsidy mechanisms and tax regulations, in order to stimulate private sector investment	High	- Create enabling environment for private sector initiatives	0-5 years	MIE, SCARES, NGOs, private sector	- New tax regulations related to sector	- Lengthy state procedures and bureaucracy leading to slow endorsements of proposed recommendations	State Funds, International Funds	$ 300,000
2	Develop a package of recommendations on tariff regulations for Tariff Council	High	- Set favorable tariff rates	0-5 years	MIE, SCARES, NGOs, private sector	- New package to stimulate private sector	- Lengthy state procedures and bureaucracy leading to slow endorsements of proposed recommendations	State Funds, International Funds	$ 200,000
Economic/financial									
3	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create easy access to affordable loans	0-5 years	MED, SCARES	- Easy access to funds created	- Low interest of financial institutions - Insufficient state funds	State Funds, International Funds	$ 100,000
Information/capacity building									
4	Technical support to R & D institutions	High	- Weak capacity of R & D institutions	5-10 years	SCARES, MED	- Improved capacity of R & D institutions	- No major risk	State Funds, International Funds	$ 500,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
5	Organize specific capacity building programmes for private sector, local authorities and local communities	Medium	- Increase capacities on technology deployment	5-10 years	MoE, SCARES	- Increased capacity	- Weak collaboration of local authorities and local communities	State Funds, International Funds, Private Funds	$ 800,000
6	Develop and conduct information campaigns on the advantages of applied technology	High	- Increase awareness level on economic/environmental advantages of technology	0-5 years	SCARES, NGOs	- Awareness level of consumers on renewable energy increase by 50%	- No major risks	State Funds, International Funds	$ 400,000
7	Organize study tours to Gobustan Demonstration Station	Medium	- Demonstrate practical application	0-5 years	SCARES, NGOs	- Practical knowledge increased	- Weak coordination by SCARES	State Funds, International Funds	$ 500,000
Other measures									
8	Donor coordination in order to enhance support to pilot project initiatives in the field of solar energy	Medium	- Coordinate various donor initiatives - Demonstrate practical application of the technology	0-10 years	MED, SCARES	- Donor coordination meetings organized at least once a year	- Weak collaboration of related organizations	State Funds, International Funds	$ 950,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Sector: Alternative energy sources ***Technology: Small hydro power plants***									
Policy/regulatory									
1	Develop specific regulations for simplifying permission mechanism	High	- Simplify permission mechanism in order to promote private sector initiatives	0-5 years	Azerenergy, SOCAR, MENR, Cabinet of Ministers	- Easy permission mechanism	- Lengthy state procedures and bureaucracy leading to slow endorsements of proposed recommendations	State Funds	$ 100,000
Economic/financial									
2	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create easy access to affordable loans for private sector	0-5 years	MED, Azerenergy	- Easy access to funds created	- Low interest of financial institutions - Insufficient state funds	State Funds, International Funds	$ 100,000
Information/capacity building									
3	Enhance research/observation activities in order to identify the potential of mountain rivers and prepare electronic atlas	High	- Weak R & D activities	0-5 years	National Academy of Sciences, Azerenergy, SCARES	- Enhanced research/observation activities	- Weak capacity of R & D institutions	State Funds, International Funds	$ 200,000
4	Capacity building trainings for respective governmental bodies responsible for research/observation activities in the field of small hydro-power	Medium	- Weak skills and capacity of R & D institutions	0-5 years	National Academy of Sciences, Azerenergy, SCARES, NGOs	- Increased capacity and skills	- No major risk	State Funds, International Funds	$ 350,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Other measures									
5	Conduct detailed environmental impact assessments at potential construction areas	Medium	- Reduce negative impact to environment and environmental risks	0-10 years	MENR, NGOs	- Detailed environmental impact assessments conducted	- Poor coordination between respective state bodies during assessment process	State Funds, International Funds	$ 500,000
6	Donor coordination in order to enhance support to pilot project initiatives in the field of small hydro-powers technology	Medium	- Coordinate various donor initiatives - Demonstrate practical application	0-10 years	MED, SCARES	- Donor coordination meetings organized at least once a year	- Weak collaboration of related organizations	State Funds, International Funds	$ 1,250,000

Commercial/residential sub-sector

Preliminary targets for technology transfer and diffusion

The commercial and residential sectors have been considered main sources of GHG emission, as emissions from these sectors have had an increasing tendency over the years.

Issues related to energy efficiency have been indicated in “the law on use of energy resources”, adopted in 1996. Although the government has not defined the strategy for prioritized technologies in this sub-sector, there are some existing initiatives to promote use of high efficiency lighting systems.

Biogas application has been supported by different local and international donors, however all initiatives were local. It should be mentioned that those initiatives were not sustainable, as project activities were not followed by appropriate awareness-raising and financial components. With regard to heating pumps, there are no specific policies or programmes related to this technology.

Major barriers to technology deployment could be categorized as economic/financial, capacity building/information, policy/regulatory, technology, environmental and social barriers. High cost of investments/infrastructures, low level of awareness and capacities, and social barriers could be mentioned as main barriers to technology application.

According to rough estimates, deployment of prioritized technologies, such as high efficiency lighting systems, heating pumps and biogas for heating/cooking and efficient stoves, will lead to a total of 32.7 MT GHG emission reductions by the year 2030.

During the preparation of TAP, prioritized measures have been assessed taking into account their priorities, time scale, related stakeholders, key indicators for measuring implementation and funding resources. TAP for each technology is provided in below table:

Table 5: Prioritization and characterization of technology acceleration measures for commercial/residential sub-sector

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Sector: Commercial/residential ***Technology: High efficiency lighting systems***									
Policy and regulatory									
1	Develop a package of recommendations for improvement of enabling environment, including subsidy mechanism and tax regulations, in order to stimulate private sector initiatives	Medium	- Create enabling environment for private sector initiatives	0-5 years	SOCAR, MIE, MED, National Parliament, NGOs	- New subsidy mechanism and tax regulations related to sector	- Lengthy state procedures and bureaucracy leading to slow endorsements of proposed recommendations	State Funds	$ 300,000
2	Develop standards and certification process	High	- Put in place standards and certification procedures	0-5 years	MIE, Standardization and Patent Agency under MED	- Standards and certification procedures in place	- Lengthy state procedures and bureaucracy leading to slow endorsements of proposed measures	State Funds	$ 100,000
Economic/financial									
3	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create easy access to affordable loans	0-5 years	MED, SCARES	- Easy access to funds created	- Low interest of financial institutions - Insufficient state funds	State Funds, International Funds	$ 100,000
Information/capacity building									
4	Capacity building programs for local authorities, communal units, private sector and residents	High	- Increase capacity on technology deployment	0-5 years	SOCAR, MIE, NGOs	- Improved capacity in energy efficiency	- Low interest of local authorities, communal units, private sector and residents	State Funds, International Funds	$ 400,000
5	Information campaigns on the advantages of applied technology	High	- Raise awareness on advantages	0-5 years	SOCAR, MIE, NGOs	- Increased awareness in energy efficiency	- No major risk	State Funds, International Funds	$ 250,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Other measures									
6	Develop mechanism for waste management of used bulbs	Medium	- Decrease environmental risks from hazardous wastes	0-10 years	Azerenergy, SOCAR, local executive committees and local authorities	- Specific mechanism for waste management of used bulbs in place	- Poor coordination among respective organizations	State Funds, International Funds	$ 350,000
7	Implementation of pilot projects at municipal or community level to demonstrate advantages of the technology	Medium	- Demonstrate practical application	5-10 years	MIE, SOCAR, MED, NGOs	- Increased level of awareness	- Weak collaboration of related organizations	State Funds, International Funds	$ 750,000
Sector: Commercial/residential ***Technology: Heating pumps***									
Policy and regulatory									
1	Develop a package of recommendations for improvement of enabling environment, including subsidy mechanism and tax regulations, in order to stimulate private sector initiatives	Medium	- Create enabling environment for private sector initiatives	0-5 years	National Parliament, NGOs	- New subsidy mechanism and tax regulations related to sector	- Lengthy state procedures and bureaucracy leading to slow endorsements of proposed recommendations	State Funds	$ 250,000
Economic/financial									
2	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create easy access to affordable loans	0-5 years	MED, MIE	- Easy access to funds created	- Low interest of financial institutions - Insufficient state funds	State Funds, International Funds	$ 100,000
Information/capacity building									
3	Capacity building programs for local authorities, communal units, private sector and residents	High	- Increase capacity on technology deployment	0-5 years	MIE, NGOs, Local authorities	- Improved capacity in energy efficiency	- Low interest of local authorities, communal units, private sector and residents	State Funds, International Funds	$ 300,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
4	Strengthen international research network programmes	Medium	- Lack of knowledge on best international practice	5-10 years	NGOs, R & D institutions	- National R & D institutions actively participate in international research network	- No major risk	State Funds, International Funds	$ 250,000
5	Information campaigns on the advantages of applied technology	High	- Raise awareness on advantages	0-5 years	MIE, Local authorities, NGOs	- Increased awareness on energy efficiency	- No major risks	State Funds, International Funds	$ 250,000
Other measures									
6	Implementation of pilot projects at municipal or community level to demonstrate advantages of the technology	Medium	- Demonstrate practical application	5-10 years	MIE, MED, NGOs	- Increased level of awareness	- Weak collaboration of related organizations	State Funds, International Funds	$ 550,000
Sector: Commercial/residential ***Technology: Biogas for heating/cooking and efficient stoves***									
Policy and regulatory									
1	Develop a package of recommendations for improvement of enabling environment, including subsidy mechanism and tax regulations, in order to stimulate private sector initiatives	Medium	- Create enabling environment for private sector initiatives to launch local production	0-5 years	National Parliament, MENR, NGOs	- New subsidy mechanism and tax regulations related to sector	- Lengthy state procedures and bureaucracy leading to slow endorsements of proposed recommendations	State Funds	$ 250,000
Economic/financial									
2	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create easy access to affordable loans for private initiatives/local residents	0-5 years	MED, Agency on Agricultural Credits	- Easy access to funds created	- Low interest of financial institutions - Insufficient state funds	State Funds, International Funds	$ 100,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Information/capacity building									
3	Specific capacity building programs to increase technical capacity of service providers	Medium	- Increase capacity on technology deployment	0-5 years	MED, MENR, NGOs	- Improved capacity on technology deployment	- Low interest of private sector and technical service providers	State Funds, International Funds	$ 250,000
4	Information campaigns on the advantages of applied technology	High	- Raise awareness on advantages	0-5 years	MENR, NGOs, Local auhtorities	- Increased awareness of technology application	- No major risks	State Funds, International Funds	$ 250,000
Other measures									
5	Implementation of pilot projects at municipal or community level to demonstrate advantages of the technology in order to promote its production and use	Medium	- Demonstrate practical application	5-10 years	MENR, MED, NGOs	- Increased level of awareness - Local production launched	- Weak collaboration of related organizations	State Funds, International Funds	$ 850,000

