THE REPUBLIC OF AZERBAIJAN

THE MINISTRY OF ECOLOGY AND NATURAL RESOURCES

Report on Barrier Analysis and Enabling Framework

FOR MITIGATION TECHNOLOGIES

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Supported by

TABLE OF CONTENTS

List of Tables

List of Figures

LIST OF ABBREVIATIONS

GEF	Global Environmental Facility
GCF	Green Climate Fund
HPS	Hydro-Power Stations
MEC	Ministry of Emergency Cases
MED	Ministry of Economic Development
MENR	Ministry of Ecology and Natural Resources
MIE	Ministry of Industry and Energy
MoE	Ministry of Education
NGO	Non-governmental Organization
RE	Renewable Energy
SCARES	State Company on Alternative and Renewable Energy Sources
TAP	Technological Action Plan
TNA	Technological Needs Assessment
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
WB	World Bank
WP	Work Plan
SFSE	State Fund for Support to Entrepreneurship under MED
SHP	Small Hydro-Power
SOCAR	State Oil Company of Azerbaijan Republic

EXECUTIVE SUMMARY

This report is the next phase of the TNA/TAP project in Azerbaijan and aims to outline the analysis of existing barriers and enabling framework for prioritized technologies in alternative energy sources and commercial/residential sub-sectors.

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). 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 have been identified in six categories:

i) economic/financial barriers;
ii) policy/regulatory barriers;
iii) technology barriers;
iv) capacity building barriers;
v) social barriers;
vi) 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 and enabling measures for prioritized technologies under alternative energy sources sub-sector could be summarized as follows:

Barriers	Measures
Grid-connected wind power	
- Unfavorable tariff mechanisms - Non-existence of tax concession mechanism to attract private investments	- Relevant economic regulations in order to promote investments for the sector - Regulation of tariff system
- High cost of investment and infrastructure	- Develop subsidy mechanism to promote private sector initiatives
- Weak access to acceptable financial means	- Enable provision of long-term and low-interest loans or grants through state funds (for instance, State Fund for Support to Entrepreneurship, SOCAR), private sources (different Banks) and international funds (GEF, GCF)
- Weak regulations on consumer use of wind energy	- Necessary regulatory actions in order to create a

sources - Non-existence of wind atlas	mechanism for consumer use of grid-connected wind power - Support development of wind atlas
- Non-compliance of standards and certification procedures - Weak capacity of technology application - Weak capacity of R & D institutions	- Develop standards and certification process - Capacity building for research institutions - Strengthen international research network programmes - Specific capacity building activities (trainings) for private sector, local authorities and local communities - Increase fiscal support to R & D institutions in order to improve technical capacity
- Low level of awareness of economic and ecological advantages	- Information campaigns on the advantages of applied technology
- Unfamiliarity with new technology	- Organize study tours to Gobustan Demonstration Station by involving representatives of local authorities, local communities and private sector - Implement pilot projects at community (municipal) level
Passive solar energy and photovoltaic	
- High cost of investment and infrastructure - Long payback period - Weak access to acceptable financial means	- Develop subsidy mechanism to promote private sector initiatives - Enable provision of long-term and low-interest loans or grants through state funds (for instance, State Fund for Support to Entrepreneurship, SOCAR), private sources (different Banks) and international funds (GEF, GCF)
- Non-compliance of standards and certification procedures - Weak capacity of technology application - Weak capacity of R & D institutions - Inadequate working skills of technical service providers	- Develop standards and certification process - Specific capacity building activities (trainings) for students, private sector, local authorities and local communities - Increase fiscal support to R & D institutions in order to improve technical capacity
- Weak regulations on consumer use of solar energy	- Develop regulations on tariff system and consumer use of solar energy sources
- Low level of awareness of economic and ecological advantages	- Information campaigns on the advantages of applied technology - Implement pilot projects at community (municipal) level
- Unfamiliarity with new technology	- Organize study tours to Gobustan Demonstration Station by involving representatives of local authorities, local communities, private sector and NGOs
Small hydro-powers at mountain rivers	
- Insufficient state investment to the sector	- Necessary state funds must be assigned for enhancement of research/observation activities to identify the potential of mountain rivers and prepare electronic atlas - Additional state funds must be assigned for constructing new Hydro-Power Stations
- Difficult permission mechanisms	- Simplify permission mechanisms
- Out-dated technology - Weak research activities due to insufficient equipment - Low capacity of research institutions	- Improve capacity and skills of respective governmental bodies responsible for research/observation - Strengthen technical capacity of respective institutions responsible for research/observation activities
- Poor environmental impact assessments	- Conduct detailed environmental impact assessment for all possible small hydro-power construction points

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

Barriers	**Measures**
High efficiency lighting systems	
- Lack of financial means	- Enable provision of long-term and low-interest loans or grants through state funds (for instance, State Fund for Support to Entrepreneurship), private sources and international funds (GEF, GCF)
- Weak regulatory and legislative framework	- Improve legislative and regulatory reforms to stimulate application and local production of the technology
- Lack of coordination among relevant institutions	- Restructuring institutional basis for better coordination
- No subsidy mechanism	- Develop specific subsidy mechanism for private sector to promote local production
- Weak technical capacity of R & D institutions and technical experts	- Capacity building for R & D institutions and technical experts
- Standards and certification procedures are not in place	- Develop standards and certification procedures
- Lack of capacity and awareness level of local authorities, communal units and residents on advantages of the technology	- Capacity building for local authorities, communal units and residents - Information campaigns on the advantages of applied technology - Implementation of pilot projects at municipal or community level to demonstrate the advantages of the technology
- No organized waste management of used bulbs	- Develop mechanism for waste management of used bulbs
Heating pumps	
- Insufficient public investments	- State investments for the application of technology at public facilities
- Weak access to financial means	- Enable provision of long-term and low-interest loans or grants through state funds (for instance, State Fund for Support to Entrepreneurship), private sources and international funds (GEF, GCF)
- Weak regulatory and legislative framework	- Necessary regulatory actions in the field of tax or customs regulations
- Weak technical capacity of R & D institutions	- Specific technical capacity building activities for R & D institutions and technical experts - Strengthen international research network programmes in order to learn from best international practices
- Lack of capacity and awareness level of local authorities, communal units and residents on advantages of the technology - Weak access to information on technology advantages	- Information campaigns on the advantages of applied technology - Implement pilot projects at municipal level

Biogas for heating/cooking and efficient stoves	
- Weak access to financial means	- Develop suitable credit mechanism to create access to financial means for rural population - Enable provision of long-term and low-interest loans or grants through state funds (for instance, State Fund for Support to Entrepreneurship), private sources and international funds (GEF, GCF)
- Weak regulatory and legislative framework	- Necessary regulations (customs and taxes) in order to stimulate local production of the technology
- Weak technical capacity	- Specific technical capacity building activities for R & D institutions and technical experts
- Lack of capacity and awareness level of local authorities and rural population on advantages of the technology	- Information campaigns on the advantages of applied technology
- Local traditions (unfamiliarity with new technology)	- Implement pilot projects at municipal and community level

The government of Azerbaijan has established a strategy for the development of renewable energy sources. Despite the clear strategy and plan for development of alternative energy sources sub-sector, specific measures are necessary in order to overcome existing barriers to the implementation of priority technologies.

Understanding the importance of the emerging tendency of GHG emissons increase from the commercial and residential sector, the government of Azerbaijan has started implementing initiatives for application of new technologies in this sub-sector. For instance, the government has begun promoting energy efficient lighting. Currently, the National Standard and Patent Agency within MED is preparing mandatory labels for light bulbs. Notwithstanding the undertaken measures, specific measures are necessary in order to overcome barriers to the application of prioritized technologies in the commercial and residential sub-sector.

Chapter 1. Alternative energy sources sub-sector

1.1. Preliminary targets for technology transfer and diffusion

Azerbaijan has rich oil and gas resources, enabling sufficient and affordable energy supply for the public and private sector. Notwithstanding that fact, the country has developed a 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). The objective of the State Program is to promote power generation from renewable and environmentally sound sources and to utilize hydrocarbon energy sources more efficiently. Major tasks of the State Program include:

- Define the potential of alternative (renewable) energy sources for electric power generation *(the technical aspects of this are largely completed)*;
- Raise the efficiency of utilization of the country's 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 at the expense of alternative energy sources and, therefore, achieve the country's energy security.

According to the program, Azerbaijan has set a target to have 20% share of renewable energy in electricity and 9.7% share of RE in total energy consumption by 2020 (MIE, 2009).

It should be mentioned that in spite of the fact that the government has identified a clear strategy for application of renewable energy sources, the use of renewable energy is not yet at a sufficient level. In this regard, at the meeting on socio-economic development results of 2010, the President of Azerbaijan noted: *"Additional measures should be taken for the development of renewable energy sources. We still do not have own wind and solar devices. I think we could do more during one year period..."*

Preliminary targets for prioritized technologies under alternative energy sources sub-sector are provided below.

For grid-connected wind power:

Rough estimates show that as a result of the application of grid-connected wind power technology, for the year 2030, the amount of fuel economy will be around 2 mln tons of conditions fuel and total GHG emission reduction will be around 3.96 mln tons of CO_2.

For solar energy (hot water) and solar photovoltaic (electricity):

Rough estimates show that the application of passive solar energy (hot water) and solar photovoltaic (electricity) technology will allow savings of 0.13 million of CFT of fuel and the reduction of 417 thousand tons of CO_2 emissions by 2030.

For small hydro-power stations:

Rough estimates show that as a result of the application of small hydro-power stations technology, for the year 2030, total GHG emission reduction will be 3.24 million tons of CO_2.

The government has identified initial targets for application of alternative energy sources within the State Program on Utilization of Alternative Energy Sources (2005 – 2013). For wind energy, the target is to generate up to 100 MW of energy by 2015. The roadmap of wind energy development is provided in table 1.

Table 1: Roadmap of wind energy development for 2012-2015

Years	2012	2013	2014	2015
Power MW	14.3	50	75	100

For solar energy, the target is to generate up to 10 MW of energy from solar heat stations and 105 MW from solar electric stations by 2015. The roadmap of solar energy development is provided in table 2.

Table 2: Roadmap of solar energy development for 2012-2015

Years	2012	2013	2014	2015
Solar electric station (MW)	10	80	100	105
Solar heat station (MW)	4	5	9	10

Regarding small hydro-power stations, results of provided assessments show that there is a potential for construction of 280 small hydro-power stations at mountain rivers and various water sources. Total power of those stations is estimated to be 700 MW. Construction of 25 small hydro-power stations is planned by 2013, 10 of which are already under construction.

The government also has a list of planned projects to be implemented by 2015. Tables 3 and 4 provide the lists of planned wind and solar energy projects.

Table 3: List of planned wind energy projects (2012-2015)

Project name	**Annual electricity production, mln kwh**	**Areas, region**	**Executive bodies, sources of finance**
Gobustan Wind Power Plant	17.5	Gobustan	SCARES, state investment
Samux Agro-Energy Complex	17.5	Samux	SCARES, state-private
Pirakushkul (South) Wind Park	280	Pirakushkul settlement	State investments and KfW German finance
Xizi (Shurabad) Wind Power Plant	168	Xizi (Shurabad)	Private “Caspian technology” Company
YeniYashma Wind Power Plant	87.5	YeniYashma	“XazarMenecment System” LC, private
YeniYashma Wind Power Plant	12.6	YeniYashma	“Trans TS” LC, private
Wind Power Plant, Mushfig settlement	28	Mushfig settlement	“Alten Group” LC, private
“Qobustanqorugu” Wind Power Plant	175	“Qobustanqorugu” – Alat highway	SCARES, state budget
Other projects	51.45		
Total	**837.55**		

Table 4: List of planned solar energy projects (2012-2015)

Project name	Annual electricity production, mln kwh	Areas	Executive bodies, sources of finance
Gobustan Solar Electric Station	2055	Gobustan	SCARES, state-private investments
Samukh Agro-Energy Complex	12.5	Samukh	SCARES, state-private investments
Pirakushkul (South) Wind Park	62.5	Pirakushkul settlement (South)	State investments and KfW Bank of Germany
10000 houses - 10000 electric stations	125	Throughout the country	SCARES, state-private investments
Development of lighting systems for residential buildings based on Solar PV model	75	Throughout the country	SCARES, state-private investments
Application of Solar PV models for lighting of highways	150	Throughout the country	SCARES, state-private investments
Utilization of Solar PV models, mini wind turbines for lighting of parks	87.5	Throughout the country	SCARES, state-private investments
Implementation of projects utilizing Solar PV models for lighting of stadiums	150	Throughout the country	SCARES, state-private investments
Other projects	72.5		

Main stakeholders related to alternative energy sources in Azerbaijan are The Ministry of Industry and Energy, The State Company on Alternative Energy sources, The State Oil Company and private companies such as “Caspian Technology” Private Company, “Khazar Management System” Ltd, “Trans TS” Ltd and “Alten Group” Ltd.

1.2. Barrier analysis and possible enabling measures for grid-connected wind power technology

1.2.1 General description of the technology

Wind power is a more preferable energy source than solar, hydro, geothermal and biomass due to its cost, environmental soundness and unlimited availability. The conversion of the kinetic energy from winds into electrical power is known as wind energy.

There are a number of ways in which this conversion can be done; however after a period of experimentation and development beginning primarily in the 1970s, one design has come to dominate the market. A large wind turbine primarily consists of a main supporting tower upon which sits a nacelle (the structure containing the mechanical to electrical conversion equipment). Extending from the nacelle is the large rotor (three blades attached to a central hub) that acts to turn a main shaft, which in turn drives a gearbox and subsequently an electrical generator.

The renewable nature of wind energy, the large available resource, and the relatively advanced nature of the technology mean that it has the potential to make a significant contribution to climate change mitigation efforts.

Main advantages of the technology could be listed as follows:

- The technology can be used in regions located far from the industrial centers;
- The technology can be used to supply electricity to individual households or used with combined regime with electricity grid;
- The technology can reduce grid electricity consumption and decrease use of organic fuels, thereby minimizing environmental effects due to emission reductions to soil, water and atmosphere air (CO_2, SO_2, NO_x etc.);
- Categorized as programmatic Clean Development Mechanism;

- Reduces poverty by creating employment opportunities;
- Technology is zero emission.

Some disadvantages of the technology are listed as follows:

- Relatively high cost of equipment;
- There is need for financial support;
- Weak development of the national industry for production of wind techniques;
- Weak public awareness on wind energy advantages;
- As there are some negative effects related to electromagnetic and phonic pollution, there may be disruption to planted lands and landscape change;
- Requires environmentally sound location.

Application of grid-connected wind power technology lines with the country's social, economic and environmental development priorities. With regard to the country's social development priorities, application of the above-mentioned technology will create new employment opportunities. Typically a capacity of 1 kW of wind energy creates work for 15-19 persons. The growth of wind energy will contribute to state energy security consolidation and will also have a positive influence on public opinion, which would realize the necessity to protect the environment and reduce consumption of energy resources. Regarding the country's economic development priorities, the technology will reduce energy production costs. Moreover, development of the national wind energy industry will decrease the initial capital investment. With regard to the country's environmental development priorities, the application of wind energy has zero emission of CO_2 and will lead to decrease of SO_2 and NO_x emissions, which have a negative impact on woods, crops, generally on vegetation and particularly on the endangered species.

Tariff-price of wind electricity in Azerbaijan is 0.045 AZN or 0.055 USD per kW (decision of tariff council 06.10.2007 No.3). Wind energy equipment and its parts are free from customs fees of the import process on the basis of decisions of the Cabinet of Ministers from 31.01.2005 No.11 and 15.10.2005 No.187.

Taking into account that there is the potential to produce 800 MW of wind energy in Azerbaijan, total capital costs for application of grid-connected wind power technology will be around 1,097,000,000 Euro, according to rough estimates. Cost of GHG reduction will be 0.105 USD per kg (CO_2).

Permits on alternative energy actions are carried out by the Ministry of Industry and Energy on the basis of recommendations of the State Company on alternative energy sources of Azerbaijan. The educational testing polygon project was implemented by the State Company on alternative energy, and includes 2.7 MW wind power plant and grid connection.

1.2.2 Identification of barriers

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 sub-sector.

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). 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 have been identified in five categories:

i) economic/financial barriers;

ii) policy/regulatory barriers;

iii) technology barriers;

iv) information/capacity building barriers;

v) social barriers.

In order to enable stakeholders to approach and delimit a problem area, the Logical Problem Analysis (LPA) tool was applied as an analysis technique. LPA tools help to create systematic and logical analysis of problems and to bring together all elements of the problem.

1.2.2.1 Economic and financial barriers

In spite of the fact that the country's economy is in the development stage, the government has established a strategy for the development of alternative energy sources taking into account its environmental, economic and social advantages. However, at the present time the market for grid-connected wind power technology is not economically viable for technology producers/importers, as electricity consumers are accustomed to the use of cheap energy.

The current tariff policy does not create a favorable economic environment, which leads to a decrease in the interest level of private sectors investing in the technology. Current tariff rates of grid-connected wind power are low, around 0.06 USD, and are not attractive to private sectors. There are many reasons for low tariff rates: the economy is still in transition phase, GDP per capita and average salary levels are not high, there about 1 million internally displaced persons living under difficult conditions who are in need of social and economic support from the government, due to the occupation of 20% of the territory. Macroeconomic indicators of the country are improving year-by-year, however at the present time increase of tariff rates is not an expedient step.

High cost of investment and infrastructure is another barrier to the development of the sector. This leads to low interest and lack of initiatives from the private sector. Not having access to low-interest and long-term financial means (loans, credits), the private sector is unable to provide sufficient investment for the development of the technology. Current interest rates in the financial market are high and the private sector does not have access to suitable financial means at local and international market.

Presently, all technology related to wind power is imported into the country, as there is no local production of the technology. This leads to high prices and high investment costs, which impede large private sector investments in the sector.