B. Climate change adaptation technology

B1. Technology need assessment for climate change adaptation

B1.1.Criteria and process of sector prioritization

In order to provide the assessment of vulnerability to climate change, the National Team identified an initial list of sectors, in keeping with the country's development priorities, that was agreed upon by the PSC. Initially identified sectors are water, agriculture, human health, forest, natural disasters and animal husbandry. The National Team has provided assessment of vulnerability of these identified sectors to climate change.

For sector prioritization, a long list of main sectors most vulnerable to climate change was prepared based on the results of assessments provided in the Second National Communication in keeping with the country's development priorities. The following sectors have been included to the initial list of the sectors most vulnerable to climate change:

- Water Resources
- Agriculture
- Forest
- Human health
- Natural disasters

After approval of the initial list of sectors by the PSC, the adaptation expert provided assessment of vulnerability to climate change in the above-mentioned sectors.

Available information on climate change impacts of the selected priority sectors have been assessed and discussed with stakeholder groups. Taking into account economic, social and environmental development priorities and applying a 0-5 scoring rating scheme, water resources and agriculture have higher scores for prioritization.

As a result, the below performance matrix for prioritizing has been identified using MCA method:

Table 6: Sector prioritization for adaptation

Sectors	Economic priorities	Social priorities	Environment priorities	Total benefit
Water Resources	4	5	4	13
Agriculture	5	5	4	14
Forest	3	3	5	11
Human health	3	5	3	11
Natural disasters	4	4	4	12

As can be seen in the table, agriculture and water resources have higher scores for prioritization. Most experts have given highest scores to the agricultural sector considering the importance of the sector within the context of vulnerability to climate change and compliance with economic and social development priorities. Taking into account the negative impact of forecasted climate change to agricultural production, applying adaptive technologies is becoming more important in order to achieve food security in the country. The next sector with the highest score, water resources, was considered an important sector in need of adaptive technologies taking into account social and economic, as well as environmental priorities in the country.

As a result, the following sectors have been identified as priority sectors for adaptation: Water resources and Agricultural sector.

Vulnerability of water resources to the upcoming climate change, as shown in the Initial National Communication, was simulated for 2021-2050 and 2071-2100 based on recently updated statistic models. These simulations reflected the dependence of river flows on meteorological factors and the accepted PRECİS 1.4 climate change model. PRECIS 1.4 modeling system developed by United Kingdom_Meteorology Office Hadley Centre for Climate Change. Based on the current Global Circulation Models, IPCC recommendations and Hadley Centre developments, and following discussions on boundary conditions on PRECIS modeling system an option for Azerbaijan with different emissions scenarios was determined. The present ECHAM4 data was selected as boundary conditions for the period 1960-2100 according to A2 scenario of atmospheric and oceanic General Circulation Model developed by Max-Planck-Institute. An assessment was made for 3 periods based on these boundary conditions:

- First period covering years 1960-1990 plays the role of a baseline climate year;
- Second period is a scenario period and covers the years 2020-2050;
- Third scenario period covers years 2070-2100.

Findings show that natural water resources gradually diminish and water shortage occurs in the country and that this trend will continue in the future. It is obvious that current water shortage occurs mainly as a result of water leakages in water distribution systems. If these leakages are not prevented the situation might be aggravated in the future.

Regards agriculture, agriculture is the sector of economy most dependent on climate conditions. A slight change in climate conditions makes a considerable impact on agricultural production.

Located in the northern end of a subtropical zone, the majority of Azerbaijan's territory is characterized by high warming resources, mild winter conditions, moisture shortage in the summer, and continuous droughts.

It is known that the climate makes its impact on agriculture by means of agro-climatic conditions and resources of the areas. Therefore, it is important to make assessments of their upcoming change. Agro-climate data calculated based on scenarios of the baseline year (1961-1990) used GISS, GFDL-3 and expert scenarios that were thoroughly reviewed in the Initial National and Second Communication. In the present report main agro-climate data simulated by PRECİS 1.4 model and climate change scenarios developed for 2021-2050 and 2071-2100 have been considered.

B1.2.Results of technology prioritization

As a next step of the TNA process, the National Team prepared an overview of technologies for adaptation. Technologies were categorized in terms of their availability in time and scale of application. This was based on assessment of the country's current experience as well as data from the source, ClimateTechWiki. The National Team of experts has prepared Technological Fact Sheets (TFS) for pre-selected technologies for both sectors.

The assessment of pre-selected technologies was based on their contribution to sustainable development goals and to adaptation, in light of climate change impact scenarios for the country. First, the criteria on which the assessments are based were decided, involving a wider group of stakeholders. The following criteria have been identified to be applied for prioritization of adaptive technologies:

- Contribution to economic development priorities;
- Contribution to social development priorities;
- Contribution to environmental development priorities;
- Implementation availability;
- Potential contribution to reduction of vulnerability to climate change.

As a result of stakeholder-driven consultation, the following possible adaption technologies have been listed for water and agricultural sector:

Table 7: Possible adaptation technologies for water and agricultural sector

Sector	Technology	Scale of application	Short, medium/long term availability
Water	Construction of water reservoirs of complex destination and increase of efficiency of the existing water reservoirs	Large-scale	Long-term
	Use of water-saving technologies in water consumption system	Large-scale	Long-term
	Improvement of the water resources management system	Large-scale	Medium-term
	Reducing water leakages in water management facilities	Medium-scale	Short-term
	Rainwater Collection from Ground Surfaces—Small Reservoirs and Micro-catchments	Medium-scale	Medium-term
	Use of hydrologic cycle water, including ground waters	Large-scale	Long-term
	Regulation of flows	Medium-scale	Medium-term
	Taking engineering protective measures in stream beds of lakes and rivers against floods	Medium-scale	Medium-term
	Water reclamation and reuse	Large-scale	Long-term
	Flood warning technology	Large-scale	Medium-term
	Clean-up of river channels	Large-scale	Medium-term
	Desalinization of sea water to be used for technical purposes	Medium-scale	Medium-term
Agriculture	Improve management and use of cultivated lands	Large-scale	Medium-term
	Optimizing of location and structure of agricultural lands with introduction of crop species resistant to expected climate changes	Large-scale	Long-term
	Implementation of desalinization measures, continuation and expansion of measures on the prevention of soil erosion and salinity by application of drainage system	Large-scale	Medium-term
	Application of water saving technologies, such as drop or spray irrigation, at irrigated lands	Small-scale/Large-scale	Long-term
	Development of agricultural infrastructure, including irrigation systems for pastures, cultivation system and its effectiveness	Large-scale	Medium-term
	Use/store rain and snow water sources for irrigation	Large-scale	Medium-term
	Enhance the application of windbreaks	Large-scale	Medium-term
	Continuation of work on selection, introduction and farming application of winter wheat varieties characterized by drought resistance and high productivity	Large-scale	Medium-term
	Continuation of work on selection, introduction and farming application of heat tolerant, drought resistant and highly productive cotton varieties	Large-scale	Medium-term
	Restoration of conventional vineyards and expansion of their area by planting new vineyards on mountain terraces	Large-scale	Long-term
	Application of conservative agricultural technologies	Small-scale	Long-term
	Create access for local farmers to timely information on climatic forecast	Small-scale	Short-term

The technology performance, or criteria measure, was assessed considering the information already collated in technology fact sheets, available country knowledge and relevant input of experts. Next, the technologies were scored on a scale of 0-100 by a stakeholder group of 11 experts. The highest value of 100 was given to the most priority technology and a 0 point was given to the least preferred technology. This was followed by assessing weights for each criterion, to enable the stakeholders to determine the relative importance of each criterion. The weighting is done after the scoring, because weights can only be given to criteria within the decision-making context.

As a result of the assessment, four priority measures for each sector have been identified.

For water sector:

1) Rainwater Collection from Ground Surfaces—Small Reservoirs and Micro-catchments

As there are water poor regions in many areas of Azerbaijan, small-scale collection infrastructure can contribute greatly to the volume of freshwater available for human use. This is especially an issue in arid and semi-arid regions, where the minimal rainfalls are usually very intense and often seasonal. As such, run-off and river flows can be abundant for brief periods and non-existent throughout the rest of the year. Technology can help to store and use water during low water periods and, therefore, increase water use efficiently as the system collects water from the nearby area and keeps it from flowing into rivers or other areas or from evaporating.

2) Flood warning

The purpose of a flood warning service is to detect and forecast threatening flood events so that the public can be alerted in advance and can undertake appropriate responses to minimize the impact of the event. It is possible to implement flood warning systems together with other adaptation measures, as part of an integrated flood risk management plan.

3) Water reclamation and reuse

This technology focuses on applications of water reuse that directly affect drinking water supplies. It is important to note that agricultural use accounts for the majority of freshwater consumption worldwide.

Water reclamation and reuse approaches utilize the same treatment technologies as conventional wastewater treatment, including secondary clarifiers, filtration basins of various designs, membranes, and disinfection basins.

Technology can help to store and use water during low water periods and, therefore, increase water use efficiently as the system collects water from the nearby area and keeps it from flowing into rivers or other areas or from evaporating.

4) Reducing water leakages in water management facilities

Management, detection and repair of small leaks in a distribution system are critical functions of system operation and maintenance. Leaks often damage pipes through erosion; therefore, additional benefits of early detection include reduced maintenance costs and lower probability of catastrophic failures. Monitoring systems remotely also enables confirmation that pipes are in good condition, preventing premature replacement. Along with reduction in water losses, such technology reduces health and environmental issues related to water (increase of salty ground water level, mixture of fresh water with waste waters and other polluted waters).

For agricultural sector:

1) Optimizing of location and structure of agricultural lands with introduction of crop species resistant to expected climate changes

The introduction of new cultivated species and improved crop varieties is a technology aimed at enhancing plant productivity, quality, health and nutritional value and/or building crop resilience to diseases, pest organisms and environmental stresses. Crop diversification refers to the addition of new crops or cropping systems to agricultural production on a particular farm, taking into account the different returns from value-added crops with complementary marketing opportunities.

New and improved crop species can be introduced through farmer experimentation with new varieties. Agricultural researchers and extension agents can help farmers identify new varieties that may be better adapted to changing climatic conditions, and facilitate farmers to compare these new varieties with those they already produce.

2) Enhance the application of windbreaks

The practice of agro-forestry was applied in Azerbaijan during former Soviet times. Currently, this practice is not applied by most private land-owners due to lack of knowledge. Agro-forestry has a broad application potential and provides a range of advantages, including the maximum use of the land and increased land-use efficiency, increased productivity of the land, protection and improvement of soils and water sources, and so on.

3) Application of water saving technologies, such as drop or spray irrigation, at irrigated lands

Efficient use of irrigation water will be very important due to expected water scarcity forecasted in light of climate change. Drip irrigation can help use water efficiently. A well-designed drip irrigation system reduces water run-off through deep percolation or evaporation to almost zero. If water consumption is reduced, production costs are lowered. Additionally, conditions may become less favorable for the onset of diseases including fungus. Irrigation scheduling can be managed precisely to meet crop demands, holding the promise of increased yield and quality.

Agricultural chemicals can be applied more efficiently and precisely with drip irrigation. Fertilizer costs and nitrate losses can be reduced. Nutrient applications can be better timed to meet the needs of plants.

Sprinkler systems eliminate water conveyance channels, thereby reducing water loss. Water is also distributed more evenly across crops helping to avoid wastage. Sprinklers provide a more even application of water to agricultural land, promoting steady crop growth. Secondary benefits from improved crop productivity include income generation, employment opportunities and food security.

4) Application of conservative agricultural technologies

Conservation tillage refers to a number of strategies and techniques for establishing crops in previous crop residues, which are purposely left on the soil surface. Conservation tillage practices typically leave about one-third of crop residue on the soil surface. This slows water movement, which reduces the amount of soil erosion. Conservation tillage is suitable for a range of crops including grains, vegetables, root crops, fruit and wine.

Unpredictability of rainfall and an increase in the mean temperature may affect soil moisture levels leading to damages to and failures in crop yields. Conservation tillage practices reduce risk from drought by reducing soil erosion, enhancing moisture retention and minimizing soil impaction. In combination, these factors improve resilience to climatic effects of drought and floods. Improved soil nutrient recycling may also help combat crop pests and diseases. Conservation tillage benefits farming by minimizing erosion, increasing soil fertility and improving yield.

Finally, sensitivity analysis on assessment results was conducted to evaluate the robustness of the results relative to the weights and scores applied and other uncertainties. Analysis provided by experts proved that the four priority measures for each selected sector are priority measures obtained by all the experts, unanimously.

Results of the technology prioritization were presented to the TNA committee. Prioritized sectors and technologies for both sectors during the TNA process were endorsed by the TNA committee.

Prioritized adaptation technologies

Introduction of drought resistance crop species

Conservative agriculture

Water saving technologies – drip and sprinkle irrigation

Windbreaks

Small reservoirs and micro-catchments

Water reclamation and reuse

Flood warning technology

Reducing water leakages

B2. Technology Action Plans

B2.1. Analyzing barriers to application of climate change adaptation technologies

As an initial step in the process of barrier analysis, a desk study of policy papers and other pertinent documents was conducted in order to identify the primary reasons why the technology is not currently applied widely, and why neither the private nor public sectors have invested significantly in it. Next, a consultation process was conducted with stakeholders through direct interviews and questionnaires.

For the organization of the barrier analysis process, a sectoral/technology working group representing relevant stakeholders was formed. National consultants have applied a participatory approach for barrier analysis and identification of enabling measures in agricultural and water sectors. Barriers related to technology implementation have been identified in five categories:

- economic/financial barriers;
- policy/regulatory barriers;
- technology barriers;
- information/capacity barriers;
- social barriers.

Along with those categories of barriers, it should be mentioned that there are specific barriers for wide range technology deployment such as occupation of 20% of the territory of the country and huge number of internally displaced people prevailing 1 million person.

After compiling a long list of barriers, a stakeholder workshop was organized in order to screen barriers and group them under different categories (information, social, technological, capacity building, economic/financial, policy/regulatory). For identification of most important barriers, a simple method was applied grouping them into key and non-key barriers and criteria such as starter, crucial, important, less important and insignificant barriers.