Capacity of local R & D institutions dealing with wind energy research and investigation activities is low and does not meet up-to-date requirements. This is mainly due to the lack of public financing and insufficient fiscal support to R & D institutions. As a result, technical capacities of R & D institutions are underdeveloped. Consequently, private sectors are obliged to apply to international R & D institutions providing relevant services, which are relatively expensive.

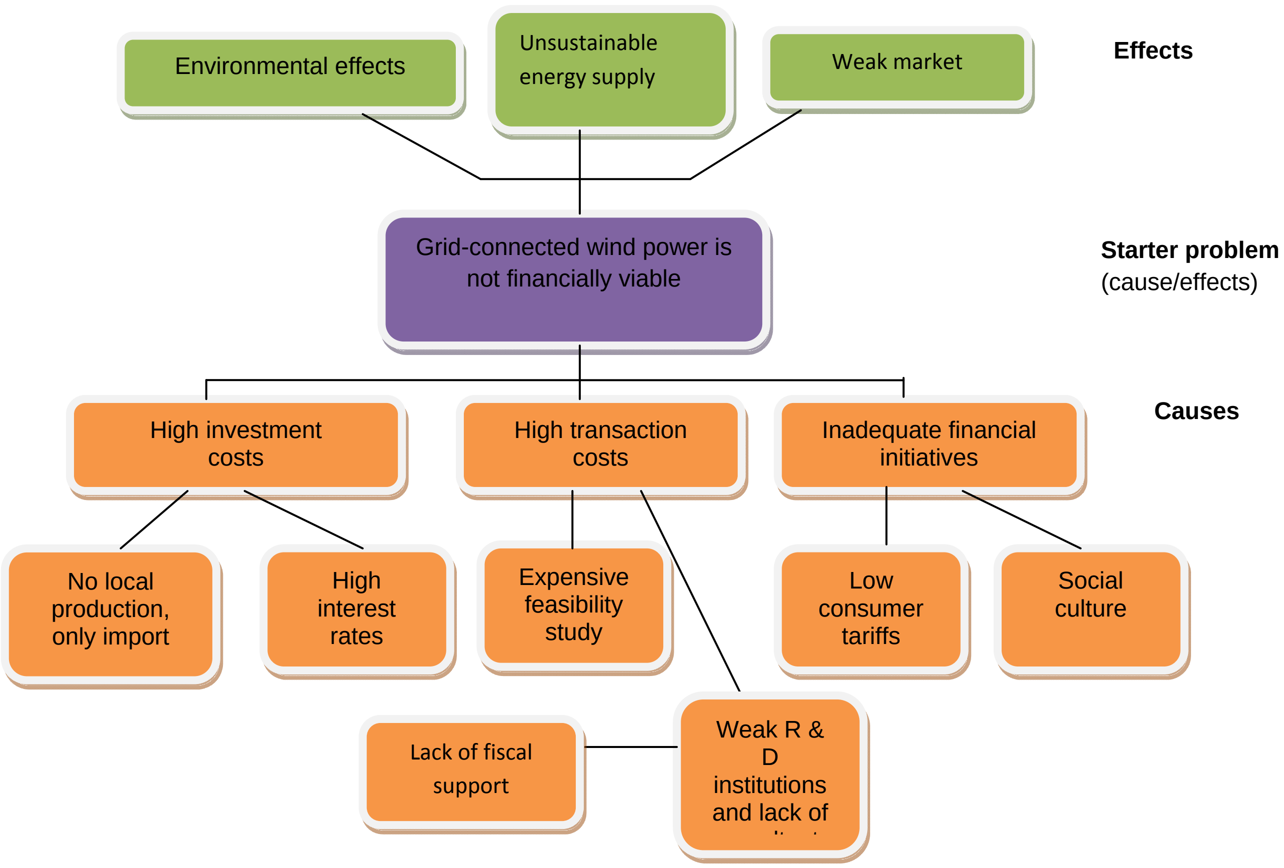

Figure 1: LPA diagram for economic/financial barriers of grid-connected wind power technology

Based on the results of market mapping analysis (figure 25) it could be assumed that the number of market players in the current grid-connected wind power technology market is low, as existing market opportunities do not provide suitable conditions for involvement of other key players (input suppliers, business service and technical service providers) to the market chain. Along with this, business-extension services (research development, financial services, market information, input suppliers and so on) are very weak and almost non-functional in the market chain. Enabling environment also does not provide suitable opportunities for development of local market for technology diffusion.

1.2.2.2 Non-financial barriers

Non-financial barriers to deployment of grid-connected wind power are analyzed in four categories: policy/regulatory barriers, technology barriers, information/capacity building barriers and social barriers.

Policy/regulatory barriers:

The country has strict policy and clear strategy regarding the development of renewable energy sources, including wind energy. Notwithstanding that, regulatory actions from the government are necessary in order to support the development of the sector--including regulations on consumption of wind energy sources. Currently, there is no mechanism for the application of grid-connected wind energy.

Policy/regulatory barriers also include regulations on tax discounts or exemptions for local producers, in order to promote investments in this sector. Tax exemptions will make the sector more attractive for private sector and lead to increase of investments in sector development. Lack of coordination and information between relevant institutions and agencies is another barrier.

Technology barriers:

Although there is an initiative for production of wind energy devices in the country and investments provided for construction of new plants, presently the technology is imported.

An up-to-date wind atlas for exact identification of wind potential has not been developed. There are unsuitable conditions for research institutions to provide necessary research in this field.

Non-compliance of standards and certification is another important barrier to technology deployment. Standards for wind power devices have not yet been identified and the certification mechanism is not in place.

Lack of qualified specialists in this field is also an important barrier.

Capacity building/information barriers:

One of the important barriers to the implementation of the technology is weak capacity and lack of information for consumers on use and advantages of the technology. The same could be said for local authorities, state and private organizations.

Weak access to information on current opportunities in the wind energy sector, as well as on advantages of technology application could be mentioned as another barrier.

Social barriers:

Unfamiliarity with new technology could be mentioned as a social barrier to application of the technology. Local populations are accustomed to traditional electricity supply and, for the most part, are not interested in replacements, as current costs of energy are fairly low.

Low level of awareness on the negative impact of climate change and advantages of application of renewable energy sources, such as wind energy, leads to formation of such social habits.

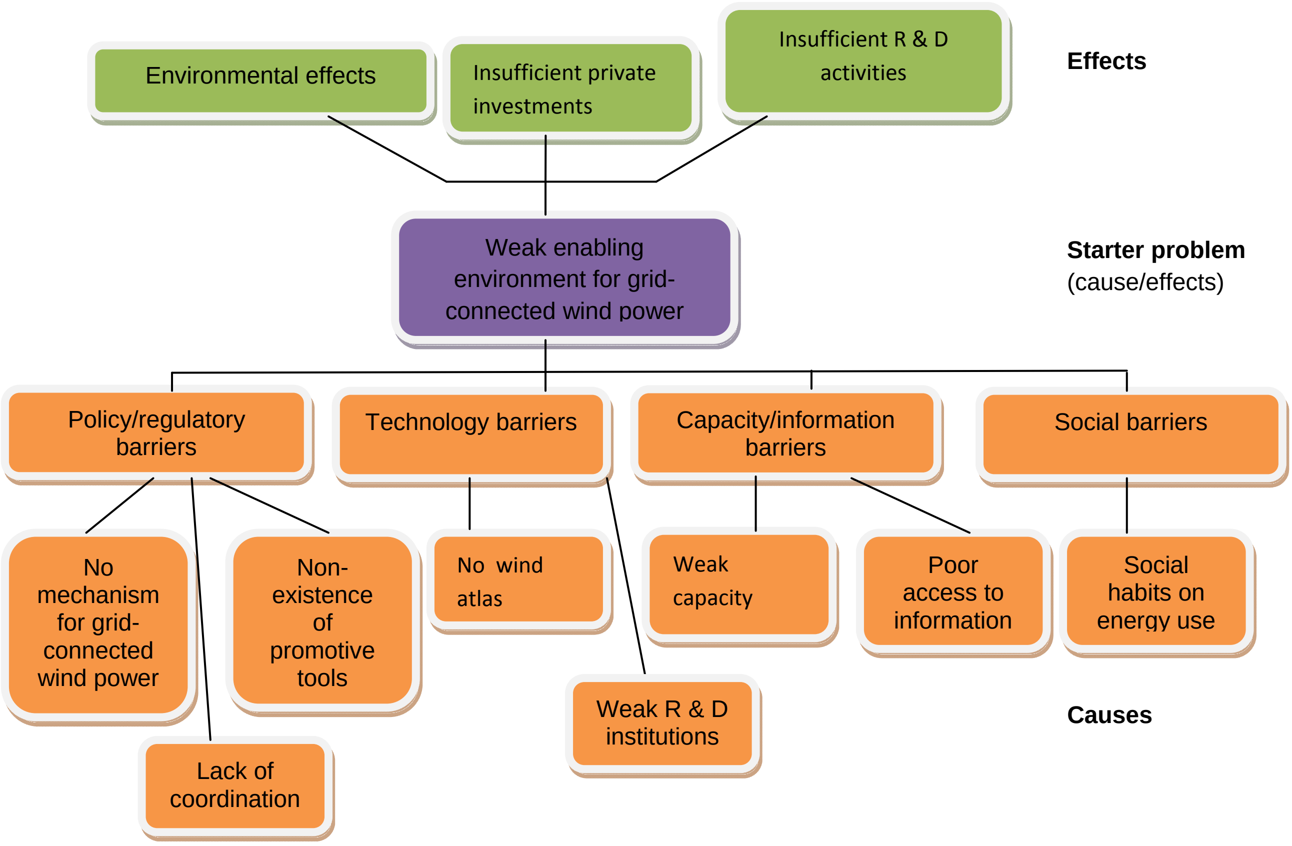

Figure 2: LPA for non-financial barriers of grid-connected wind power technology

1.2.3 Identified measures

Identifying relevant measures is the process of analyzing necessary actions to be taken in order to overcome current barriers to the implementation of prioritized technologies. These measures should have sustained the diffusion.

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. Current measures for development of wind energy were also taken into account during the process. For instance, actions on wind energy sources identified in the draft versions of "Middle term action plan for alternative energy sources application for the period 2013-2015" include measures such as development of wind cadastre in Azerbaijan, implementation of projects on wind power plants throughout the country and construction of wind energy observation stations.

1.2.3.1 Economic and financial measures

In order to overcome existing economic and financial barriers to the implementation of grid-connected wind power technology, the following measures should be provided:

- Current market in wind energy systems should be supported and production/import of technology and other necessary equipment should be promoted by the government through different subsidy mechanisms (such as tax discounts/exemptions). Promoting local production of technology will lead to decrease in technology prices and investment costs;
- Technology is not cost-effective at current tariff rates. Relevant economic regulations, such as regulations of tariff system, should be provided in order to promote investments in the sector. Market oriented tariff systems will make the sector attractive for private sector investors;
- Government should support the investors in this field by providing long-term and low-interest loans through different state funds (for instance, State Fund for Support to Entrepreneurship functioning within the Ministry of Economic Development, SOCAR), private sources (different Banks) and international funds (GEF, GCF). Having access to affordable financial means, the private sector will be able to provide large and long-term investments to the sector.

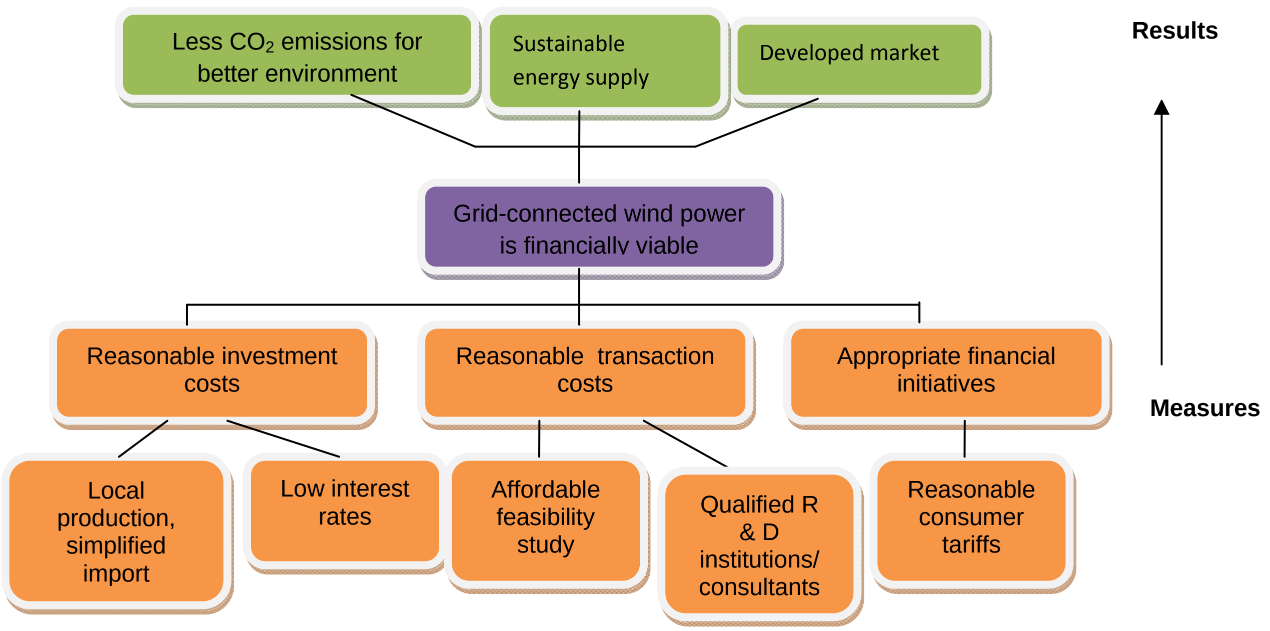

Figure 3: LPA for economic/financial measures for grid-connected wind energy

1.2.3.2 Non-financial measures

In order to overcome existing non-financial barriers to the implementation of grid-connected wind power technology, the following measures should be provided:

- Necessary regulatory actions must be provided by the government in order to create a mechanism for consumer use of grid-connected wind power, including tariff regulations;
- Capacity building for research institutions by involvement in different trainings or study tours with the support of government and other international funds in order to improve their skills and capacities;
- Strengthen international research network programmes in order to learn from best international practices;
- Wind atlas should be prepared in order to identify exact wind energy potential of the country;
- Information campaigns on the advantages of applied technology must be organized and funded in order to increase capacity of consumers (local residents, local authorities and private sector), by involving NGO sector in the process;
- Organize specific capacity building activities for private sector representatives and local communities in order to increase capacities and awareness level on advantages of renewable energy sources;
- Organize study tours to Gobustan Demonstration Station by involving representatives of local authorities, local communities, private sector and NGOs, in order to increase awareness level and demonstrate practical application of the technology.

These measures will result in increase of private sector initiatives in the wind energy sector. Moreover, consumers, local communities, municipalities, and private sector will start widely applying the technology.

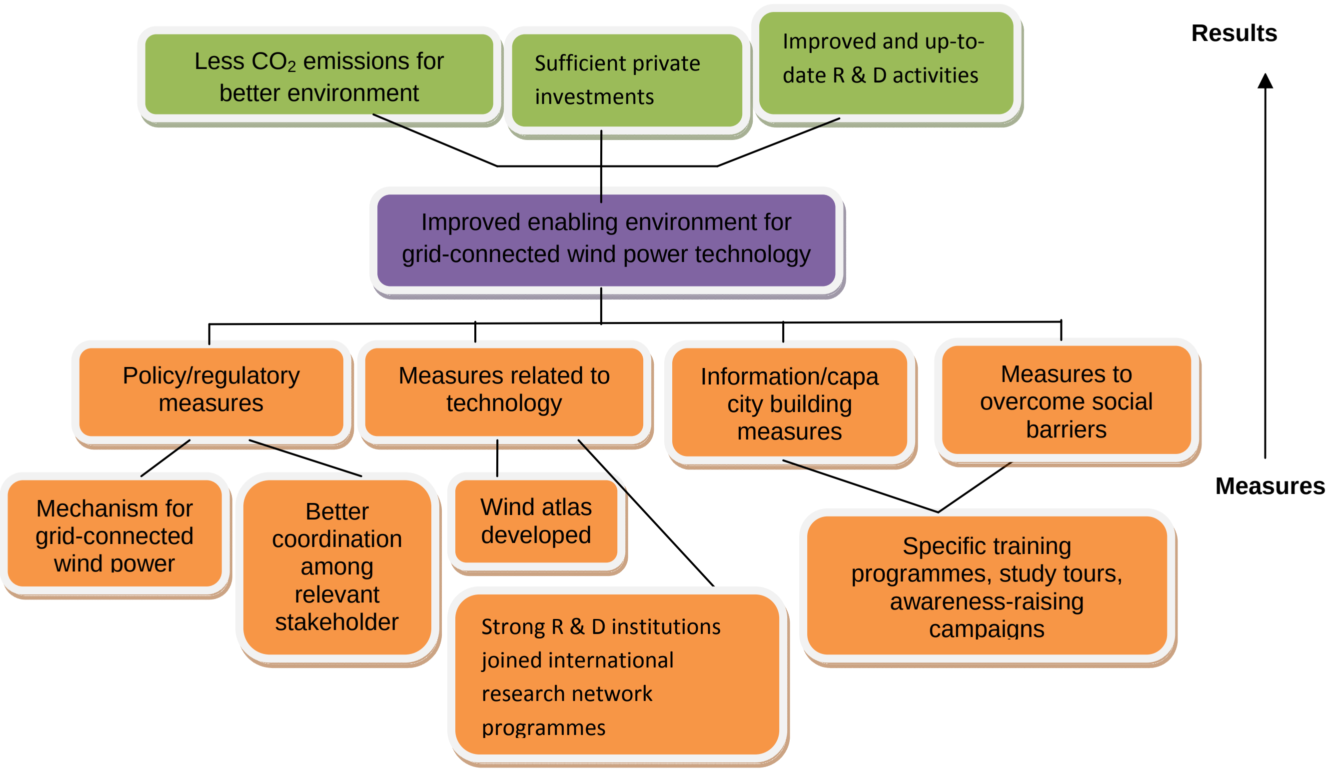

Figure 4: LPA for non-financial measures for grid-connected wind energy

1.3. Barrier analysis and possible enabling measures for passive solar energy (hot water) and solar photovoltaic (electricity) technology

1.3.1 General description of the technology

A solar heating system can capture the sun's radiation and use it for both water heating and supplement home heating by piping hot water through traditional or modern radiators, furnaces, or in hydronic systems for in-floor radiant heat. Solar Home Heating uses the solar collectors to capture the sun's energy, which is then transferred to a storage tank or concrete pad (in-floor heating).