Barriers of prioritized technologies under agricultural sector could be summarized as follows:

Type of barriers	Barriers
Introduction of new crop species resistant to climate change	
Economic/financial barriers	- Weak access to acceptable financial means - Weak access to markets - High prices of seeds - Expensive feasibility study
Policy/regulatory barriers	- No specific subsidy mechanism to promote application of new crop varieties
Information/capacity barriers	- Weak capacity of research institutions - Weak agricultural extension services - Low level of awareness of economic and ecological advantages
Social barriers	- Unfamiliarity with new technology
Application of windbreaks technology	
Economic/financial barriers	- Weak access to acceptable financial means - Weak access to markets - Lack of fiscal support to R & D institutions
Policy/regulatory barriers	- No specific subsidy mechanism to promote application of windbreaks technology
Information/capacity barriers	- Weak capacity of research institutions - Weak agricultural extension services - Low level of awareness of economic and ecological advantages
Social barriers	- Unfamiliarity with new technology - Small-scale lands
Introduction of water saving technologies	
Economic/financial barriers	- Weak access to acceptable financial means - High investment costs

Type of barriers	Barriers
Policy/regulatory barriers	- No market-based pricing mechanism for use of irrigation water
Technological barriers	- Lack of technological knowledge and skills
Information/capacity barriers	- Weak agricultural extension services - Low level of awareness of economic and ecological advantages
Social barriers	- Unfamiliarity with new technology - Small-scale lands
Application of conservative cultivation technologies	
Economic/financial barriers	- Weak access to acceptable financial means - High investment costs - Expensive feasibility study
Policy/regulatory barriers	- No specific subsidy mechanism to promote application of conservative cultivation technology
Technological barriers	- Weak access to agricultural machinery
Information/capacity barriers	- Weak agricultural extension services - Low level of awareness of economic and ecological advantages
Social barriers	- Unfamiliarity with new technology - Small-scale lands

Barriers of technology deployment under the water sector could be summarized as follows:

Type of barriers	Barriers
Rainwater collection from ground surfaces—small reservoirs and micro-catchments technology	
Economic/financial barriers	- Insufficient governmental support for enhancement research activities - High capital costs for large-scale projects - Weak access to financial sources
Policy/regulatory barriers	- Weak institutional basis and lack of coordination - Lack of stakeholder network for the development and transfer of the technology - Non-existence of mechanism for customs regulations for stimulation of import of necessary technology
Technological barriers	- Difficulties in identification of suitable site and scale of rainwater reservoirs or tanks
Information/capacity barriers	- Weak capacity and lack of skills of existing research institutions
Social barriers	- Unfamiliarity with new technology - Possible conflicts between communities on water access rights
Flood warning technology	
Economic/financial barriers	- High investment cost for surveying devices - High operating cost - Lack of funds

Type of barriers	Barriers
Technological barriers	- Lack of experts to develop programs for automatic analysis, processing, and interpreting images - Lack of research works including short-range run-off models and short-range weather forecast models - Lack of data and data management system - Lack of data linkage among the models -Lack of system to automatically analyze a situation to support a command **Modeling problems** - Lack of data and data storage - Lack of research works - Lack of data linkage among the models **Event Detection and Projection technologies** - Lack of data format standardization - Lack of experts **Real-time Satellite Monitoring area** - High operating cost - Lack of funds - Lack of experts **Data linkage system and data warehouse related barriers:** Lack of data sharing network to easily access the database **Data display system related barriers:** Lack of system to automatically analyze the situation to support a command
Policy/regulatory barriers	- Lack of coordination among relevant institutions - Non-existence of mechanism for customs regulations for stimulation of import of necessary technology
Water reclamation and reuse technology	
Economic/financial barriers	- High capital costs - Inadequate financial initiatives
Policy/regulatory barriers	- Weak regulatory and legislative framework - Weak institutional basis - Lack of coordination among relevant institutions - Non-existence of mechanism for customs regulations for stimulation of import of technology
Information/capacity barriers	- Limited awareness and lack of capacity of local authorities, communal units and residents on advantages of the technology
Social barriers	- Unfamiliarity with the technology
Reducing water leakages in water management facilities technology	
Economic/financial barriers	- High capital costs - Inadequate financial initiatives
Policy/regulatory barriers	- Weak regulatory and legislative framework - Weak institutional basis - Lack of coordination among relevant institutions - Non-existence of mechanism for customs regulations for stimulation of import of necessary technology
Information/capacity barriers	- Limited awareness and lack of capacity of local authorities, communal units and residents on advantages of the technology

Some of the identified barriers are similar throughout all the technologies. For instance, weak capacity and lack of information on use and advantages of the technology are some of the main barriers to deployment of all prioritized technologies under agricultural sector.

For the identification of relevant measures, detailed analysis of current practices at national and international level was provided. National consultants have applied a participatory approach during the analysis by involving a wide range of stakeholders in the process. Measures have been indentified based on grouped barriers. LPA analysis was applied to identification of measures process in order to get from problems to solution.

B2.2. Action plans

Agricultural sector

Preliminary targets for technology transfer and diffusion

Agriculture is one of the traditional economic activities in Azerbaijan. Historically, vine growing, silkworm breeding and fruit-growing activities have been widely applied in the country. As most of the country is mountainous, cattle-breeding activities play an important role in income generating for local populations.

Agriculture is sensitive to the climate and is a vulnerable sector. The climate projections for Azerbaijan are for significantly higher temperatures and possibly less rainfall. On the other hand, rising carbon dioxide levels will help offset some or all of the production losses, and agriculture and forestry are projected to continue being viable (all else being equal) over much of the current cropping, livestock and fruit-growing regions.

However, the agricultural sector still faces difficulties; in many regions, precipitation is both inadequate and inconsistently distributed. Due to the river network, water resources are unevenly distributed across Azerbaijan. Total water resources of Azerbaijan are about 39 km^3, of which approximately 29.3 km^3 are surface waters and 8.8 km^3 are groundwater. Insufficient precipitation and uneven distribution over the year are problematic for agriculture. As a result, roughly 33% of agricultural land is irrigated and it is this land that accounts for more than 80% of Azerbaijan's total agricultural output.

The key documents setting out the Government policies for the country, agriculture, rural and agro-industry development include:

- State Programme on Socio-Economic Development of the Regions of Azerbaijan for 2009-2013;
- State Programme on Poverty Reduction and Sustainable Development for 2008-2015;
- State Programme on Reliable food supply to the population for 2008-2015;
- State Programme on Development of Vine-growing activities for 2012-2020;
- "Azerbaijan-2020: glance to future" Development Conception.

Main aspects of agricultural development are more specifically represented by the "Azerbaijan State Programme on Reliable Food Supply of Population" (2009-2015). Its Action Plan consists of 12 main goals including improving land and water use efficiency, plant protection services and crop production.

Almost all development programmes are lacking in aspects related to future tendencies of climate change in spite of the fact that climate change projections have already been provided in the Second National Communication of Azerbaijan to UNFCCC.

Main targets of prioritized technologies in the agricultural sector are to adapt to changes in climate and sustain or increase agricultural productivity in the areas most vulnerable to climate change. Examples of such areas are, agricultural lands with irrigation water scarcity, areas with potential risks of droughts and high temperatures, and cultivated lands with high risk of erosion.

Table 8: Prioritization and characterization of technology acceleration measures for agricultural sector

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Sector: Agriculture ***Technology: Introduction of crop species resistant to expected climate change***									
Economic/financial									
1	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create access to financial sources	0-5 years	MED, MoA	- Easy access to funds created for farmers	- Low interest of financial institutions - Insufficient State funds	State Funds, International Funds	$ 200,000
2	Develop specific subsidy mechanism to promote application of the technology	Medium	- Promote wide application of technology	5-10 years	MoA, MoF, MED	- new set of package to support local farmers during application of new species	- State procedures may be slow to endorse proposed recommendations	State Funds, International Funds	$ 100,000
Technology									
3	Technical support to R & D institutions	High	- Improve technical capacity of R & D institutions	5-10 years	MED, MoA	- Improved capacity of R & D institutions	- No major risk	State Funds, International Funds	$ 500,000
4	Strengthen international research network programmes	Medium	- Share best practices and experiences	5-10 years	MoA, National Academy of Sciences	- National R & D institutions actively participate in international research network	- No major risk	State Funds, International Funds	$ 40,000
Information/capacity									
5	Organize specific capacity building programmes (trainings, seminars, workshops) for local farmers	High	- Increase capacities	0-10 years	MoA, NGOs	- Increased capacity	- No major risk	State Funds, International Funds	$ 600,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
6	Develop and conduct information campaigns on the advantages of applied technology	High	- Raise awareness level	0-5 years	MoA, NGOs	- Awareness level on advantages of new technology increase by 50%	- No major risk	State Funds, International Funds	$ 500,000
7	Develop mechanism for support to agricultural extension services	High	- Increase quality of agricultural extension services	0-10 years	MoA, MED, MoF, NGOs	- Capacity and quality of current extension service providers improved	- Weak collaboration with existing extension service providers	State Funds, International Funds	$ 800,000
Other measures									
8	Donor coordination in order to enhance support to R & D project initiatives related to the technology	Medium	- Coordinate various donor initiatives - Demonstrate practical application of the technology	0-10 years	MED, MoA	- Donor coordination meetings organized at least once a year	- Weak collaboration of related organizations	State Funds, International Funds	$ 100,000
9	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	MED, MoA	- Practical knowledge and skills of farmers increased	- Lack of funds	State Funds, International Funds	$ 600,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Sector: Agriculture ***Technology: Enhancing the application of windbreak technology***									
Economic/financial									
1	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create access to financial sources	0-5 years	MED, MoA	- Easy access to funds created for farmers	- Low interest of financial institutions - Insufficient State funds	State Funds, International Funds	$ 200, 000
2	Develop specific subsidy mechanism to promote application of the technology	Medium	- Promote wide application of technology	5-10 years	MoA, MoF, MED	- new set of package to support local farmers during application of windbreaks	- State procedures may be slow to endorse proposed recommendations	State Funds, International Funds	$ 100,000
Technology									
3	Technical support to R & D institutions	High	- Improve technical capacity of R & D institutions	5-10 years	MED, MoA	- Improved capacity of R & D institutions	- No major risk	State Funds, International Funds	$ 500,000
Information/capacity									
4	Organize specific capacity building programmes (trainings, seminars, workshops) for local farmers	High	- Increase capacities	0-10 years	MoA, NGOs	- Increased capacity	- No major risk	State Funds, International Funds	$ 600,000
5	Develop and conduct information campaigns on the advantages of applied technology	High	- Raise awareness level	0-5 years	MoA, NGOs	- Awareness level on advantages of new technology increase by 50%	- No major risk	State Funds, International Funds	$ 500,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
6	Develop mechanism for support to agricultural extension services	High	- Increase quality of agricultural extension services	0-10 years	MoA, MED, MoF, NGOs	- Capacity and quality of current extension service providers improved	- Weak collaboration with existing extension service providers	State Funds, International Funds	$ 800,000
Other measures									
7	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	MED, MoA	- Practical knowledge and skills of farmers increased	- Lack of funds	State Funds, International Funds	$ 800,000
Sector: Agriculture ***Technology: Application of water saving technologies at irrigated lands***									
Policy/regulatory									
1	Regulate tariff system for irrigation water	High	- Tariff system needs to be improved for use of irrigation water	0-5 years	National Parliament, MED, Tariff Council, Amelioration and Water Farms OSC	- Tariff system regulated	- State procedures may be slow to endorse proposed recommendations	State Funds	$ 250,000
2	Develop mechanism for distribution and pricing of irrigation water	High	- New working mechanism needed for distribution and pricing of irrigation water	0-5 years	MED, Amelioration and Water Farms OSC	- Working mechanism for distribution and pricing of irrigation water created	- State procedures may be slow to endorse proposed recommendations	State Funds	$ 100,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
3	Develop specific subsidy mechanism to promote application of the technology	Medium	- New initiatives need financial support	5-10 years	MoA, MoF, MED	- New set of package to support local farmers during application of new species	- Lack of funds	State Funds, International Funds	$ 200,000
4	Develop specific tax and customs regulations to promote technology import and production	Medium	- Private sector initiatives promoted	5-10 years	MED, MoT	- Enabling framework for technology import and local production created	- State procedures may be slow to endorse proposed recommendations	State Funds	$ 150,000
Economic/financial									
5	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create access to financial sources	0-5 years	MED, MoA	- Easy access to funds created for farmers	- Low interest of financial institutions - Insufficient State funds	State Funds, International Funds	$ 200,000
Technology									
6	Technical support to R & D institutions	High	- Improve technical capacity of R & D institutions	5-10 years	MED, MoA	- Improved capacity of R & D institutions	- No major risk	State Funds, International Funds	$ 500,000
7	Strengthen international research network programmes	Medium	- Share best practices and experiences	5-10 years	MoA, National Academy of Sciences	- National R & D institutions actively participate in international research network	- No major risk	State Funds, International Funds	$ 40,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Information/capacity									
8	Organize specific capacity building programmes (trainings, seminars, workshops) for local farmers	High	- Increase capacities	0-10 years	MoA, NGOs	- Increased capacity	- No major risk	State Funds, International Funds	$ 600,000
9	Develop and conduct information campaigns on the advantages of applied technology	High	- Raise awareness level	0-5 years	MoA, NGOs	- Awareness level on advantages of new technology increase by 50%	- No major risk	State Funds, International Funds	$ 500,000
10	Develop mechanism for support to agricultural extension services	High	- Increase quality of agricultural extension services	0-10 years	MoA, MED, MoF, NGOs	- Capacity and quality of current extension service providers improved	- Weak collaboration with existing extension service providers	State Funds, International Funds	$ 800,000
Other measures									
11	Donor coordination in order to enhance support to R & D project initiatives related to the technology	Medium	- Coordinate various donor initiatives - Demonstrate practical application of the technology	0-10 years	MED, MoA	- Donor coordination meetings organized at least once a year	- Weak collaboration of related organizations	State Funds, International Funds	$ 800,000
12	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	MED, MoA	- Practical knowledge and skills of farmers increased	- Lack of funds	State Funds, International Funds	$ 500,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Sector: Agriculture ***Technology: Application of conservative cultivation technologies***									
Economic/financial									
1	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create access to financial sources	0-5 years	MED, MoA, MoF	- Easy access to funds created for farmers	- Low interest of financial institutions - Insufficient State funds	State Funds, International Funds	$ 200,000
2	Develop specific subsidy mechanism to improve access to agricultural machinery	Medium	- Promote wide application of technology	5-10 years	MoA, MoF, MED	- new set of package to support local farmers during technology	- State procedures may be slow to endorse proposed recommendations	State Funds, International Funds	$ 700,000
Information/capacity building									
3	Organize specific capacity building programmes (trainings, seminars, workshops) for local farmers	High	- Increase capacities	0-10 years	MoA, NGOs	- Increased capacity	- No major risk	State Funds, International Funds	$ 600,000
4	Develop and conduct information campaigns on the advantages of applied technology	High	- Raise awareness level	0-5 years	MoA, NGOs	- Awareness level on advantages of new technology increase by 50%	- No major risk	State Funds, International Funds	$ 500,000
5	Develop mechanism to support agricultural extension services	High	- Increase quality of agricultural extension services	0-10 years	MoA, MED, MoF, NGOs	- Capacity and quality of current extension service providers improved	- Weak collaboration with existing extension service providers	State Funds, International Funds	$ 800,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
6	Technical support to R & D institutions	High	- Improve technical capacity of R & D institutions	5-10 years	MED, MoA	- Improved capacity of R & D institutions	- No major risk	State Funds, International Funds	$ 500,000
Other measures									
7	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	MED, MoA	- Practical knowledge and skills of farmers increased	- Lack of funds	State Funds, International Funds	$ 950,000

Water sector

Preliminary targets for technology transfer and diffusion

The water sector is considered to be one of the vulnerable sectors in light of climate change. For Azerbaijan, a country facing water shortage, implementation of adaptive measures in order to adapt to forecasted climate change tendencies is very important. Based on these factors, the water sector has been considered as one of the prioritized sectors for adaptation to climate change during the Technological Needs Assessment process.

Although the government has not defined the strategy for prioritized technologies for this sub-sector, there are some existing initiatives to promote use of water adaptation technologies in the areas of irrigation water use, drinking water supply and sanitation; however all initiatives are very limited.

Measures for overcoming existing barriers of prioritized technologies have been grouped as follows:

- Policy/regulatory
- Economic/financial
- Information/capacity building
- Technological
- Other measures

These measures include the activities, timelines, stakeholders, and indicators (both qualitative and quantitative) to facilitate the implementation of the technology.