Passive solar space heating takes advantage of warmth from the sun through design features, such as large south-facing windows, and materials in the floors or walls that absorb warmth during the day and release it at night when it is needed most. While industrial applications of the technology are low at the moment, several forms of solar thermal systems can be applied for domestic use. This system can be installed on the roof of a house with solar collectors that can either be flat plates, or evacuated tubes (efficiencies of 30% and 40%, respectively) that are joined to a storage tank for the hot water.

Solar photovoltaic, or simply photovoltaic (SPV or PV), refers to the technology of using solar cells to convert solar radiation directly into electricity. A solar cell works based on the photovoltaic effect.

There is an obvious yet important qualification to the above noted efficiency, which is that solar panels are limited to only producing electricity during periods of sunlight--either direct light or diffused sunlight on overcast days. This means that solar cells, if used for remote/off-grid generation purposes, need to be implemented in conjunction with some kind of storage system, such as a battery, or as a hybrid system with some other type of generator. Where solar cells are grid-connected this is less of a problem. They can be used during the day to reduce local demand from the grid (or even to export back to the grid) while at night, or during periods of low incident light, the grid can supply the necessary power.

Development of solar power can partially solve energy problems in many regions of Azerbaijan. Use of solar energy is preferable in sectors such as heating and hot water supply, air conditioning, industry, communications and transport. The relative simplicity of the usage of solar energy enables mass construction of standard small power plants with a capacity of 50 to 3000 kW.

Main advantages of the technology could be listed as follows:

- The technology can be used in regions located far from the industrial centers;
- The technology can be used to supply electricity and heat to individual households or used with combined regime with electricity grid;
- The technology can reduce grid electricity consumption and decrease use of organic fuels, thereby minimizing environmental effects, due to emission reductions to soil, water and atmosphere air (CO_2, SO_2, NO_x etc.);
- The technology is ready for industrial application.

Some disadvantages of the technology could be listed as follows:

- Relatively high cost of equipment;
- There is need for financial support;
- Weak development of the national industry for production of solar techniques;
- Weak public awareness on solar energy advantages;
- Dependent on weather conditions;
- Does not work during night period.

Application of passive solar energy and solar photovoltaic technology lines with the country's social, economic and environmental development priorities. With regard to the country's social development priorities, application of the above-mentioned technology will create new employment opportunities and will also have a positive influence on public opinion, which would realize the necessity to protect the environment and reduce consumption of energy resources. Regarding the country's economic development priorities, the technology will reduce energy production costs. With regard to the country's environmental development priorities, the application of an environmentally sound technology that has zero emission will help create a better environment.

Total capital costs for the application of solar energy technology will be around 21,370,000 USD, according to rough estimates. Cost of GHG reduction will be 0.19÷0.85 USD per kg (CO_2).

Tariff-price of solar energy is not yet defined by the government. Permits on alternative energy actions are carried out by the Ministry of Industry and Energy on the basis of recommendations of the State Company on alternative and renewable energy sources.

1.3.2 Identification of barriers

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). 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.

As with the previous technology, passive solar energy (hot water) and solar photovoltaic energy barriers related to technology implementation have been identified in five categories: i) economic/financial barriers, ii) policy/regulatory barriers, iii) technology barriers, iv) capacity building barriers and v) social barriers.

1.3.2.1 Economic and financial barriers

Presently, there are no major economic barriers to the implementation of the technology. There is a recently established plant, Sumgayit Technology Plant, in Sumgayit city (close to the capital city of Baku) that produces solar panels. There are also plans to launch production of solar photovoltaic panels at that plant in the near future.

Long payback period is an important barrier to technology deployment. Cost/benefit analyses of passive solar and solar photovoltaic technology show that current prices are not attractive for consumers, as other energy sources are comparatively cheaper. This technology requires a 5-7 year payback period; consequently, consumers are not interested in purchasing such expensive technology.

A public initiatives mechanism is necessary for sectoral development. Such regulations/initiatives are needed until the technology is fully competitive with traditional energy sources. These may include some economic privileges (e.g. exemption from import/export taxes, income taxes, etc.) for private investors.

Lack of specified tariffs for solar energy could be mentioned as a main barrier to technology deployment.

One of the major problems of this sector is the weak consumer market. Due to relatively high investment costs, consumers (local communities, local authorities, private sector) are lacking in financial means to invest in/purchase the technology. The reason for these high investment costs is that the technology is still imported and local production has not developed yet.

Weak access to affordable financial means, such as loans, credits, investments, is another barrier for consumers (local communities, local authorities, private sector) to purchase the relevant equipment.

Capacity of local R & D institutions dealing with solar energy research and investigation activities is low and does not meet up-to-date requirements. This is mainly due to the lack of public financing and insufficient fiscal support to R & D institutions. As a result, technical capacities of R & D institutions are underdeveloped. Consequently, private sectors are obliged to apply to international R & D institutions providing relevant services, which are relatively expensive.

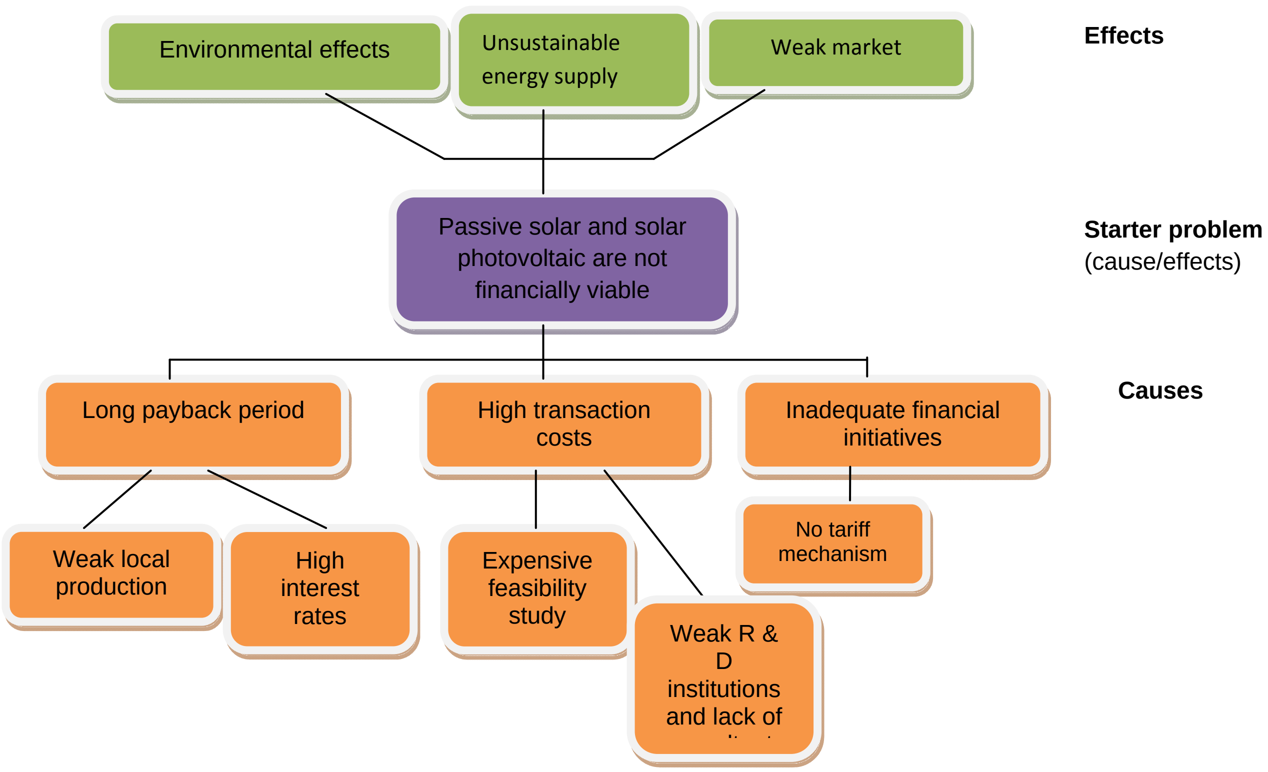

Figure 5: LPA for economic/financial barriers of passive solar and solar photovoltaic technology

Based on the results of market mapping analysis (figure 26) it could be assumed that the current condition of the solar passive and solar photovoltaic technology market is the same as grid-connected wind power technology. The number of market players in the current technology market is low, as existing market opportunities do not provide suitable conditions for involvement of other key players (input suppliers, business service and technical service providers) to the market chain. Along with this, business-extension services (research development, financial services, market information, input suppliers and so on) are very weak and almost non-functional in the market chain. Enabling environment also does not provide suitable opportunities for development of local market for technology diffusion.

1.3.2.2 Non-financial barriers

Non-financial barriers to deployment of solar passive and solar photovoltaic technology are analyzed in four categories: policy/regulatory barriers, technology barriers, information/capacity building barriers and social barriers.

Policy/regulatory barriers:

The country has strict policy and clear strategy regarding the development of renewable energy sources, including solar energy. Notwithstanding that, regulatory actions from the government are necessary in order to provide additional support for private sector, as well as to local consumers to promote use of technology.

Technology barriers:

Inadequate workforce skills are one of the main barriers of technology deployment. This includes lack of adequate technical skills, lack of reliable installation, maintenance and inspection services.

Non-compliance of standards and certification is another important barrier to technology deployment. Standards for solar energy devices have not yet been identified and the certification mechanism is not in place.

Weak educational/training system for new technologies is also an important barrier.

Information/capacity building barriers:

One of the important barriers to the implementation of the technology is weak capacity and lack of information for consumers on use and advantages of the technology. The same could be said for local authorities, state and private organizations.

Social barriers:

Unfamiliarity with new technology could be mentioned as a social barrier to application of the technology. Local populations are accustomed to traditional electricity supply and, for the most part, are not interested in replacements, as current costs for traditionally used electricity are fairly low.

Low level of awareness on the negative impact of climate change and advantages of application of renewable energy sources, such as solar energy, leads to formation of such social habits.

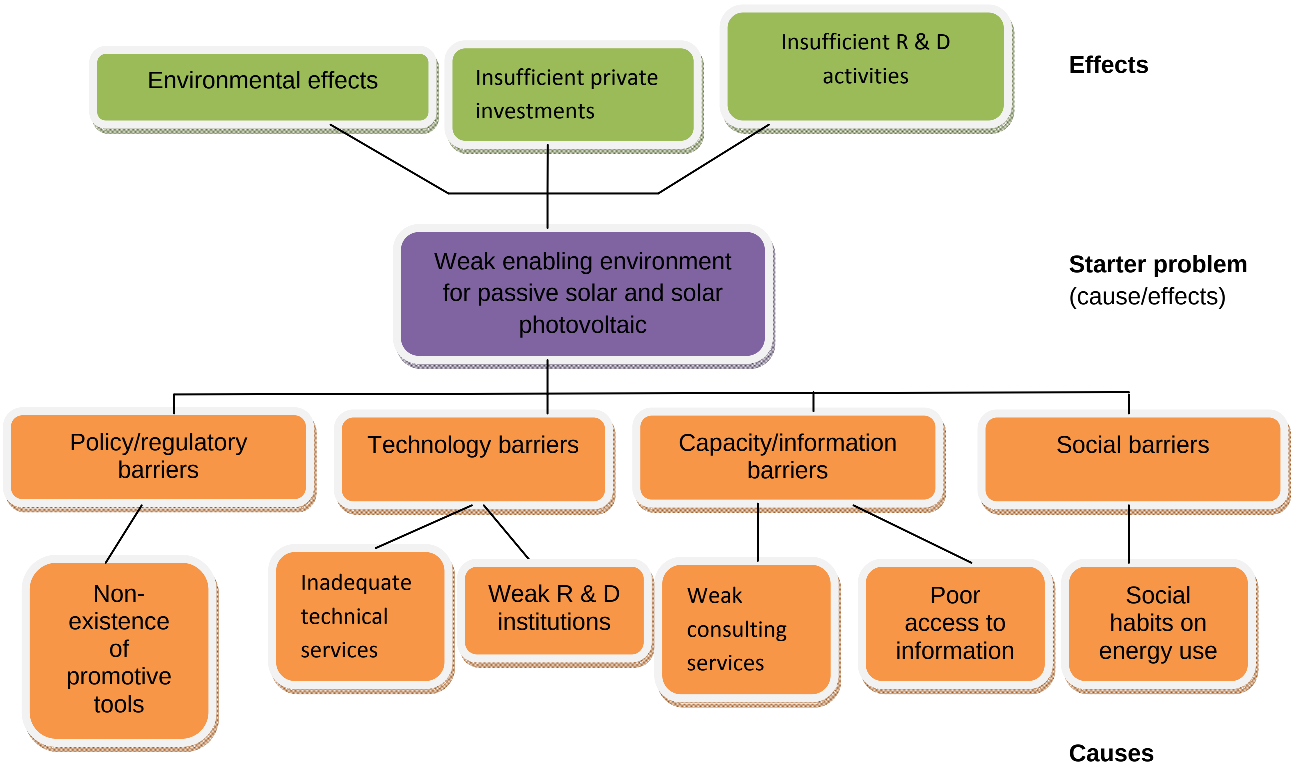

Figure 6: LPA for non-financial barriers of passive solar and solar photovoltaic technology

1.3.3 Identified measures

1.3.3.1 Economic and financial measures

Regarding economic/financial measures, it could be mentioned that the government should support the investors in this field by providing long-term and low-interest loans through state funds (State Fund for Support to Entrepreneurship functioning within the Ministry of Economic Development), private sources (different banks) and international funds.

Current market in solar energy systems should be supported and production/import of technology and other necessary equipment should be promoted by the government through different subsidy mechanisms (such as tax discounts or subsidy programs).

Necessary fiscal support to R & D institutions should be increased in order to improve technical capacity and skills of technical staff.

In order to promote private initiatives and technology deployment in solar energy (passive and photovoltaic) tariff mechanisms should be fixed.

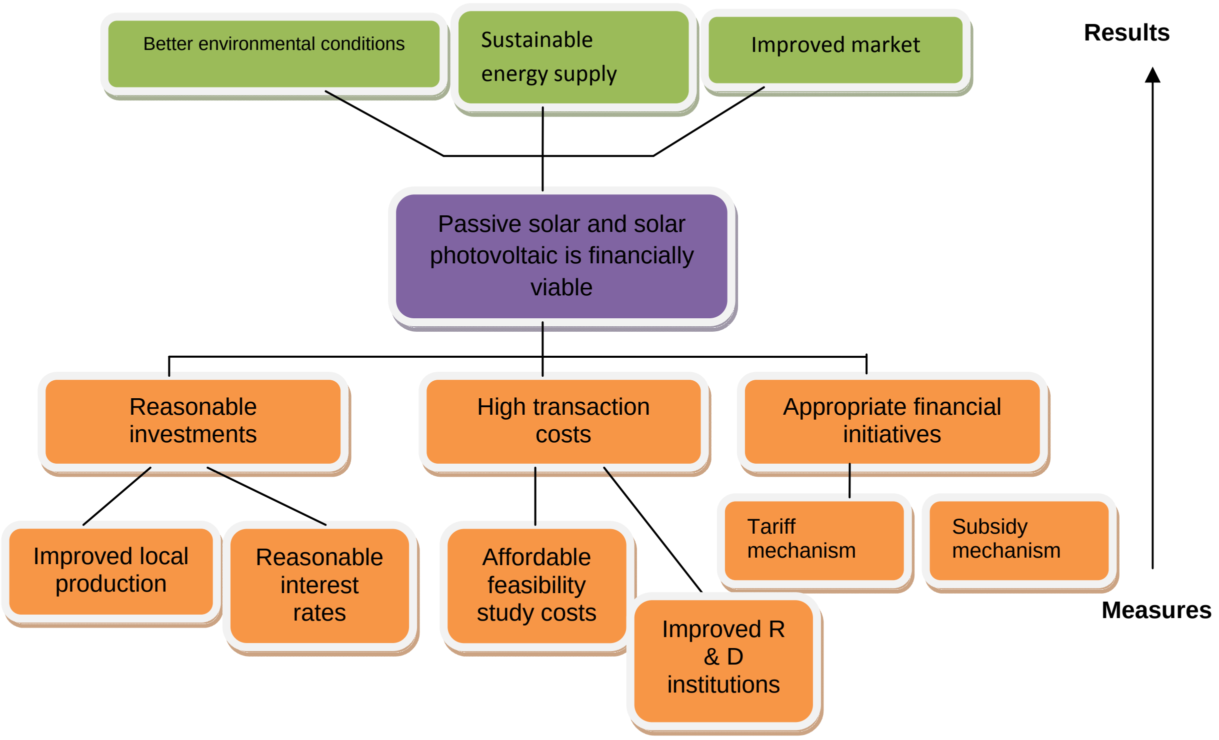

Figure 7: LPA for economic/financial measures for passive solar and solar photovoltaic technology

1.3.3.2 Non-financial measures

In order to overcome existing non-financial barriers to the implementation of passive solar (hot water) and solar photovoltaic technology, the following measures should be provided:

- Necessary regulatory actions must be provided by the government in order to simplify certification mechanism for application of passive solar and solar photovoltaic technology;
- Necessary fiscal support to R & D institutions in order to improve technical capacity and skills of technical staff;
- Information campaigns on the advantages of applied technology must be organized and funded in order to increase capacity and awareness level of consumers (local residents, local authorities and private sector), by involving NGO sector in the process;

- Organize specific capacity building activities for technical service providers, private sector representatives and local communities in order to increase capacities on renewable energy sources;
- Organize study tours to Gobustan Demonstration Station by involving representatives of local authorities, local communities, private sector and NGOs, in order to increase awareness level;
- Pilot projects at local level (municipal or community level) must be implemented in order to demonstrate advantages and promote use of the technology.

These measures will result in increase of private sector initiatives in the solar energy sector. Moreover, consumers, local communities, municipalities, and private sector will start widely applying the technology.

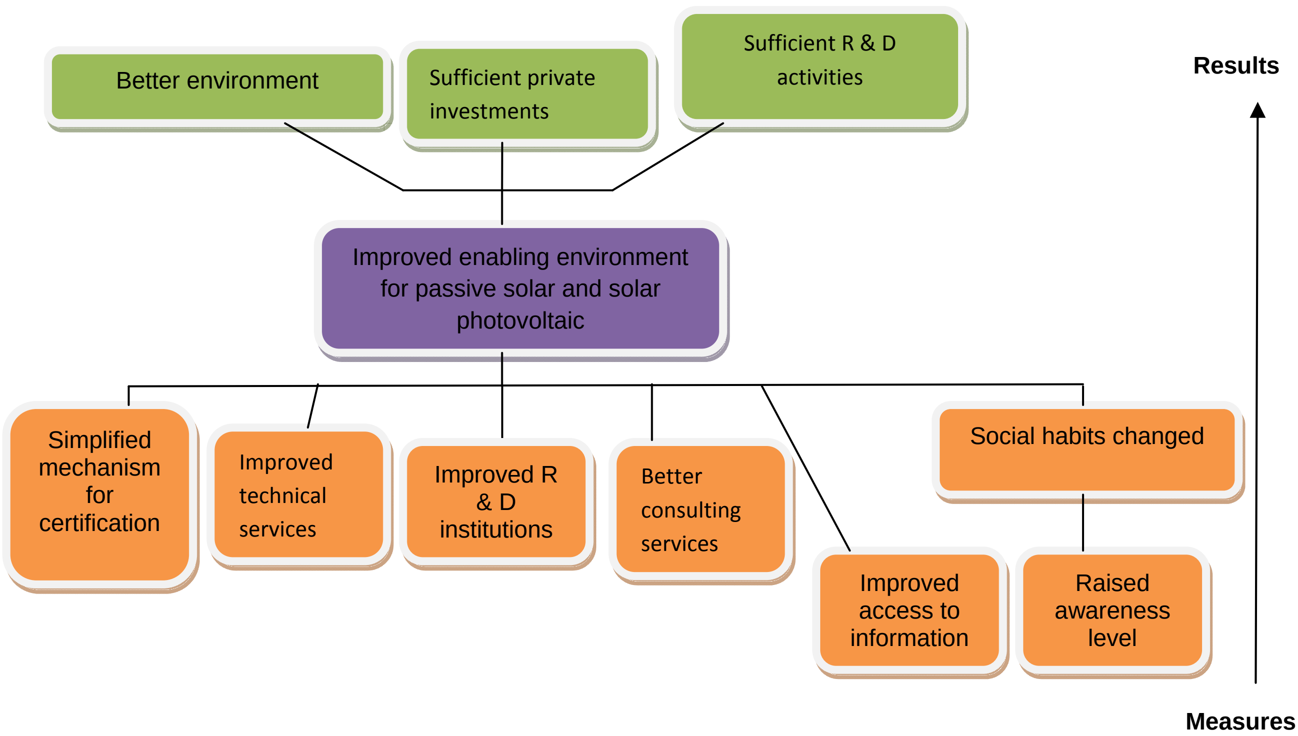

Figure 8: LPA for non-financial measures for passive solar and solar photovoltaic technology

1.4. Barrier analysis and possible enabling measures for small hydro-powers on mountain rivers technology

1.4.1 General description of the technology

Small hydro-power refers to hydroelectric power plants below 10 MW installed capacity. Hydroelectric power plants are power plants that produce electrical energy by driving turbines and generators as a result of the gravitational force of falling or flowing water.

Small-scale hydro power may be a useful source of electricity to isolated sites and may provide an extra contribution to national electrical production for peak demand.

Substituting traditional fuels by switching to electricity can reduce air pollution, improve health and decrease social burdens, e.g. from collecting firewood. The electricity can be used to increase income generating activities, in particular it can improve irrigation, crop processing and food production.

Construction of hydro-power plants plays 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.

There are many advantages of SHPs. For example:

- They may be located close to energy consumers;
- Losses occurring during the long distance transportation of the energy are low;
- Smaller HPPs conserve the natural landscape;
- Smaller HPPs eliminate the possibility of GHG emissions.

A disadvantage of the technology is that it depends on the geographical climate and relief conditions.

Application of small hydro-powers at mountain rivers technology lines with the country's social, economic and environmental development priorities. With regard to the country's social development priorities, application of the above-mentioned technology will create new employment opportunities and will also have a positive influence on public opinion, which would realize the necessity to protect the environment and reduce consumption of energy resources. Regarding the country's economic development priorities, the technology will reduce energy production costs. With regard to the country's environmental development priorities, the application of an environmentally sound technology that has zero emission will help create a better environment.

Total capital costs for the application of small hydro-power stations technology will be around 656,000,000 USD, according to rough estimates. Cost of GHG reduction will be 0.018÷0.126 USD per kg (CO_2).

1.4.2 Identification of barriers

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). 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.

As with the previous technology, small hydro-powers at mountain rivers barriers related to technology implementation have been identified in five categories: i) economic/financial barriers, ii) policy/regulatory barriers, iii) technology barriers iv) environmental barriers and v) capacity building/information barriers.

1.4.2.1 Economic and financial barriers

Small hydro-power stations technology has a public nature; currently, services and investments are only provided by the public sector. Therefore, an insufficient amount of public investment to the sector could be mentioned as a financial barrier. The main reason for this insufficient investment is that the government currently provides large investments for other social and economic infrastructure, including the modernization of functioning heat power stations and hydro-power stations. Moreover, the country already meets the local demand for electricity and some electricity is even sold to other countries. At the moment, the provision of large investments for construction of small hydro-power stations is not a top issue on the priority list of public investments by the government, however this tendency is going to change in the future.

There are no obstacles or barriers for the private sector to construct small hydro-power stations, but the mechanism for providing permits for the construction is complicated and lengthy. There are three organizations involved in providing permits: Ministry of Emergency Cases, Azerenergy company under SOCAR and the Ministry of Ecology and Natural Resources.

High investment costs are one of the barriers of the technology. Weak access to affordable financial means is another barrier to private sector investments.

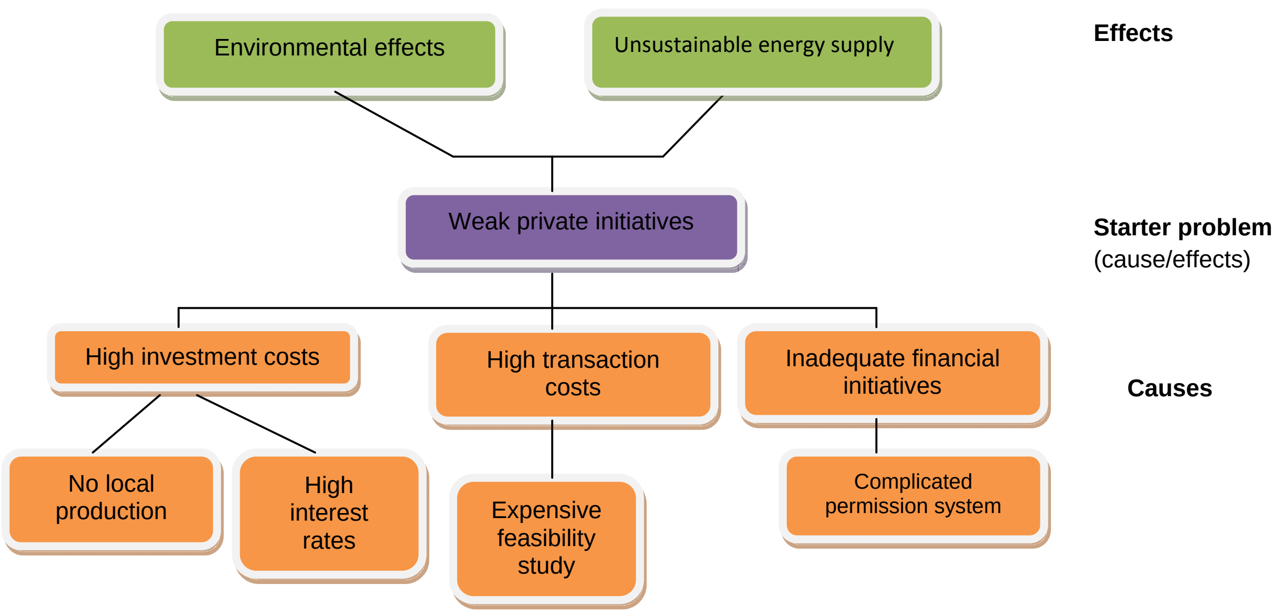

Figure 9: LPA for economic/financial barriers of small hydro-power technology

Based on the results of market mapping analysis (figure 30) it could be assumed that the current small-hydro power technology market is dominated by importing, as the technology is only imported into the country. The number of market players in the current technology market is low, as existing market opportunities do not provide suitable conditions for involvement of other key players (for instance, input suppliers) to the market chain. Along with this, business-extension services are very weak and almost non-functional in the market chain. Enabling environment also does not provide suitable opportunities for development of local market for technology diffusion.

1.4.2.2 Non-financial barriers

The country has strict policy and clear strategy regarding the development of renewable energy sources, including development of small hydro-powers. Notwithstanding that, there are a number of barriers impeding technology deployment.

Policy/regulatory barriers:

There are no obstacles or barriers for the private sector to construct small hydro-power stations. However, in order to promote the initiative a legislative base should be developed in this field, including regulations on permits, rights and obligations of energy producers and consumers. The mechanism for providing permits for the construction of small hydro-power stations is complicated and needs to be simplified.

Environmental barriers:

There are some environmental barriers to construction of small hydro-powers at mountain rivers; however, the full environmental impact has not been studied in detail.

Another barrier is the high risk for technology deployment. Taking into account future climate change tendencies, low precipitation will lead to decrease in stream levels. Specific analyses on potential impact on river streams are not provided under current climate change scenario assessments.

Technology barriers:

The main technological barrier is that small hydro-power technology is only imported into the country. Despite the fact that there is practice of similar technology from previous applications, there is a need for studying best international practices and applying more modern technologies.

Capacity building/information barriers:

One of the important barriers is weak capacity of research institutions responsible for providing research/investigation on the potential of small rivers. Additionally, there are no small field measuring–observatory stations for studying the energy potential of mountain rivers.

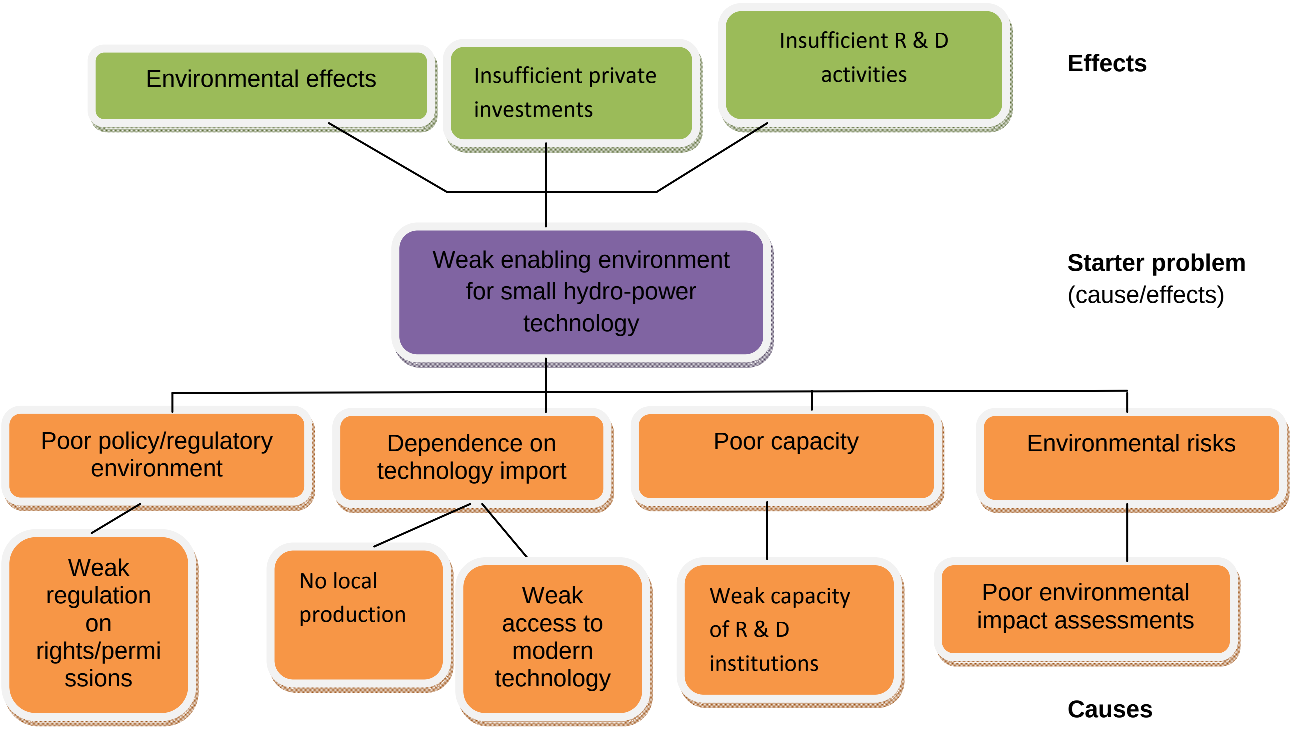

Figure 10: LPA for non-financial barriers of small hydro-power technology

1.4.3 Identified measures

1.4.3.1 Economic and financial measures

Regarding economic/financial measures it could be mentioned that the government should provide more public funds for research/observation activities and investments for hydro-power stations at mountain rivers. This will lead to improved technical capacity of R & D institutions and increase quality of provided services.

The government should support the investors in this field by providing long-term and low-interest loans through different state funds (such as State Fund for Support to Entrepreneurship functioning within the Ministry of Economic Development), private sources (different banks) and international funds.

Private initiatives for application of small hydro-power stations should be promoted by the government through different subsidy mechanisms (such as tax discounts or different subsidy programmes).

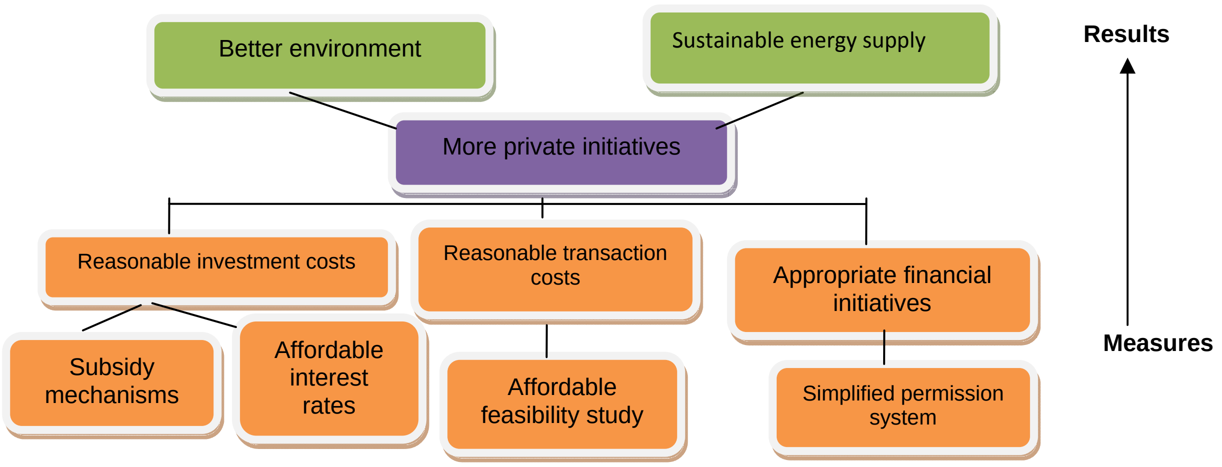

Figure 11: LPA for economic/financial measures for small hydro-power technology

1.4.3.2 Non-financial measures

In order to overcome existing non-financial barriers to the implementation of small hydro-powers technology, the following measures should be provided:

- Support research/observation activities to identify the potential of mountain rivers and prepare electronic atlas;
- Capacity and skills of respective governmental bodies responsible for research/observation activities must be improved by involvement in different trainings or study tours with the support of government;
- Legislative base (regulation, permits, subsidy mechanism) should be improved in order to make the sector attractive to private sector;
- Detailed environmental impact assessment, including issues related to future climate change tendencies;
- Strengthen technical capacity of respective institutions responsible for research/observation activities in order to facilitate the implementation of best international experience and technology.