Technological Action Plans have been prepared for each technology under water sector. During the preparation of TAP, measures have been assessed taking into account their priorities, time scale, related stakeholders, key indicators for measuring implementation and funding resources. TAP for water sector is provided in table 9:

Table 9: Prioritization and characterization of technology acceleration measures for water sector

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Sector: Water ***Technology: Rainwater collection from ground surfaces – small reservoirs and micro-catchments***									
Policy/regulatory									
1	Develop supportive policies for local deployment of the technology	High	- Promote application of technology in areas with water scarcity	0-3 years	MENR, SWRA, Azersu JSC, Amelioration JSC, National Parliament, NGOs, local authorities	- Developed/ implemented supportive policies for technology deployment	- State procedures may be slow to endorse proposed recommendations	State Funds	$ 150,000
Economic/financial									
2	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create access to financial sources	0-5 years	MED, MENR, SWRA, Azersu JSC, Amelioration JSC, local authorities	- Easy access to funds created for farmers	- Low interest of financial institutions - Insufficient State funds	State Funds, International Funds	$ 200,000
Information/capacity									
3	Capacity building for water management, operation and protection	High	- Increase capacities	0-10 years	MED, MENR, SWRA, Azersu JSC, Amelioration JSC, local authorities	- Increased capacity	- No major risk	State Funds, International Funds	$ 600,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
4	Develop and conduct information campaigns on the advantages of applied technology	High	- Raise awareness level	0-5 years	MED, MENR, SWRA, Azersu JSC, Amelioration JSC, local authorities	- Awareness level on advantages of new technology increase by 50%	- No major risk	State Funds, International Funds	$ 500,000
Other measures									
5	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	MENR, SWRA, Azersu JSC, Amelioration JSC, local authorities	- Practical knowledge and skills of farmers increased	- Lack of funds	State Funds, International Funds	$ 700,000
Sector: Water ***Technology: Flood warning***									
Policy/regulatory									
1	Clearly determining policy/agreement from state management in order to create understanding among agencies involved in data collection, co-ownership, and data sharing (urgent)	High	- Institutional basis improved	0-3 years	National Parliament, MENR, SWRA, local authorities	- The number of data agreements	- State procedures may be slow to endorse proposed recommendations	State Funds	$ 100,000
Economic/financial									
2	Investing in the procurement of high-quality devices used in conducting water source surveys	High	- Out-dated technology used	2 years	MED, MOF, MENR, SWRA, NGOs, local authorities	- The budget ratio spent on the procurement of survey devices	- Insufficient State funds	State Funds	$ 250,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
3	Determining a long-term budget plan to cover maintenance	High	- Lack of financial support during maintenance	2 years	MED, MOF, MENR, SWRA, NGOs, local authorities	- Improved budget plan for maintenance	- Insufficient State funds	StateFunds	$ 60,000
Technology									
4	Promoting devices and supporting locally-developed devices/research works	High	- Need for modern technologies	0-4 years	National Academy of Sciences, MENR, SWRA, NGOs, local authorities	- Improved capacity of R & D institutions	- No major risk	State Funds, International Funds	$ 200,000
5	Promoting research works in collaboration with foreign agencies/private companies in order to receive and transfer the technologies	High	- Need for modern technologies	0-4 years	National Academy of Sciences, MENR, SWRA, NGOs, local authorities	- Improved capacity of R & D institutions	- No major risk	State Funds, International Funds	$ 60,000
Information/capacity									
6	Enhancing the performance of data administrative officers to ensure they can collect and prepare data according to the standard before distributing the data	High	- There is need for capacity improvement	3 years	MENR, SWRA, NGOs, local authorities	- The number of personnel capable of transferring knowledge on data collection and preparation	- No major risk	State Funds, International Funds	$ 200,000
7	Providing knowledge and understanding on how the system operates to both managers and operators, in order to set an efficient line of command	High	- There is need for capacity improvement	3 years	MENR, SWRA, NGOs, local authorities	- The number of trainings/meetings	- No major risk	State Funds, International Funds	$ 250,000
8	Developing governmental personnel involved in R & D in	High	- There is need for	5 years	MENR, SWRA, NGOs, local	- The number of personnel	- Weak collaboration of	State Funds,	$ 150,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
	mathematic programs/geo-informatics		capacity improvement		authorities	in the fields of mathematic programs/geo-informatics	personnel	International Funds	
Other measures									
9	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	Local authorities, International and National donors, NGOs	- Practical knowledge and skills of farmers increased	- Lack of funds	State Funds, International Funds	$ 900,000
Sector: Water ***Technology: Water reclamation and reuse***									
Policy/regulatory									
1	Support policies for local deployment of the technology	High	- Promote application of technology in areas with water scarcity	0-3 years	MENR, SWRA, Azersu JSC, Amelioration JSC, National Parliament, NGOs, local authorities	- Developed/implemented supportive policies	- State procedures may be slow to endorse proposed recommendations	State Funds	$ 100,000
Economic/financial									
2	Develop mechanism for provision of long-term and low-interest loans, as well as grants through state, private and international funds	High	- Create access to financial sources	0-5 years	MED, MENR, SWRA, Azersu JSC, Amelioration JSC, local authorities	- Easy access to funds created for farmers	- Low interest of financial institutions - Insufficient State funds	State Funds, International Funds	$ 80,000
Information/capacity building									

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
3	Capacity building for waste water reclamation and reuse	High	- Increase capacities	0-10 years	MED, MENR, SWRA, Azersu JSC, Amelioration JSC, local authorities	- Increased capacity	- No major risk	State Funds, International Funds	$ 300,000
4	Develop and conduct information campaigns on the advantages of applied technology	High	- Raise awareness level	0-5 years	MED, MENR, SWRA, Azersu JSC, Amelioration JSC, local authorities	- Awareness level on advantages of new technology increase by 50%	- No major risk	State Funds, International Funds	$ 200,000
Other measures									
5	Develop mechanism for implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	MENR, SWRA, Azersu JSC, Amelioration JSC, local authorities	- Practical knowledge and skills of farmers increased	- Lack of funds	State Funds, International Funds	$ 400,000
Sector: Water ***Technology: Reducing water leakages in water management facilities***									
Policy/regulatory									
1	Provision of policies and legal frameworks that facilitate application of leakage management programs to either be created or aligned, in order to ensure efficient use of water resources	High	- Improve legislative base	3 years	National Parliament, MENR, SWRA, NGOs, local authorities	- Legal basis will be created to apply the technology	- State procedures may be slow to endorse proposed recommendations	State Funds	$ 100,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
Economic/financial									
2	Expanding financing opportunities and services for leakage management initiatives	High	- Need for financial support	2 years	MED, MOF, MENR, SWRA, NGOs, local authorities	- The budget ratio spent on the procurement of survey devices	- Insufficient State funds	State Funds	$ 250,000
3	Determining a long-term budget plan to cover maintenance	High	- Lack of financial support during maintenance	2 years	MED, MOF, MENR, SWRA, NGOs, local authorities	- Improved budget plan for maintenance	- Insufficient State funds	State Funds	$ 60,000
Technology									
4	Promoting devices and supporting locally-developed devices/research works	High	- Need for modern technologies	0-4 years	National Academy of Sciences, MENR, SWRA, NGOs, local authorities	- Improved capacity of R & D institutions	- No major risk	State Funds, International Funds	$ 100,000
5	Promoting research works in collaboration with foreign agencies/private companies in order to receive and transfer the technologies	High	- Need for modern technologies	0-4 years	National Academy of Sciences, MENR, SWRA, NGOs, local authorities	- Improved capacity of R & D institutions	- No major risk	State Funds, International Funds	$ 60,000
Information/capacity building									
6	Enhancing the performance of data administrative officers to ensure they can collect and prepare data according to the standard before distributing the data	High	- There is need for capacity improvement	3 years	MENR, SWRA, NGOs, local authorities	- The number of personnel capable of transferring knowledge on data collection and preparation	- No major risk	State Funds, International Funds	$ 200,000

#	Measures	Priority	Why it is important	Time scale	Related stakeholders, implementers	Key indicators	Risks	Funding sources	Costs
7	Strengthening capacity and supporting national and local institutions to improve effectiveness in regulating and managing water losses, including leakage detection and management	High	- There is need for capacity improvement	3 years	MENR, SWRA, NGOs, local authorities	- The number of trainings/meetings	- No major risk	State Funds, International Funds	$ 250,000
8	Improving the capability of utilities and potential users to understand and access leak management services	High	- There is need for capacity improvement	5 years	MENR, SWRA, NGOs, local authorities	- The number of personnel in the fields of mathematic programs/geo-informatics	- Weak collaboration of personnel	State Funds, International Funds	$ 150,000
Other measures									
9	Implementation of demonstrative pilot projects	High	- Demonstrate practical advantages	0-5 years	Local authorities, International and National donors, NGOs	- Practical knowledge and skills of farmers increased	- Lack of funds	State Funds, International Funds	$ 600,000