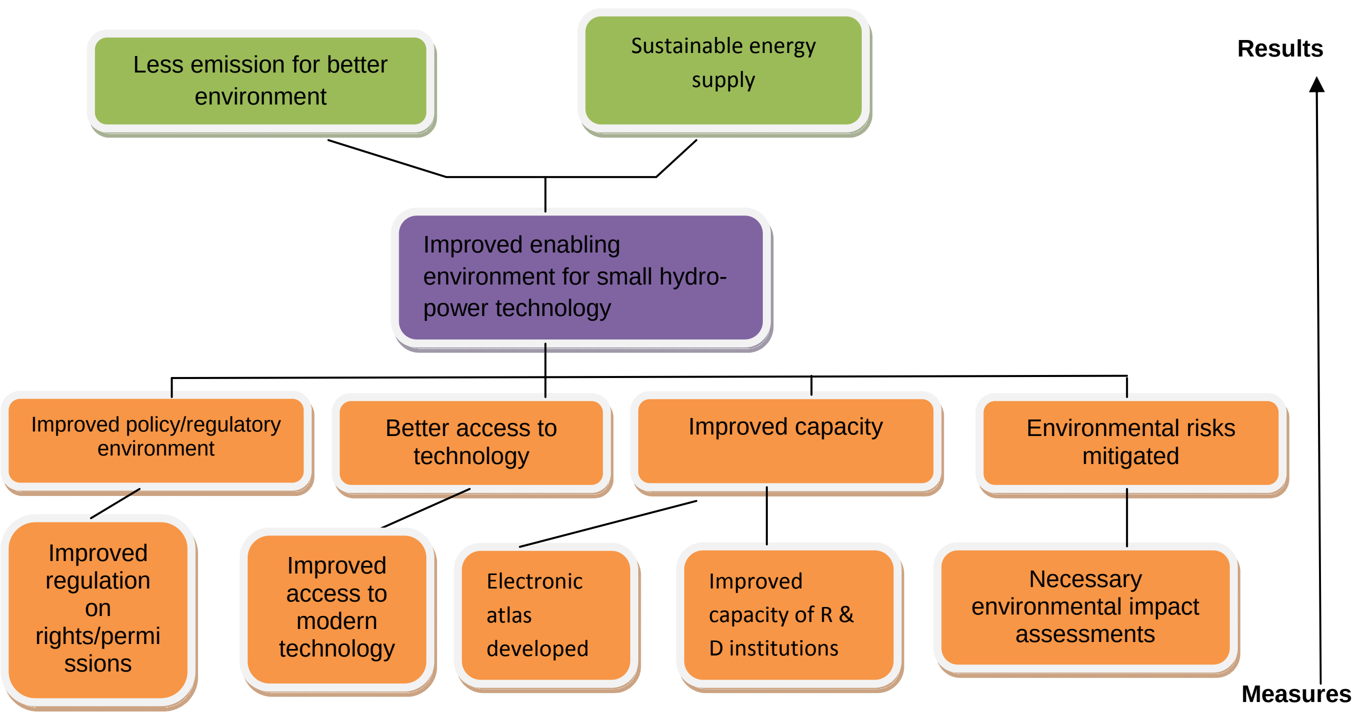

Figure 12: LPA for non-financial measures for small hydro-power stations technology

1.5. Linkages of barriers identified

As it was indicated in previous sections, barriers related to the implementation of technologies for alternative energy sources sub-sector have been identified in six categories: i) economic/financial barriers, ii) policy/regulatory barriers, iii) technology barriers, iv) capacity building barriers, v) environmental barriers and vi) social barriers.

Some barriers of all three technologies are similar. For instance, weak capacity and lack of information for consumers on use and advantages of the technology are similar for all three prioritized technologies. Unfamiliarity with new technology could be mentioned as a social barrier to application of prioritized technologies (wind power and solar energy). Local populations are accustomed to traditional electricity supply and, for the most part, are not interested in replacements, as current costs of energy are fairly low. Low level of awareness on the negative impact of climate change and advantages of application of renewable energy sources, such as wind energy, leads to formation of such social habits.

With regard to grid-connected wind power technology, regulatory actions from the government are necessary in order to support the development of the sector--including regulations on use of wind energy sources. These also include regulations on tax discounts for local producers and other concessions during technology import, in order to promote investments in this sector. High cost of investment and infrastructure is another barrier to the development of the sector. Not having access to low-interest and long-term financial means, the private sector is unable to provide sufficient investment for the development of the technology.

Regarding small hydro-power stations technology, technological barriers are considered to be important ones. Despite the fact that there is practice of similar technology from previous applications, there is a need for studying best international practices and applying more modern technologies.

As private initiatives in deployment of greenhouse gas mitigation technologies are considered Clean Development Mechanism projects, they may be attractive to the private sector. However, difficulties in application, registration and approval procedures create constraints in the use of this attractive tool.

For instance, to date, 17 Clean Development Mechanism projects have been prepared and submitted by Azerbaijan, but only 2 of them have been registered by the UNFCCC secretariat. Such long processes reduce the interest of private sector in mitigation initiatives.

It is possible to achieve synergy between the identified barriers as all three technologies are currently coordinated by one organization – the State Company on Alternative and Renewable Energy Sources. Therefore, capacity building barriers of the three technologies may be addressed within one measure. Along with this, the barrier related to tariff regulations may be addressed jointly to wind power and solar energy (when regulating tariffs on wind energy, identify solar energy tariffs). The same can be said for financial barriers such as access to acceptable loans; when developing a mechanism for provision of affordable financial loans, all technologies may be covered under one umbrella.

Barriers related to the implementation of alternative energy sources technologies could be summarized as follows:

Table 5: Summary of barriers of alternative energy sources sub-sector

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 - 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
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	- Difficult permission procedures
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 building	- 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	

1.6. Enabling framework for overcoming barriers in alternative energy sources sub-sector

The government of Azerbaijan has established a strategy for the development of renewable energy sources. Despite the clear strategy and plan for development of alternative energy sources sub-sector, specific measures are necessary in order to overcome existing barriers to the implementation of priority technologies.

Identified measures are listed in the table below.

Table 6: Barriers and measures for alternative energy sources sub-sector

Barriers	Measures
Grid-connected wind power	
- Unfavorable tariff mechanisms - Non-existence of tax concession mechanism to attract private investments	- Relevant economic regulations in order to promote investments for the sector - Regulation of tariff system
- High cost of investment and infrastructure - Weak access to acceptable financial means	- Develop subsidy mechanism to promote private sector initiatives - Enable provision of long-term and low-interest loans or grants through state funds (for instance, State Fund for Support to Entrepreneurship, SOCAR), private sources (different Banks) and international funds (GEF, GCF)
- Weak regulations on consumer use of wind energy sources - Non-existence of wind atlas	- Necessary regulatory actions in order to create a mechanism for consumer use of grid-connected wind power - Support development of wind atlas
- Non-compliance of standards and certification procedures - Weak capacity of technology application - Weak capacity of R & D institutions	- Develop standards and certification process - Capacity building for research institutions - Strengthen international research network programmes - Specific capacity building activities (trainings) for private sector, local authorities and local communities - Increase fiscal support to R & D institutions in order to improve technical capacity
- Low level of awareness of economic and ecological advantages	- Information campaigns on the advantages of applied technology
- Unfamiliarity with new technology	- Organize study tours to Gobustan Demonstration Station by involving representatives of local authorities, local communities and private sector - Implement pilot projects at community (municipal) level
Passive solar energy and photovoltaic	
- High cost of investment and infrastructure - Long payback period - Weak access to acceptable financial means	- Develop subsidy mechanism to promote private sector initiatives - Enable provision of long-term and low-interest loans or grants through state funds (for instance, State Fund for Support to Entrepreneurship, SOCAR), private sources (different Banks) and international funds (GEF, GCF)
- Non-compliance of standards and certification procedures - Weak capacity of technology application - Weak capacity of R& D institutions - Inadequate working skills of technical service providers	- Develop standards and certification process - Specific capacity building activities (trainings) for students, private sector, local authorities and local communities - Increase fiscal support to R & D institutions in order to improve technical capacity

Barriers	Measures
- Weak regulations on consumer use of solar energy	- Develop regulations on tariff system and consumer use of solar energy sources
- Low level of awareness of economic and ecological advantages	- Information campaigns on the advantages of applied technology - Implement pilot projects at community (municipal) level
- Unfamiliarity with new technology	- Organize study tours to Gobustan Demonstration Station by involving representatives of local authorities, local communities, private sector and NGOs
Small hydro-powers at mountain rivers	
- Insufficient state investment to the sector	- Necessary state funds must be assigned for enhancement of research/observation activities to identify the potential of mountain rivers and prepare electronic atlas - Additional state funds must be assigned for constructing new Hydro-Power Stations
- Dificult permission mechanisms	- Simplify permission mechanisms
- Out-dated technology - Weak research activities due to insufficient equipment - Low capacity of research institutions	- Improve capacity and skills of respective governmental bodies responsible for research/observation - Strengthen technical capacity of respective institutions responsible for research/observation activities
- Poor environmental impact assessments	- Conduct detailed environmental impact assessment for all possible small hydro-power construction points

Chapter 2. Commercial and residential sub-sector

2.1. Preliminary targets for technology transfer and diffusion

The commercial and residential sector is the largest sector with energy consumers. The increase of population and economic development leads to a rise in the use of energy, both in commercial and residential sectors. Increase in the volume of energy consumed comes from inefficient heating systems and lack of natural gas supplied to some rural areas. In most rural areas, people still use electrical devices with low efficiency, as well as kerosene and wood, to heat their houses and for cooking purposes. Active heating systems in some parts of the cities work inefficiently and require periodic maintenance.

CO_2 emissions from the commercial and residential sector contain all the emissions from fuel combustion in households. Data on GHG emissions from the residential and commercial sector (for 2005) was provided in the Second National Communication and was noted as being 8,888 Gg.

In general there are many problems facing the commercial and residential sector of Azerbaijan, which require a complex solution of organizational, regulative and technological components. High efficiency lighting systems, heating pumps and biogas in rural areas are the most prioritized technologies.

Preliminary targets for prioritized technologies are provided below.

For high efficiency lighting systems: Presently, there are no exact statistics of how much energy consumption comes from the use of heating, air conditioning or lighting. This creates some difficulties in providing exact estimates on energy savings, particularly for the application of high efficiency lighting systems. According to revised estimates, by the year 2030 GHG reductions resulting from the application of high efficiency lighting systems will total 23 MT—taking into account the use of 2 million bulbs. This is approximately a 1.28 MT decrease in emission per year.

For heating pumps technology: According to rough estimates, as a result of the application of heating pumps technology, total GHG emission reduction will be 8 MT of CO_2 by the year 2030.

For biogas for heating/cooking and efficient stoves technology: According to rough estimates, for the year 2030, total GHG emission reduction will be 1.7 million tons of CO_2.

Azerbaijan has begun promoting energy efficient lighting. Currently, there is a proposal for the Parliament to consider Minimum Energy Performance Standards (MEPS) for lamps, and the National Standard Agency is preparing mandatory labels for light bulbs. Energy efficiency awareness-raising campaigns through media and schools/educational programmes have been conducted in some cities. However, there lacks a robust quality control and enforcement system to prevent low performance bulbs from entering the market. International testing standards and a lighting laboratory need to be established, and an enforcement system created.

Regarding heating pumps and biogas for heating/cooking and efficient stoves, there are no specific governmental initiatives and only a limited number of projects implemented by NGOs or direct application by private sector.

2.2. Barrier analysis and possible enabling measures for high efficiency lighting system technology

2.2.1 General description of the technology

Use of high efficiency lighting systems is a very effective tool in reducing energy losses. As main advantages of the technology, it could be mentioned that it generates savings in energy costs and provides a reliable lighting service. It also generates employment in manufacturing and retail. High efficiency lighting systems contribute to security of energy supply as they make a significant contribution to the reduction in electricity demand.

Both conserving lighting use and adopting more efficient technologies can yield substantial energy savings. New lighting technologies are many times more efficient than traditional technologies such as incandescent bulbs. Moreover, switching to newer technologies can result in substantial net energy use reduction, as well as associated reductions in greenhouse gas emissions.

Some of these technologies and practices have no up front costs, while others pay for themselves over time in the form of lower utility bills. In addition to helping reduce energy use, and therefore greenhouse gas emissions, other benefits may include better reading and working conditions and reduced light pollution.

There are a wide range of different light bulbs, from ordinary incandescent tungsten filament bulbs to Tungsten Halogen, Halogen infrared reflecting, Mercury vapor lamps, Compact fluorescent lamps, linear fluorescent, metal halide, compact metal halide, high pressure sodium (High Intensity Discharge HID lamp) and Light Emitting Diodes (LED).

Application of high efficiency lighting system technology lines with the country's social, economic and environmental development priorities. With regard to the country's social development priorities, it increases livelihood of the population by reducing energy costs. Regarding the country's economic development priorities, the technology contributes to security of energy supply and generates a new manufacturing sector leading to the reviving of that economic sector. With regard to the country's environmental development priorities, the application of the technology contributes to government strategy to provide more environmentally sound energy supply.

A disadvantage to the technology is that initial costs of the bulbs are high. However, due to savings, there will be additional future benefits. Consumers may need to be provided with awareness-raising activities in order to understand this trend.

The cost for the application of high efficiency lighting system technology depends on the price of bulbs--quality and manufacturer. On average, the price of one bulb is about 2-3 USD. Total capital costs in the case of full replacement (312 million bulbs) will be 936 million USD. Cost of GHG reduction will be 0.087 USD per kg CO_2.

2.2.2 Identification of barriers

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 sub-sector.

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). 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.

In order to enable stakeholders to approach and delimit a problem area, the Logical Problem Analysis (LPA) tool was applied as an analysis technique. LPA tools help to create systematic and logical analysis of problems and to bring together all elements of the problem.

Barriers related to high efficiency lighting systems have been identified in four categories: i) economic/financial barriers, ii) policy/regulatory barriers, iii) environmental barriers and iv) capacity building/information barriers.

2.2.2.1 Economic and financial barriers

Presently, high efficiency lighting systems are imported into the country. As a result, prices are high and the commercial/residential sector is not ready to pay additional costs for efficient bulbs.

High efficiency bulbs are not currently manufactured locally, but the construction of a new plant for technology production is going to be finalized soon where production of LED bulbs will be launched.

There are no economic incentives, such as tax discounts or subsidy mechanisms, to make this sector more attractive to private sector. Consumers in both the residential and commercial sectors are not interested in investing in efficient lighting systems.

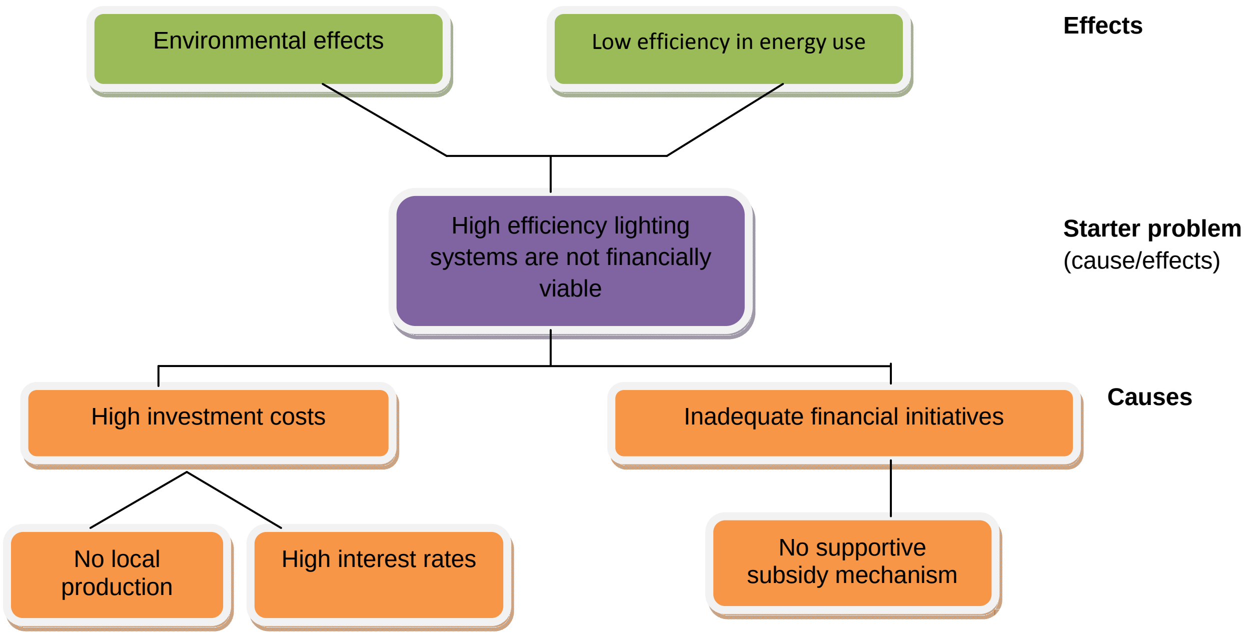

Figure 13: LPA for financial barriers related to high efficiency lighting system technology

Based on the results of market mapping analysis (figure 27) it could be assumed that the current market of high efficiency lighting system technology is dominated by importing, as the technology is only imported into country. The number of market players in the current technology market is low, as existing market opportunities do not provide suitable conditions for involvement of other key players (for instance, financial service providers) to the market chain. Along with this, business-extension services are very weak and almost non-functional in the market chain. Enabling environment also does not provide suitable opportunities for development of local market for technology diffusion.

2.2.2.2 Non-financial barriers

Policy/regulatory barriers:

The legislative base related to energy efficiency is weak for the commercial and residential sector. Institutional basis of relevant institutions and agencies, including local authorities, are also weak. Poor coordination of activities among relevant organizations (Ministry of Economic Development, Ministry of Industry and Energy, municipalities, communal units) could be mentioned as another barrier impeding application of the technology.

Capacity building/information barriers:

Capacity building/information barriers are the most important barriers to the application of high efficiency lighting system technology. Local authorities, communal units and residents do not have enough information on advantages of the technology. Lack of awareness-raising activities on high efficiency lighting system technology among local population is also a significant barrier.

Environmental barriers:

Currently, there is no specific mechanism for waste management of used bulbs. This could create a negative impact on the environment, as well as a barrier to technology deployment.

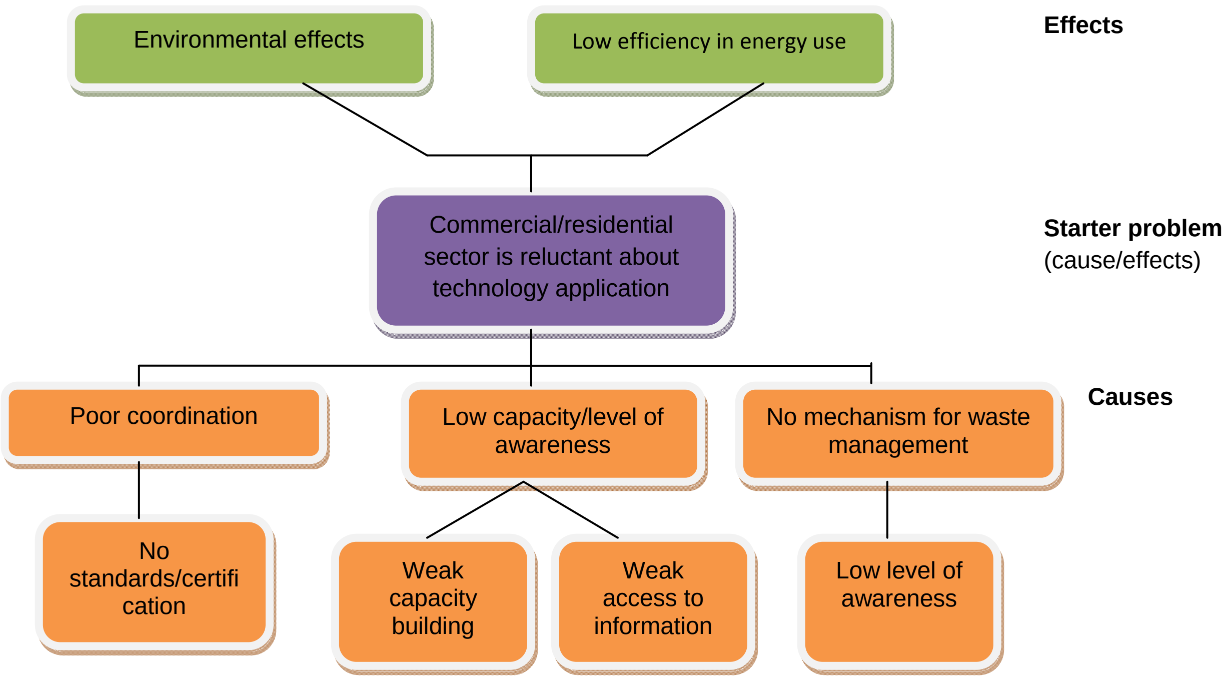

Figure 14: LPA for non-financial barriers related to high efficiency lighting system technology

2.2.3 Identified measures

2.2.3.1 Economic and financial measures

In order to overcome existing economic and financial barriers to the implementation of high efficiency lighting system technology, the following measures should be provided:

- Government should provide a launch program to apply high efficiency lighting systems at all public facilities;
- Necessary enabling mechanisms (subsidy, tax discounts, customs regulations) should be provided in order to make the sector attractive for private sector;
- Support to the investors in securing long-term and low-interest loans through different state funds (such as State Fund for Support to Entrepreneurship functioning within the Ministry of Economic Development), private sources (different banks) and international funds to enable them to provide long-term and large investments.

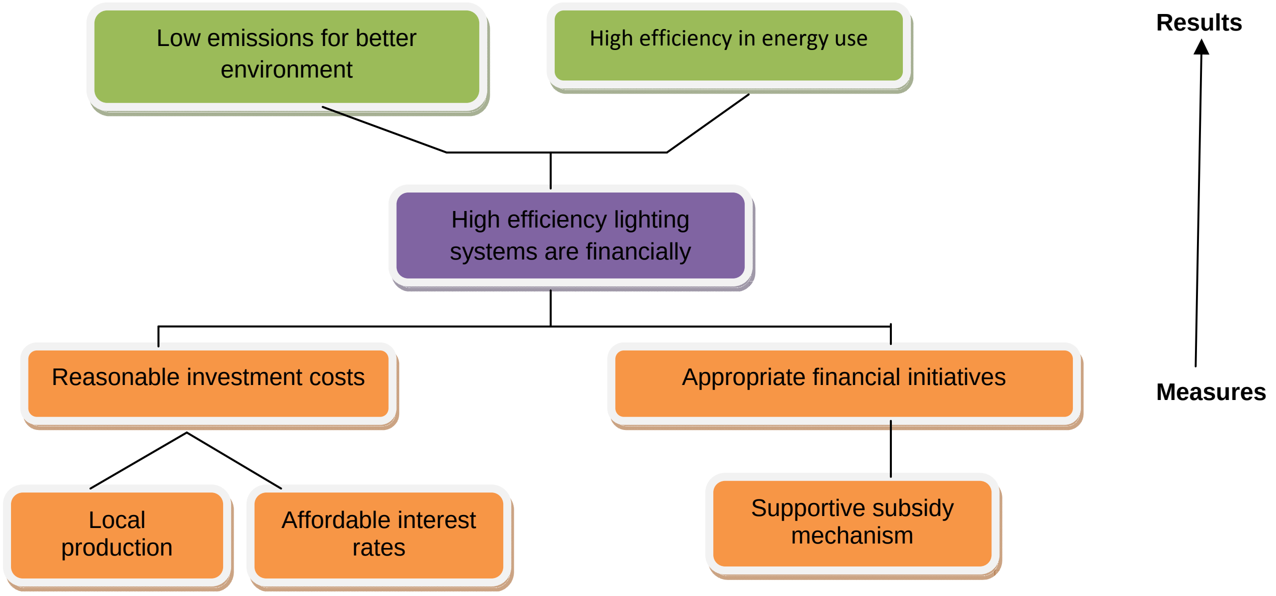

Figure 15: LPA for economic/financial measures for high efficiency lighting system technology

2.2.3.2 Non-financial measures

In order to overcome existing non-financial barriers to technology implementation, the following measures should be provided:

- Legislative basis and regulatory framework related to energy efficiency issues should be improved;
- Coordination among relevant institutions dealing with energy efficiency issues, including use of high efficiency lighting systems, should be improved;
- Specific regulations on waste management of used bulbs;
- Information campaigns and capacity building activities on the advantages of applied technology must be organized and funded in order to increase capacity and awareness level of consumers (local residents, local authorities and private sector), by involving NGO sector in the process;
- Development of quality specifications for bulbs and lighting controls to protect local markets and consumers from inferior products at lower price points;
- Technical advice and training network for laboratories that intend to be qualified to test and evaluate the performance of LED lamps and lighting control products;
- Pilot projects at local level (municipal or community level) must be implemented in order to demonstrate advantages and promote use of the technology.

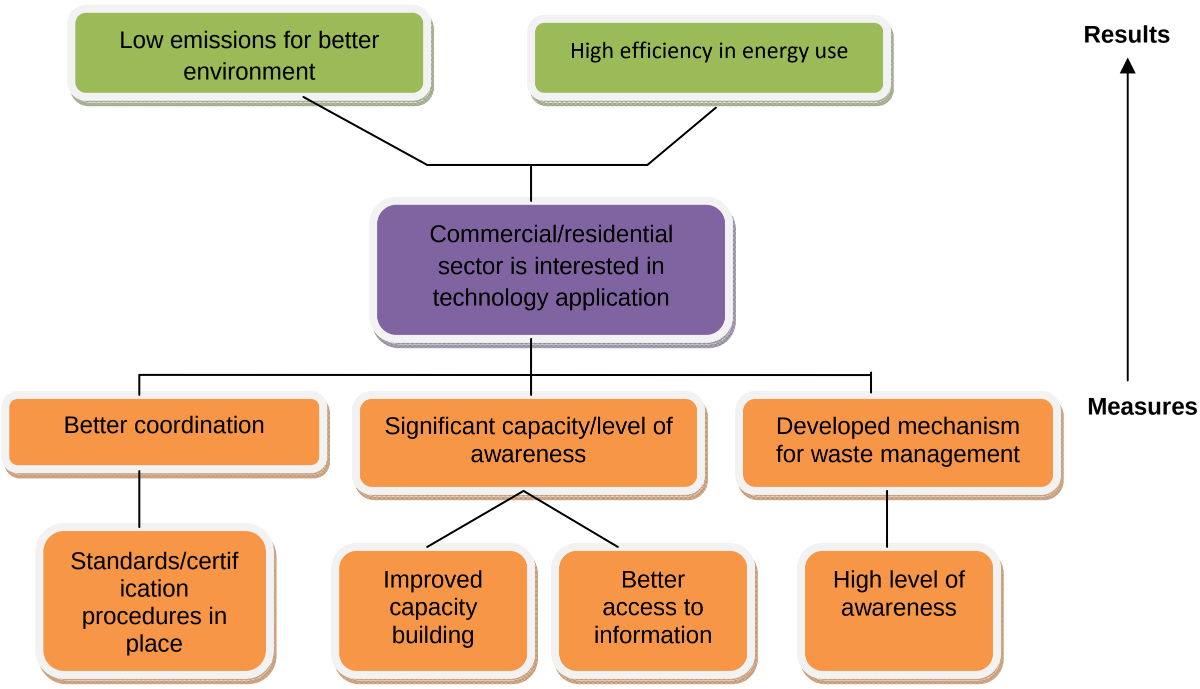

Figure 16: LPA for non-financial measures for high efficiency lighting system technology

2.3. Barrier analysis and possible enabling measures for heating pumps technology

2.3.1 General description of the technology

Heat pumps deliver heating, cooling and hot water to buildings in the domestic, public and industrial sectors. Most heat pumps operate on a vapor-compression cycle and are driven by an electric motor. Some heat pumps use the absorption principle, with gas or waste heat as the driving energy. This means that heat rather than mechanical energy is supplied to drive the cycle. Absorption heat pumps for space air conditioning can be gas-fired, while industrial installations are usually driven by high-pressure steam or waste heat. Heat pumps are most suitable for use in cooling, space heating, hot water, and industrial heat.

The type of heat pump chosen depends on the soil or rock type, land availability and whether a water well can be drilled economically. Heat pumps can be used in any climate but the configuration of this technology depends on local conditions.

Heating 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 up front capital costs are higher.

Heat pumps can be applied in the following places:

- Swimming pools and other large-scale low-temperature uses (*e.g*. greenhouses);
- Hotels;
- Schools and kindergartens;
- Government buildings;
- Commercial buildings;
- Apartment buildings;
- Domestic space and water heating.

The advantage of the technology is that the system is more energy efficient. The disadvantage of the technology is that, although running costs are lower, investment costs for the equipment are high.

Application of heating pumps technology lines with the country's social, economic and environmental development priorities. With regard to the country's social development priorities, it increases livelihood of the population by reducing energy costs. Regarding the country's economic development priorities, the technology contributes to security of energy supply. With regard to the country's environmental development priorities, the application of the technology contributes to government strategy to provide more environmentally sound energy supply.

According to rough estimates, the cost for application of heating pump systems throughout the country will be 1 billion USD. Cost of GHG reduction will be 0.06 USD per kg CO_2.

2.3.2 Identification of barriers

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). 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 heating pumps technology have been identified in three categories: i) economic/financial barriers, ii) technology barriers and iii) capacity building barriers.

2.3.2.1 Economic and financial barriers

Presently, there is no production of heating pumps in the country and the technology is imported.

Cost of investment is high as there is no mechanism for customs regulations to stimulate import of necessary technology. Value added tax is applied to imported technology (18%), which leads to increase of prices.

Lack of financial means is another barrier. Private sector and local population do not have access to acceptable financial means such as long-term and low-interest rates or credits. Current loan rates in the financial market (from 18-24% annual rate) are not attractive or effective for private sector.

Not applying heating pump systems at public facilities is another barrier. The government does not provide significant funds for the application of the system at public buildings.

No fiscal support to R & D institutions for providing assessments of technology and feasibility studies creates an important barrier to technology deployment.

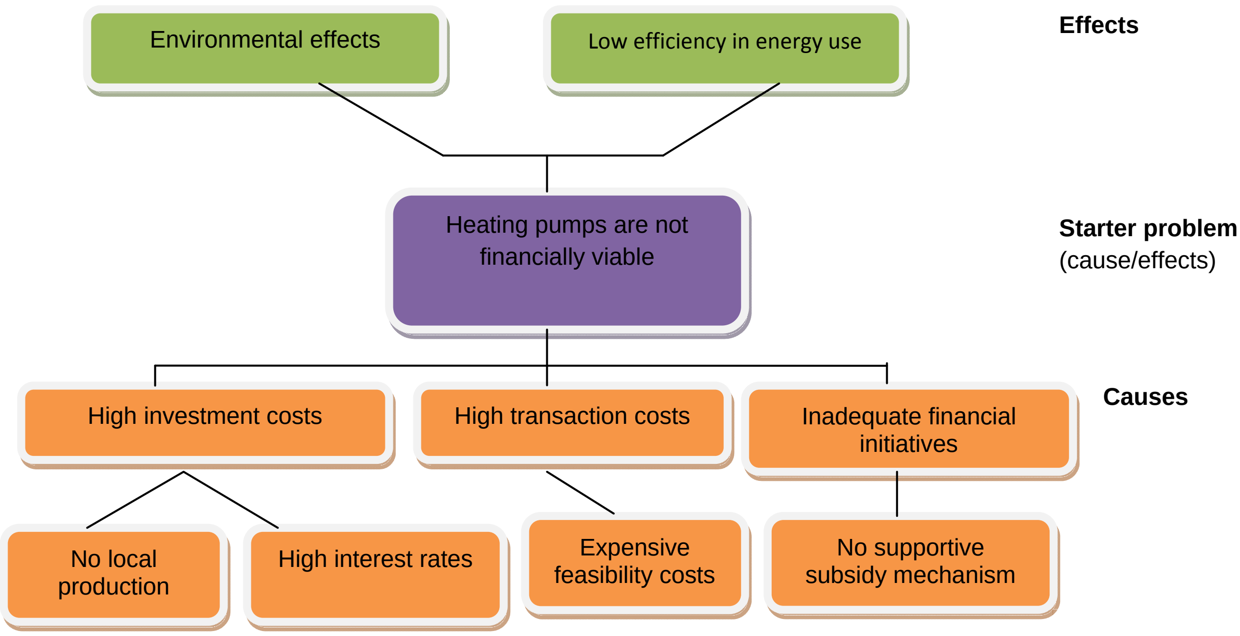

Figure 17: LPA for financial barriers related to heating pumps technology

Based on the results of market mapping analysis (figure 28) it could be assumed that the current heating pumps market is dominated by importing, as the technology is only imported into the country. The number of market players in the current technology market is low, as the technology is not widely applied and existing market opportunities do not provide suitable conditions for involvement of other key players (for instance, financial service providers) to the market chain. Along with this, business-extension services are very weak and almost non-functional in the market chain. Enabling environment also does not provide suitable opportunities for technology diffusion.

2.3.2.2 Non-financial barriers

It should be mentioned that heating pumps technology has not been significantly assessed or practiced in the country. It is almost a new technology and there is a great need for awareness-raising activities for both commercial and residential sectors in order to create interest for technology deployment.

Technology barriers:

One of the main technological barriers to the application of heating pumps is that the technology is only imported into the country. Skills and capacity of related technical experts are not enough for the provision of qualitative technical services for applying the technology.

Capacity building/information barriers:

Capacity building barriers are also significant barriers to the application of the technology. Local authorities, communal units and residents do not have enough information on advantages of the technology. Capacity of R & D institutions is another barrier preventing the provision of necessary studies/research in related fields.

Poor access to information on best international practices of technology deployment is also an important barrier. State institutions, private sector organizations and NGOs do not actively participate in international networking programmes related to heat pumps technology application.

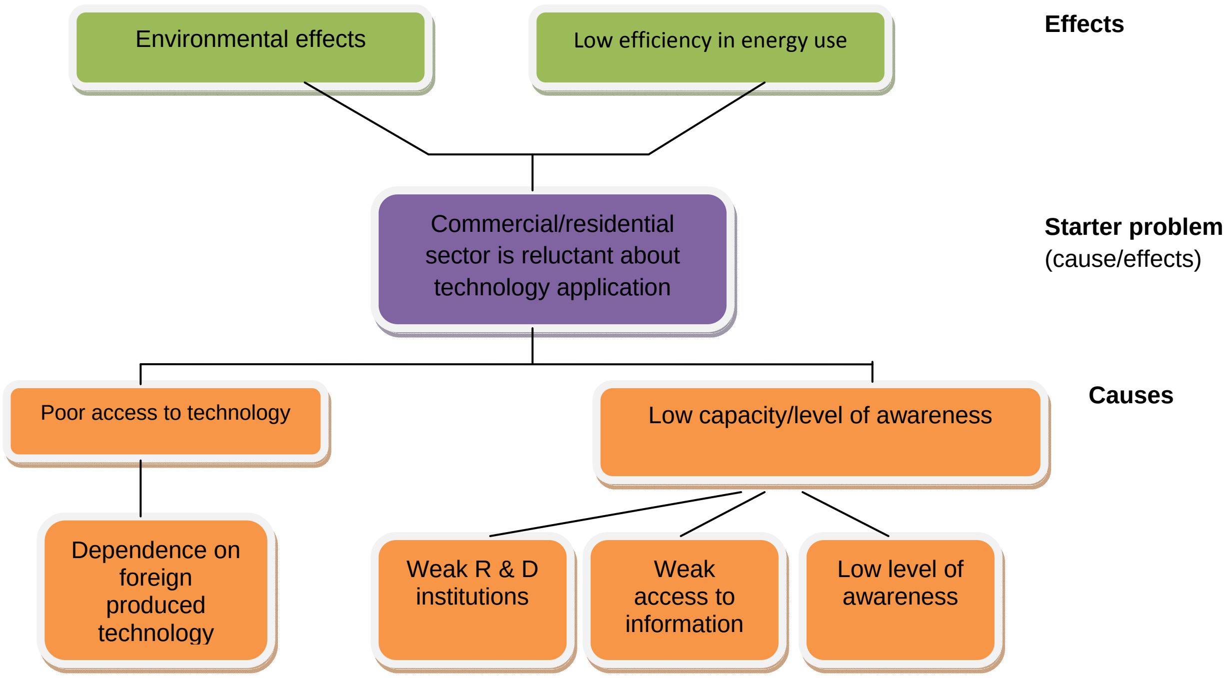

Figure 18: LPA for non-financial barriers related to heating pumps technology

2.3.3 Identified measures

2.3.3.1 Economic and financial measures

In order to overcome existing economic and financial barriers to the implementation of heating pumps technology, the following measures should be provided:

- Government should provide a significant budget for application of the technology at public facilities;
- Necessary regulations related to customs should be provided in order to make the sector attractive for private sector;
- Create access to long-term and low-interest loans through different state funds (such as State Fund for Support to Entrepreneurship functioning within the Ministry of Economic Development), private sources (different banks) and international funds;
- Develop specific subsidy mechanism to promote technology deployment;
- Provide necessary fiscal support to R & D institutions.