IV. Project ideas

Project proposals for application of prioritized adaptation and mitigation technologies have been selected as a result of stakeholder-driven consultation process. Main criteria during selection of most appropriate project ideas were implementation availability, compliance with sectoral development programs and sustainability of the action. Along with this, it was paid attention to avoid replication of project initiatives in the same sector. As a result of intensive stakeholder consultations the following project ideas have been selected for prioritized mitigation and adaptation technologies:

For mitigation:

1. Pilot project promoting use of solar energy for hot water at municipal and community level at floodplain and lowland areas of Azerbaijan

2. Pilot project promoting application of biogas technology in remote rural communities of Azerbaijan

3. Demonstrate effective practices of application of efficient stoves in remote rural communities of Azerbaijan

For adaptation:

1. Demonstration of effective adaptation practices in the agricultural sector in arid zones of Azerbaijan

2. Promotion of application of conservative cultivation technology in rural communities of Azerbaijan

3. Demonstration of effective application of rainwater collection from ground surfaces—small reservoirs and micro-catchments technology in rural communities of Azerbaijan

Summary of proposed project proposals for mitigation and adaptation technologies have been provided in below tables 10 and 11:

Table 10: Projects for mitigation technologies

#	Project name	Project goals and objectives	Project scope	Budget
Alternative energy sources sub-sector				
1	Promote use of solar energy for hot water at municipal and community level at floodplain and lowland areas of Azerbaijan	The proposed pilot project envisages the measures to effectively address the information, technical knowledge and capacity building barriers, and create linkages with financial institutions providing loans at suitable terms acceptable for local users. The project has great value as it addresses capacity/building, technical and financial barriers of technology deployment. Implementation of project activities will result in increase of awareness of local communities on economic and environmental advantages of technology deployment. The main project goal is to promote deployment of solar energy for hot water in local communities by increasing level of awareness, improving knowledge and skills of community residents, local authorities, private sectors, NGOs and other relevant stakeholders, in order to overcome capacity building/information barriers. Another goal is to create access to information on financial opportunities at current market and improve linkages of local communities with financial institutions, such as credit unions, banks, other relevant state and international funds. Main project objectives are listed below: - Increase awareness level of local communities, local authorities, private sector and other relevant stakeholders on advantages of solar energy; - Increase technical capacity of relevant stakeholders involved in technology application; - Promote application of solar energy at community level through practical demonstration of its advantages; - Increase access to financing (credits, loans, grants) at acceptable terms for technology deployment	Project beneficiaries are local communities situated in floodplain and lowland areas of Azerbaijan, as well as local authorities, private sector, NGOs and other relevant stakeholders. The current project will cover two pilot communities (totaling 500 households) and will have 500 direct project beneficiaries. It is intended to enhance replication of applied best practices in territories of the country with solar energy potential. As a result of the project, total reduction in GHG emission will be 189 thousand tons per year, taking into account that each household will use 2 kW/hour less energy from general electric power per day-- on average 300 days per year. The project will cover two local communities (totaling 500 households) situated in arid regions with high solar energy potential. All relevant stakeholders (state institutions, agencies, private sector, local authorities, NGOs, local communities) are interested in project implementation. In the past there were similar project initiatives, however they were at the individual level and lacked capacity building or financial components.	3.250.000 USD

#	Project name	Project goals and objectives	Project scope	Budget
2	Promote application of biogas technology in remote rural communities of Azerbaijan	The proposed pilot project envisages the measures to effectively address the information, technical knowledge and capacity building barriers, and create linkages with financial institutions providing loans at suitable terms acceptable for local users.. The main project goal is to promote application of biogas technology in rural communities by increasing level of awareness, improving knowledge and skills of community residents, local authorities, private sectors, NGOs and other relevant stakeholders. Another goal of the project is to promote local production of biogas technology The project will consist of three main components: ***Component I: Promote application of biogas technology at community level*** - Increase awareness level of local communities, local authorities, private sector and other relevant stakeholders on advantages of biogas technology; - Promote application of biogas technology at community level through practical demonstration of its advantages. ***Component II: Promote application of biogas technology at large livestock farms*** - Increase awareness level and demonstrate practical advantages of biogas technology. ***Component III: Support for private sector to promote local production of technology*** - Support private sector initiatives for launching local production of biogas technology; - Increase technical capacity of relevant stakeholders involved in technology application.	The project will cover five rural communities (totaling 500 households) situated in remote regions with less developed infrastructure (roads, gas/energy supply). All relevant stakeholders (state institutions, agencies, private sector, local authorities, NGOs, local communities) are interested in project implementation. In the past there were similar project initiatives, however they were at the individual level and lacked capacity building or financial components, and were therefore unsustainable. Project beneficiaries are local communities situated in mountainous areas of Azerbaijan, as well as local authorities, private sector, NGOs and other relevant stakeholders. The current project will cover five pilot communities (totaling 300 households), two large livestock farms and one private sector representative, and will have 320 direct project beneficiaries. It is intended to enhance replication of applied best practices in territories of the country, mainly focusing on remote mountainous regions. As a result of the project, total reduction in GHG emission will be 113 thousand tons per year, taking into account that each household will use 2 kW/hour less energy from general electric power per day-- 300 days on average per year. Additionally, local communities will apply less pressure to forest resources, which will lead to increase of CO_2 absorption.	2.200.000 USD

#	Project name	Project goals and objectives	Project scope	Budget
Commercial/residential sector				
3	Demonstrate effective practices of application of efficient stoves in remote rural communities of Azerbaijan	The main project goal is to promote application of efficient stoves in rural communities by increasing level of awareness, improving knowledge and skills of community residents, local authorities, private sectors, NGOs and other relevant stakeholders. Another goal of the project is to support local production of efficient stoves. The proposed pilot project envisages the measures to effectively address the information, technical knowledge, social and capacity building barriers, and create linkages with financial institutions providing loans at suitable terms acceptable for local users. By supporting local production market prices may decrease, enabling local residents to afford purchasing the technology. The project has a great potential for being replicated in other regions of the country, as its effective practice will be demonstrated by organizing study tours to the project area. Main project objectives are listed below: - Increase awareness level of local communities, local authorities, private sector and other relevant stakeholders on advantages of the technology; - Promote application of the technology at community level through practical demonstration of its advantages; - Support private sector initiatives to launch local production of efficient stoves; - Increase technical capacity of relevant stakeholders involved in technology application.	The project will cover two rural communities (totaling 200 households) situated in remote regions with less developed infrastructure (roads, gas/energy supply). All relevant stakeholders (state institutions, agencies, private sector, local authorities, NGOs, local communities) are interested in project implementation. In the past there were similar project initiatives, however they were at the individual level and lacked capacity building or financial components, and were therefore unsustainable. Project beneficiaries are local communities situated in remote rural areas of Azerbaijan, as well as local authorities, private sector, NGOs and other relevant stakeholders. The current project will cover three pilot communities (totaling 200 households), three private sector representatives, and will have 220 direct project beneficiaries. It is intended to enhance replication of applied best practices in territories of the country, mainly focusing on remote rural areas. As a result of project activities, total reduction in GHG emission will be 37.8 thousand tons per year, taking into account that each household will use 1 kW less energy from general electric power per day. Additionally, local communities will apply less pressure to forest resources, which will lead to increase of CO_2 absorption.	550.000 USD

Table 11: Projects for adaptation technologies

#	Project name	Project goals and objectives	Project scope	Budget
Agricultural sector				
1	Demonstration of effective adaptation practices in the agricultural sector in arid zones of Azerbaijan	The main goal of the project is to demonstrate effective practices of adaptation actions to local farmers, local authorities, private sector, NGOs and other relevant stakeholders, and increase their adaptive capacities. Another goal is to reduce vulnerability of local communities to climate change by increasing productivity and income level of local residents. The project will apply a complex approach by demonstrating effective practice of three adaptive technologies: 1) Introduction of new crop species resistant to climate change; 2) Application of water saving technologies (drip and sprinkler); 3) Application of windbreaks technology. The proposed pilot project envisages the measures to effectively address the information, technical knowledge and capacity building barriers, and create linkages with financial institutions providing loans at suitable terms acceptable for local farmers. The project also aims to improve technical capacity of R & D institutions in related fields. The project has a great potential for being replicated in other regions of the country, as its effective practice will be demonstrated by organizing study tours to the project area	The project will cover four rural communities (totaling 1000 households) situated in arid and semi-arid regions. All relevant stakeholders (State institutions, agencies, private sector, local authorities, NGOs, local communities) are interested in project implementation. In the past, there were similar project initiatives, however they were lacking in capacity building or financial components, and were therefore unsustainable.	950.000 $