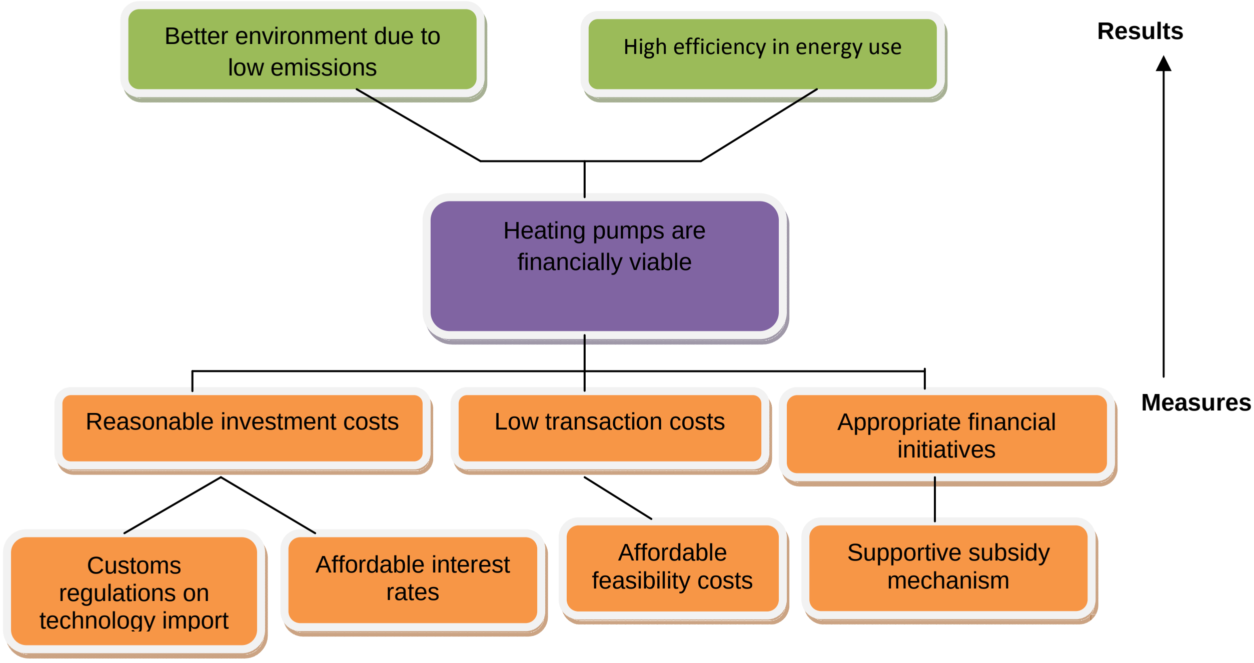

Figure 19: LPA for economic/financial measures for heating pumps technology

2.3.3.2 Non-financial measures

In order to overcome existing non-financial barriers to technology implementation, the following measures should be provided:

- Technical advice and trainings as capacity building activities for R & D institutions and technical experts;
- Strengthen international research network programmes in order to learn from best international practices;
- Information campaigns and capacity building activities on the advantages of applied technology must be organized and funded in order to increase capacity and awareness level of local residents, local authorities and private sector, by involving NGO sector in the process;
- Pilot projects at local level (municipal or community level) must be implemented in order to demonstrate advantages and promote use of the technology.

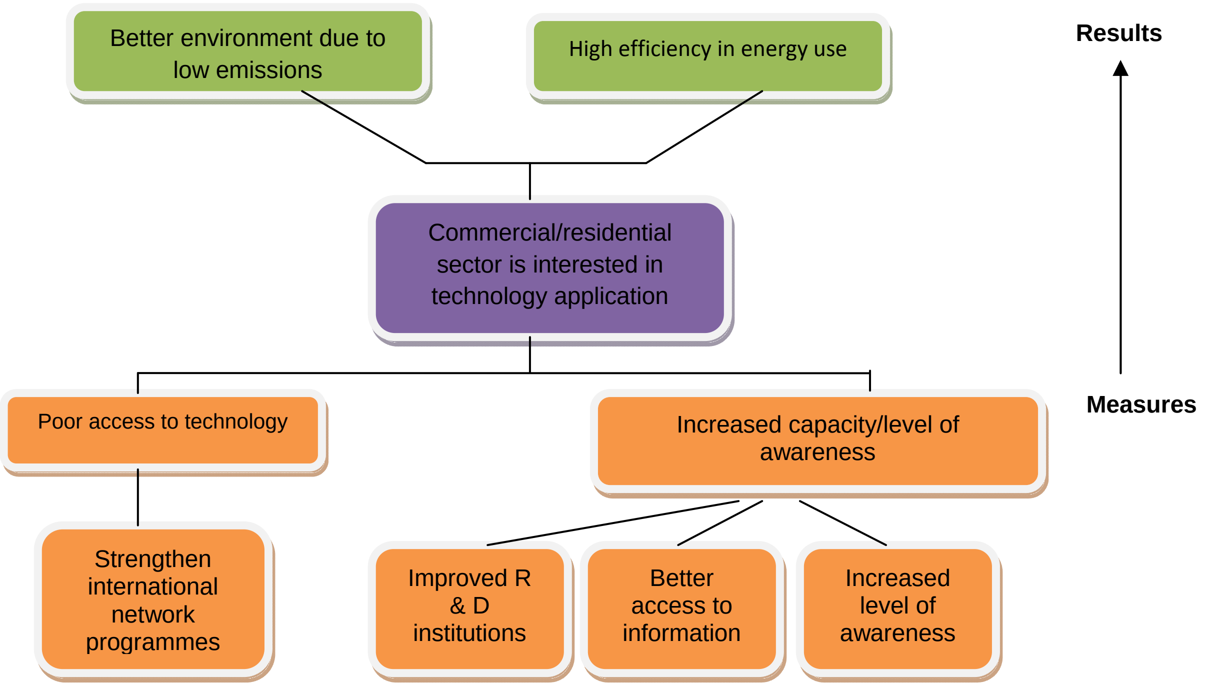

Figure 20: LPA for non-financial measures for heating pumps technology

2.4. Barrier analysis and possible enabling measures for biogas for heating/cooking and efficient stoves technology

2.4.1 General description of the technology

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

An advantage of biogas technology is that it can make a positive contribution to multiple goals in government programmes. It has the potential to become one of the most efficient and economical sources of renewable fuel with anaerobic digestion, and economically viable technology for small-scale rural applications in developing countries.

Possible negative aspects of the biogas installations are the potential reduction in soil fertility since animal dung is now used as feedstock for the biogas installation instead of for fertilization. Another potential problem is related to the possible build-up of pathogens (worms, protozoa and some fatal bacteria such as salmonella) in the biogas system.

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.

During discussions regarding the technology prioritization process, reforestation activities have been mentioned as one of the actions for carbon sink--predominantly in remote areas not supplied with gas, where local population still use wood for heating and cooking purposes. Currently used stoves are not efficient and consume too much wood. By introducing efficient stoves it is possible to reduce the impact on forests by local population in rural communities.

Application of the technology lines with the country's social, economic and environmental development priorities. With regard to the country's social development priorities, it increases livelihood of the population by reducing energy costs.

Regarding the country's economic development priorities, the technology contributes to security of energy supply and to socio-economic development of State Programmes. With regard to the country's environmental development priorities, the application of the technology contributes to government strategy to improve the environment in rural areas. Keeping manure and waste in a confined area and processing them in the digester reduces the amount of pollutants in the immediate environment and increases sanitation. Additionally, households will no longer need to extract wood for cooking, which can reduce deforestation levels in areas where people rely heavily on wood fuel. Moreover, the sludge remaining after digestion is a good fertilizer, which can increase land productivity and farm incomes.

According to rough estimates, the cost for application of biogas technology throughout the country will be 1.8 billion USD. Cost of GHG reduction will be 0.055 USD per kg CO_2.

2.4.2 Identification of barriers

Barriers related to biogas for heating/cooking and efficient stoves technology have been identified in four categories: i) economic/financial barriers, ii) technology barriers, iii) capacity building barriers and iv) social barriers.

2.4.2.1 Economic and financial barriers

High investment costs are the main barrier to technology deployment. Presently, there is production of biogas devices in Azerbaijan by private sector company, Alten Group. However, produced devices are not accessible for most of the rural population due to high prices.

A suitable economic environment should be created for local production of small-scale biogas equipment. Necessary customs and tax regulations and other enabling environment measures can stimulate the private sector to launch local production.

Access to financial means is another barrier. Private sector and local population do not have access to acceptable financial means, such as long-term and low-interest rates or credits, in order to launch business activities or purchase the equipment.

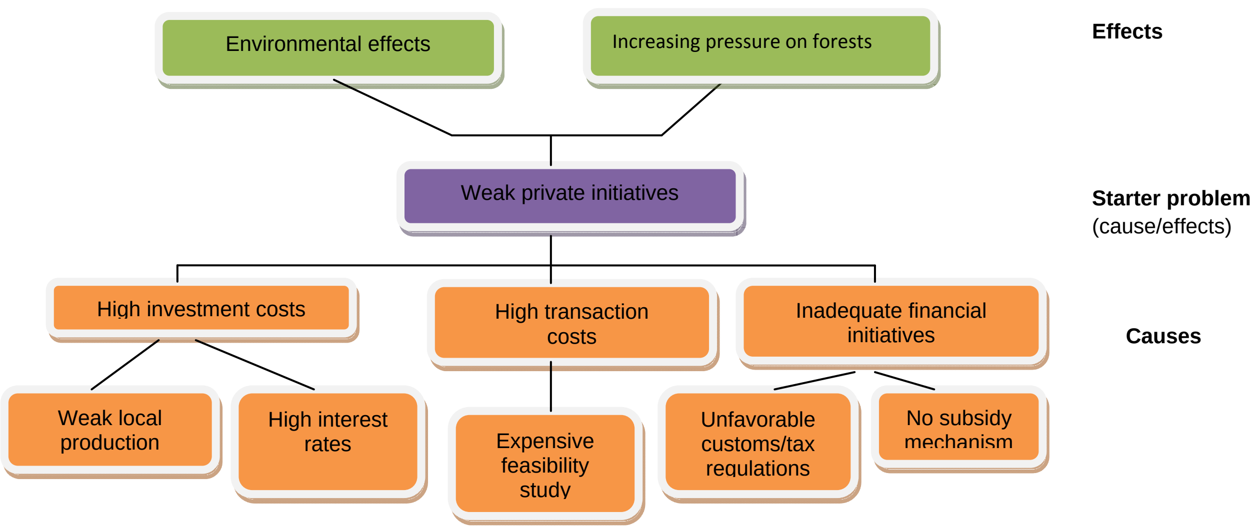

Figure 21: LPA for economic/financial barriers of biogas for cooking/heating technology

Based on the results of market mapping analysis (figure 29) it could be assumed that the current biogas technology market is underdeveloped. There is local production, but most of the technology is imported. The number of market players in the current technology market is low, as the technology is not widely applied and existing market opportunities do not provide suitable conditions for involvement of other key players (for instance, financial service providers) to the market chain. Along with this, business-extension services are very weak and almost non-functional in the market chain. Enabling environment also does not provide suitable opportunities for technology diffusion.

2.4.2.2 Non-financial barriers

Technology barriers:

One of the main technological barriers to the application of biogas for cooking/heating is that the technology is mainly imported into the country. Skills and capacity of related technical experts are not enough for the provision of qualitative technical services for applying the technology.

Capacity building/information barriers:

Capacity building is another barrier to the application of the technology. Local authorities and local farmers do not have enough information on advantages of the technology.

Social barriers:

Social barriers are also important barriers to the application of the technology. Farmers mainly use manure for increasing fertility of lands and in some parts for heating of stoves or cooking. Moreover, the local population uses traditional stoves for heating and cooking, as they are unaware of the advantages of efficient stoves, which use less wood.

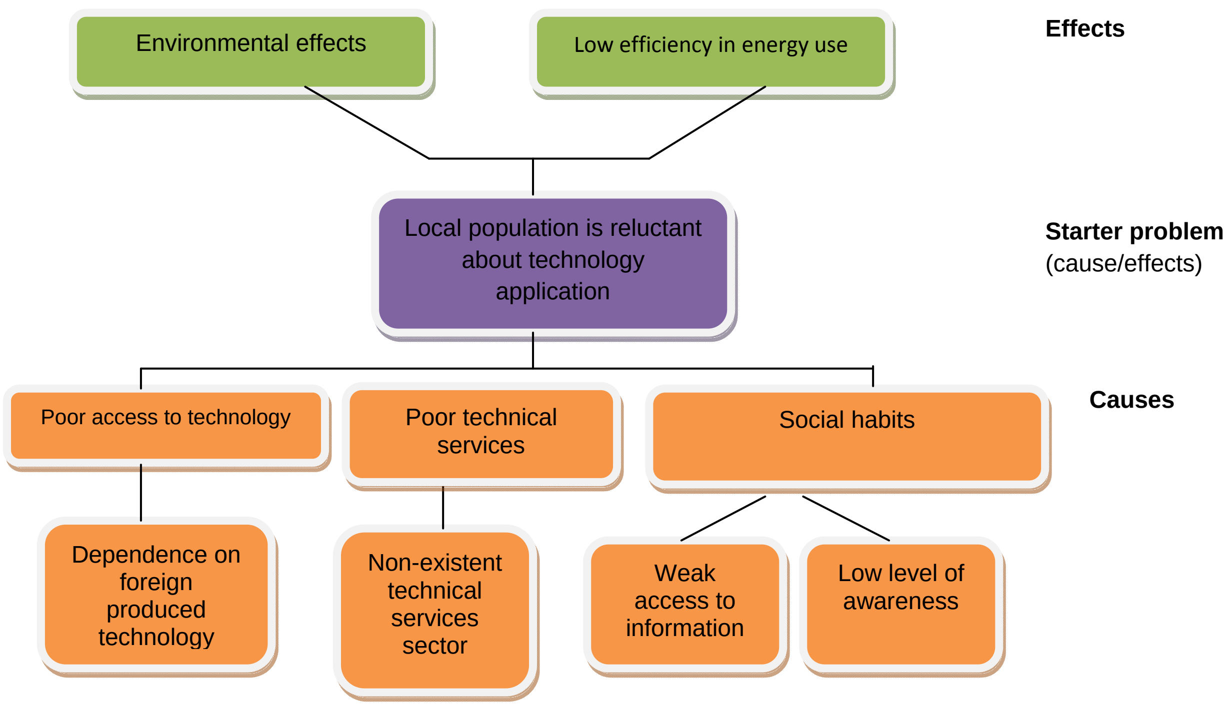

Figure 22: LPA for non-financial barriers of biogas for cooking/heating technology

2.4.3 Identified measures

2.4.3.1 Economic and financial measures

In order to overcome existing economic and financial barriers to the implementation of the technology, the following measures should be provided:

- Government should provide necessary customs and tax regulations in order to stimulate local production of the technology;
- Access to acceptable financial means should be created through state and international funds for private sector to launch local production or for local farmers to purchase the equipment;
- Develop specific subsidy mechanism for private sector to launch local production, as well as for local farmers to purchase and apply technology.

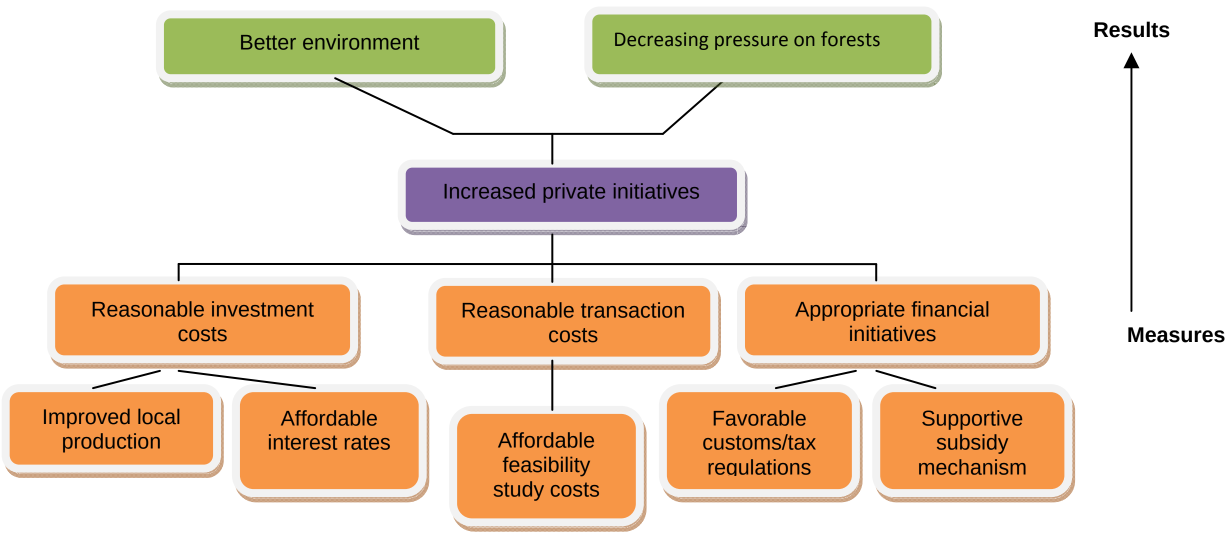

Figure 23: LPA for economic/financial measures for biogas for cooking/heating technology

2.4.3.2 Non-financial measures

In order to overcome existing non-financial barriers to technology implementation, the following measures should be provided:

- Technical advice and trainings as capacity building activities for R & D institutions and technical experts;
- Information campaigns and capacity building activities on the advantages of applied technology must be organized and funded in order to increase capacity and awareness level of local residents, local authorities and private sector, by involving NGO sector to the process;
- Pilot projects at local level (municipal or community level) must be implemented in order to demonstrate advantages and promote production and use of the technology.