#	Project name	Project goals and objectives	Project scope	Budget
2	Promote application of conservative cultivation technology in rural communities of Azerbaijan	The main goal of the proposed project is to demonstrate effective practices of conservative cultivation technology to local farmers, local authorities, private sector, NGOs and other relevant stakeholders, and increase their knowledge on advantages of the technology. Another goal is to increase access to necessary agricultural machinery for application of conservative cultivation technology, by providing advocacy activities with respective agencies and state bodies. Main project objectives could be listed as follows: • Increase awareness level of local communities, local authorities and other relevant stakeholders on forecasted climate change tendencies and environmental/economic advantages of applied technology; • Increase availability of necessary agricultural machinery for application of conservative cultivation technologies and feasibility study; • Demonstrate practical application of conservative cultivation technology; • Organize advocacy activities with respective agencies and bodies (Ministry of Agriculture, Agro-service Centers) in order to improve access to necessary agricultural machinery; • Organize effective outreach activities in order to achieve replication of applied technology in other communities and regions.	The project will cover three rural communities (totaling 800 households) situated in rural agricultural regions. All relevant stakeholders (State institutions, agencies, private sector, local authorities, NGOs, local communities) are interested in project implementation. In the past, there were similar project initiatives, however they were lacking in capacity building or advocacy components, and were therefore unsustainable.	900.000 $

#	Project name	Project goals and objectives	Project scope	Budget
Water sector				
3	Demonstration of effective application of rainwater collection from ground surfaces—small reservoirs and micro-catchments technology in rural communities of Azerbaijan	The main goal of the project is to demonstrate effective practice of the application of rainwater collection from ground surfaces—small reservoirs and micro-catchments technology in rural communities. This can be done by demonstrating practical advantages and by increasing level of awareness, improving knowledge and skills of community residents, local authorities, private sector, NGOs and other relevant stakeholders. Main project objectives could be listed as follows: • Increase awareness level of local communities, local authorities, private sector and other relevant stakeholders on advantages of the technology; • Promote application of the technology at community level through practical demonstration of its advantages; • Increase technical capacity of relevant stakeholders involved in technology application.	The project will cover two rural communities (totaling 600 households) situated in arid zones. All relevant stakeholders (State institutions, agencies, private sector, local authorities, NGOs, local communities) are interested in project implementation. In the past there were no similar project initiatives in the arid regions of Azerbaijan.	900.000 $

V. Prospects for deployment of prioritized technologies

The identification and prioritization of climate change adaptation technologies, as well as assessing the barriers for technology deployment and developing measures for overcoming those barriers, are important steps for Azerbaijan in developing its low carbon and climate-resilient strategy.

It is obvious that the TNA/TAP reports will contribute to the development of a climate-resilient strategy in the country and make an important contribution to the implementation of the country's sustainable development strategies and serve as a roadmap for country in fulfilling its obligations under UNFCCC.

In short perspective, deployment of prioritized technologies will lead to decrease of environmental pollution, especially air pollution and it will contribute to integrity of ecosystem and improvement of health condition of population. Along with this, application of technologies will decrease dependency of economy on oil-gas resources, provide suitable conditions for the development of non-oil sector and subsequently stimulate sustainable development. Similarly, application and widely use of new technologies by private sector will reduce dependency of the sector on traditional energy resources, strengthen its independency and lead to the development of the sector.

Regards prioritized technologies in alternative energy sources (solar, wind, small hydropower), deployment of prioritized technologies will lead to rational and efficient use of natural resources and ensure maintaining those resources for future generations. Last speech of President of Azerbaijan Republic, his Excellency Mr. Ilham Aliyev, at the conference held on 12 February 2012 dedicated to the results of the 'State Program on Socio-economic Development of the Regions 2009-2013' creates clear picture for future perspectives for deployment of prioritized technologies under alternative energy sources sector. It his last speech, President of Azerbaijan Republic stated that: "It is already launched works towards creation of renewable energy sources. I hope, initiatives in this direction will be very perspective. Notwithstanding that we have rich gas, oil reserves and Azerbaijan will not have any problems with internal energy sources for other 100 year, I consider that it is important creation of renewable energy sources and enhance its application. For of all it will create additional financial sources for us. On the other hand, I consider that development of new and application of renewable technologies, creation of "green energy" will be our contribution to the solving global ecological problems in the world".

It should be mentioned that, stakeholder-driven consultation process applied during TNA/TAP process enabled participation of all relevant stakeholders involved in sectoral development in the process of prioritization of adaptation and mitigation technologies, assessing barriers, identification of necessary measures and actions to overcome identified barriers, as well in proposing project ideas to promote and initiate application of prioritized technologies. Such active participation of respective governmental institutions in TNA/TAP development process ensures that the identified actions will be considered by respective institutions during development of sectoral plans and programmes.

Annex 1: TNA Committee Endorsement

Minutes of TNA Committee meeting

25 June 2012, Baku city

Chairman: F. Aliyev

Secretary: E. Garabagly

Participants: 11 members

On 25 June 2012, TNA Committee meeting was held at the Oarhus Center in Baku city. The following issues were on the Agenda:

1) Endorsement of prioritized technologies under adaptation/mitigation reports

2) Finalization of TNA preparation phase and shifting to Barriers Analysis and TAP preparation phase

The Chairman has opened the meeting and provided information on the current status of TNA report preparation. He noted that the TNA process was implemented in close cooperation with relevant stakeholders representing different sectors. As a result of comprehensive analysis provided under the assessment process of involved adaptation and mitigation experts and intensive discussions with respective stakeholders, final prioritization has been provided applying MCDA approach. Subsequently, the following sectors and technologies have been prioritized for adaptation and mitigation:

For mitigation:

For alternative energy sources sector:

- Grid-connected wind power
- Passive solar energy (hot water) and solar photovoltaic (electricity)
- Small hydro-powers on mountain rivers

For commercial and residential sector:

- Heating pumps
- High efficiency lighting systems
- Biogas for heating/cooking and efficient stoves

For Adaptation:

Water sector:

- Rainwater Collection from Ground Surfaces—Small Reservoirs and Micro-catchments
- Flood warning
- Water reclamation and reuse
- Reducing water leakages in water management facilities

Agricultural sector:

- Optimizing of location and structure of agricultural lands with introduction of crop species resistant to expected climate changes
- Enhance the application of windbreaks
- Application of water saving technologies, such as drip or spray irrigation, at irrigated lands
- Application of conservative cultivation technologies

Then, intensive discussions were held between TNA Committee members on prioritized technologies, and adaptation/mitigation experts have clarified all unclear points related to applied approach and methodology. As a result of productive discussions, TNA Committee members have come to the following decision by common consent:

1) TNA Committee endorses prioritized technologies in adaptation/mitigation reports

2) TNA Committee entrusts adaptation/mitigation experts to finalize TNA preparation phase and launch Barriers Analysis and TAP preparation phase

Annex 2: Experts and stakeholders involved to TNA/TAP process

Emin Garabagly	Ministry of Ecology and Natural Resources, Head of International Department
Issa Aliyev	UNFCCC National Focal Point
Feyzulla Muradov	Ministry of Industry and Energy
Cemil Isayev	Ministry of Agriculture, Head of Department of livestock production and processing, pedigree and pasture
Anar Mehtiyev	Climate Change and Ozone Center under Ministry of Ecology and Natural Resources
Seymur Safarly	National Academy of Sciences, Director of Erosion Institute
Ogtay Cafarov	Ministry of Ecology and Natural Resources, UNCCD National Focal Point
Gasham Yagubov	State Land and Cartography Committee, Head of Division at the Scientific Research Institute on Soil Science
Arzuman Bayramov	“Azersu” State agency
Abdulxalig Heydarov	Azenerji Open Joint-Stock Company
Teymur Osmanov	Amelioration and Water Farms Open Stock Company
Meherrem Mehtiyev	SOCAR
Nadir Gadirov	Ministry of Agriculture, Shamakhi Regional Agricultural Office
Shamil Movsumov	Independent consultant
Gulmali Suleymanov	Independent consultant
Rafig Verdiyev	Independent consultant
Bariz Mehdiyev	Independent consultant
Muslum Gurbanov	Ecoyl NGO
Islam Mustafayev	Ruzgar NGO