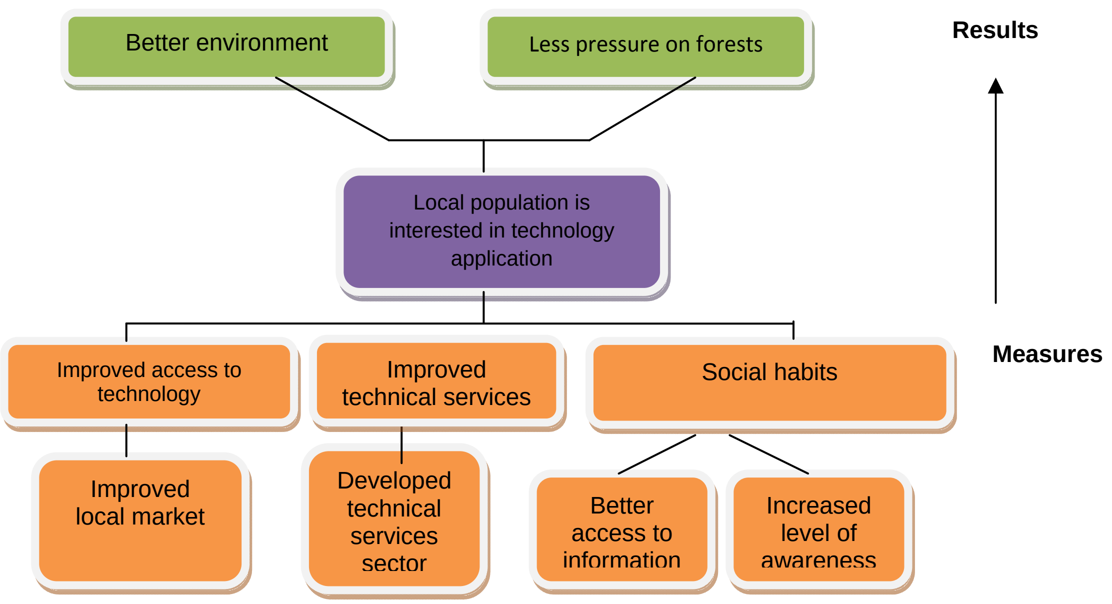

Figure 24: LPA for non-financial measures for biogas for cooking/heating technology

2.5. Linkages of barriers identified

It is possible to achieve synergy between identified barriers of technologies under commercial/residential sector, particularly with regard to financial barriers. Access to acceptable loans, as well as developing a mechanism for the provision of affordable financial loans and supportive subsidy for all technologies can be covered under one umbrella. Additionally, capacity building/awareness-raising activities for all three technologies may be addressed within one measure.

Barriers related to the implementation of commercial/residential sub-sector technologies could be summarized as follows:

Table 7: Summary of barriers of commercial/residental sub-sector

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	- 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
	- Standards and certification procedures are not in place		
Information/capacity building	- 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)

2.6. Enabling framework for overcoming barriers in commercial and residential sub-sector

The government of Azerbaijan has started implementing initiatives for application of new technologies in order to mitigate CO_2 emissons from this sub-sector. For instance, the government has begun promoting energy efficient lighting. Currently, the National Standard and Patent Agency within MED is preparing mandatory labels for light bulbs. Notwithstanding the undertaken measures, specific measures are necessary in order to overcome barriers to the application of prioritized technologies.

Table 8: Barriers and measures for commercial and residential sub-sector

Barriers	Measures
High efficiency lighting systems	
- Lack of financial means	- Enable provision of long-term and low-interest loans or grants through state funds (for instance, State Fund for Support to Entrepreneurship), private sources and international funds (GEF, GCF)
- Weak regulatory and legislative framework	- Improve legislative and regulatory reforms to stimulate application and local production of the technology
- Lack of coordination among relevant institutions	- Restructuring institutional basis for better coordination
- No subsidy mechanism	- Develop specific subsidy mechanism for private sector to promote local production
- Weak technical capacity of R & D institutions and technical experts	- Capacity building for R & D institutions and technical experts
- Standards and certification procedures are not in place	- Develop standards and certification procedures
- Lack of capacity and awareness level of local authorities, communal units and residents on advantages of the technology	- Capacity building for local authorities, communal units and residents - Information campaigns on the advantages of applied technology - Implementation of pilot projects at municipal or community level to demonstrate the advantages of the technology

Barriers	Measures
- No organized waste management of used bulbs	- Develop mechanism for waste management of used bulbs
Heating pumps	
- Insufficient public investments	- State investments for the application of technology at public facilities
- Weak access to financial means	- Enable provision of long-term and low-interest loans or grants through state funds (for instance, State Fund for Support to Entrepreneurship), private sources and international funds (GEF, GCF)
- Weak regulatory and legislative framework	- Necessary regulatory actions in the field of tax or customs regulations
- Weak technical capacity of R & D institutions	- Specific technical capacity building activities for R & D institutions and technical experts - Strengthen international research network programmes in order to learn from best international practices
- Lack of capacity and awareness level of local authorities, communal units and residents on advantages of the technology - Weak access to information on technology advantages	- Information campaigns on the advantages of applied technology - Implement pilot projects at municipal level
Biogas for heating/cooking and efficient stoves	
- Weak access to financial means	- Develop suitable credit mechanism to create access to financial means for rural population - Enable provision of long-term and low-interest loans or grants through state funds (for instance, State Fund for Support to Entrepreneurship), private sources and international funds (GEF, GCF)
- Weak regulatory and legislative framework	- Necessary regulations (customs and taxes) in order to stimulate local production of the technology
- Weak technical capacity	- Specific technical capacity building activities for R & D institutions and technical experts
- Lack of capacity and awareness level of local authorities and rural population on advantages of the technology	- Information campaigns on the advantages of applied technology
- Local traditions (unfamiliarity with new technology)	- Implement pilot projects at municipal and community level

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Annex I. Market maps for prioritized technologies

Figure 25: Market mapping for grid-connected wind power technology

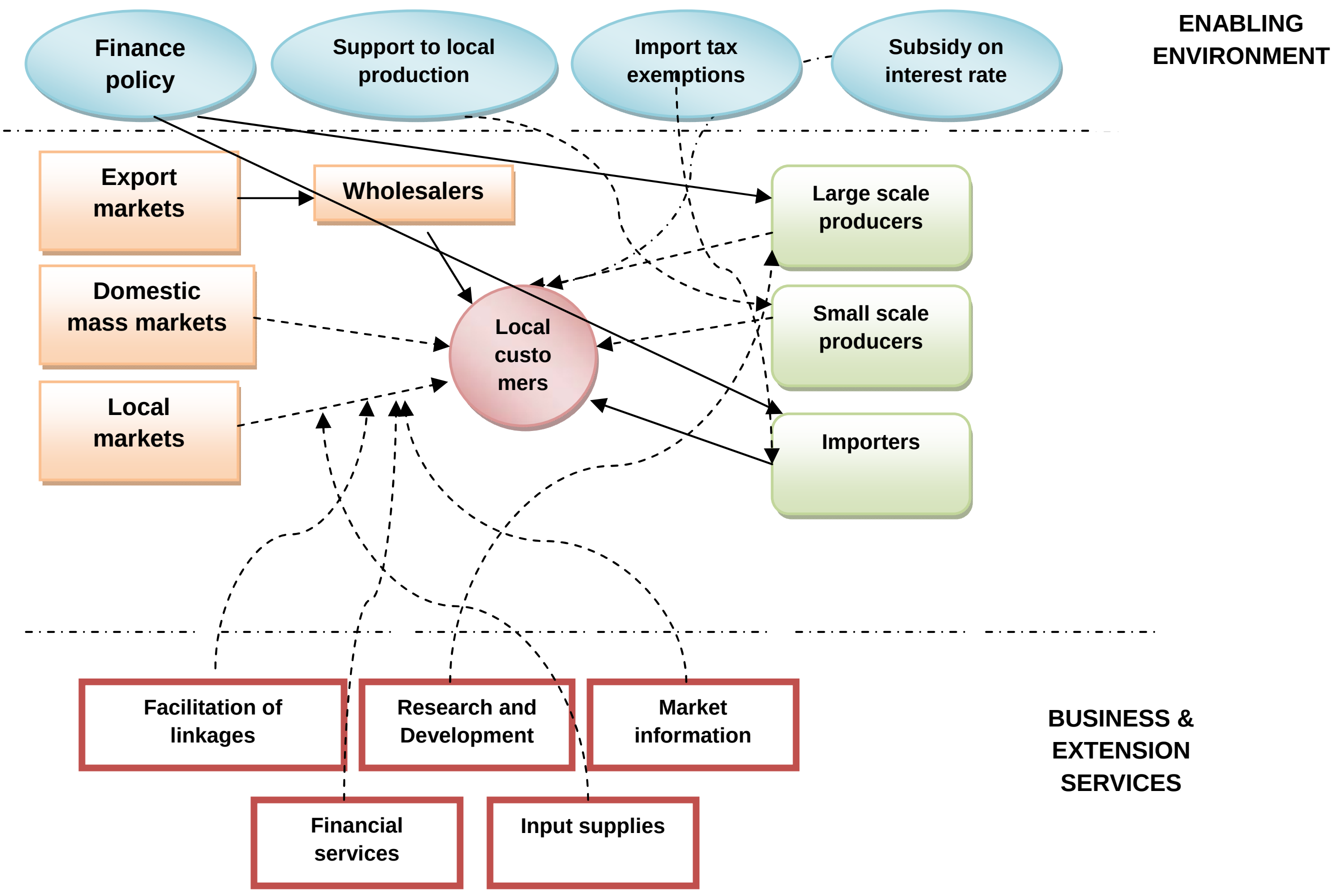


Figure 26: Market mapping for passive solar and photovoltaic technology

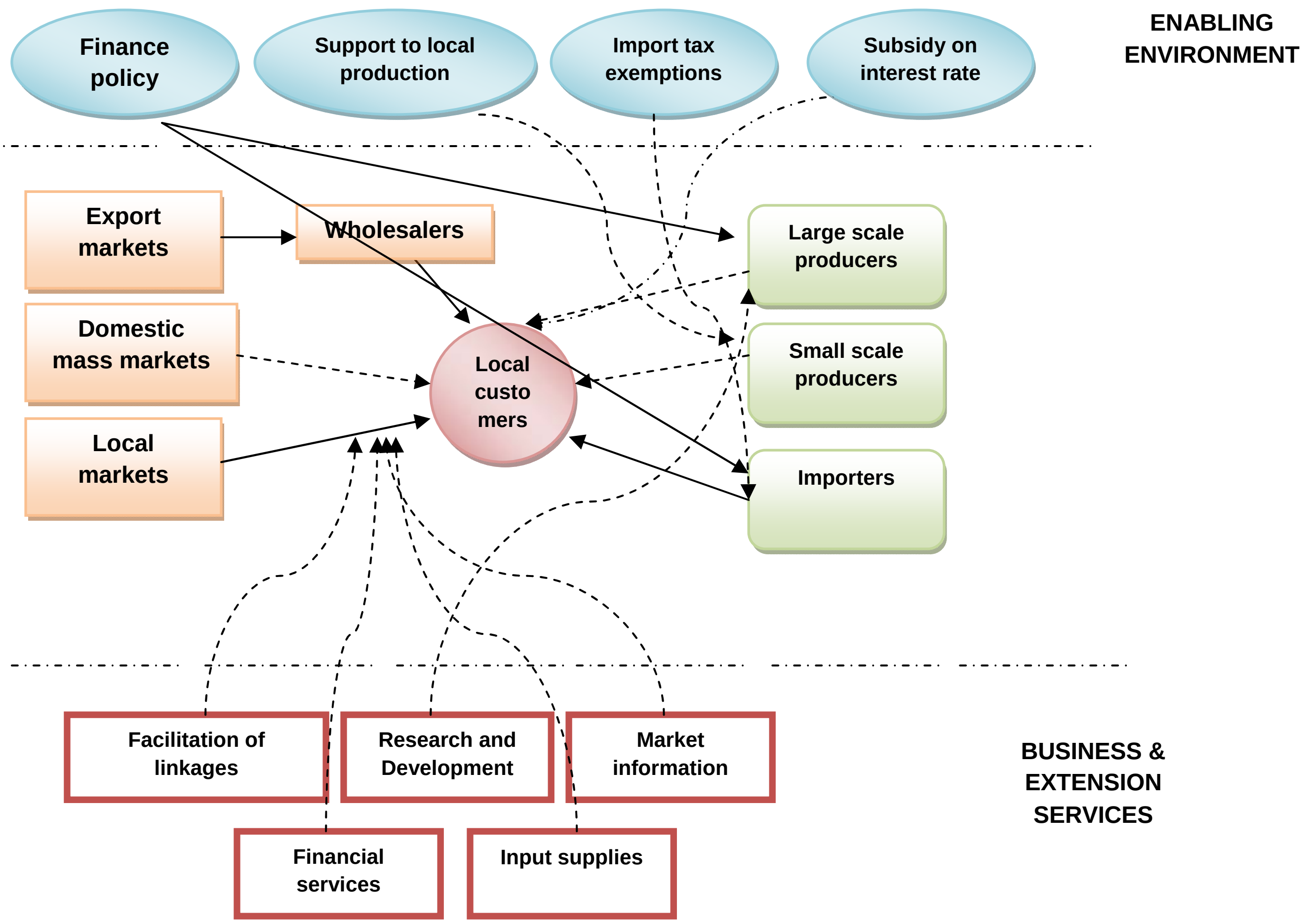


Figure 27: Market mapping for high efficiency lighting system technology

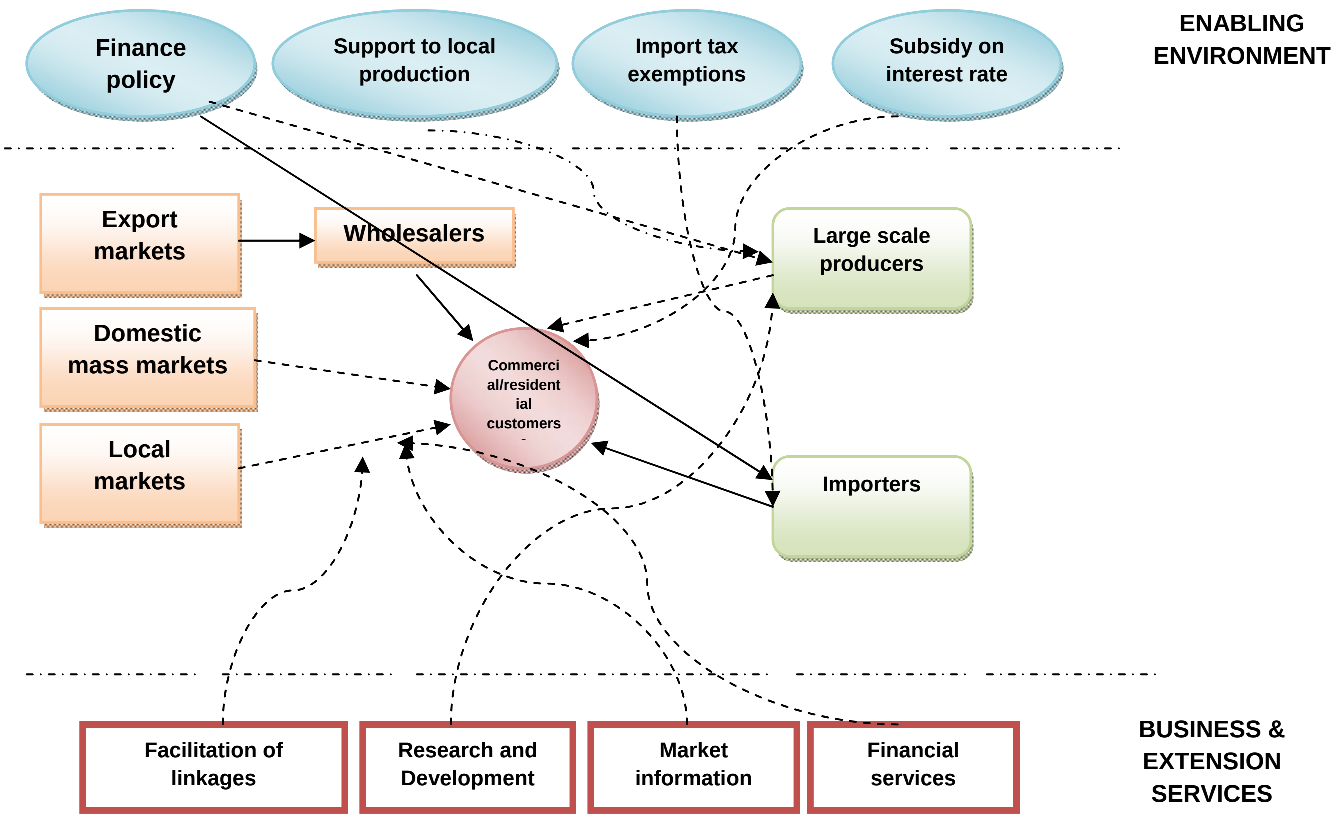


Figure 28: Heating pumps technology

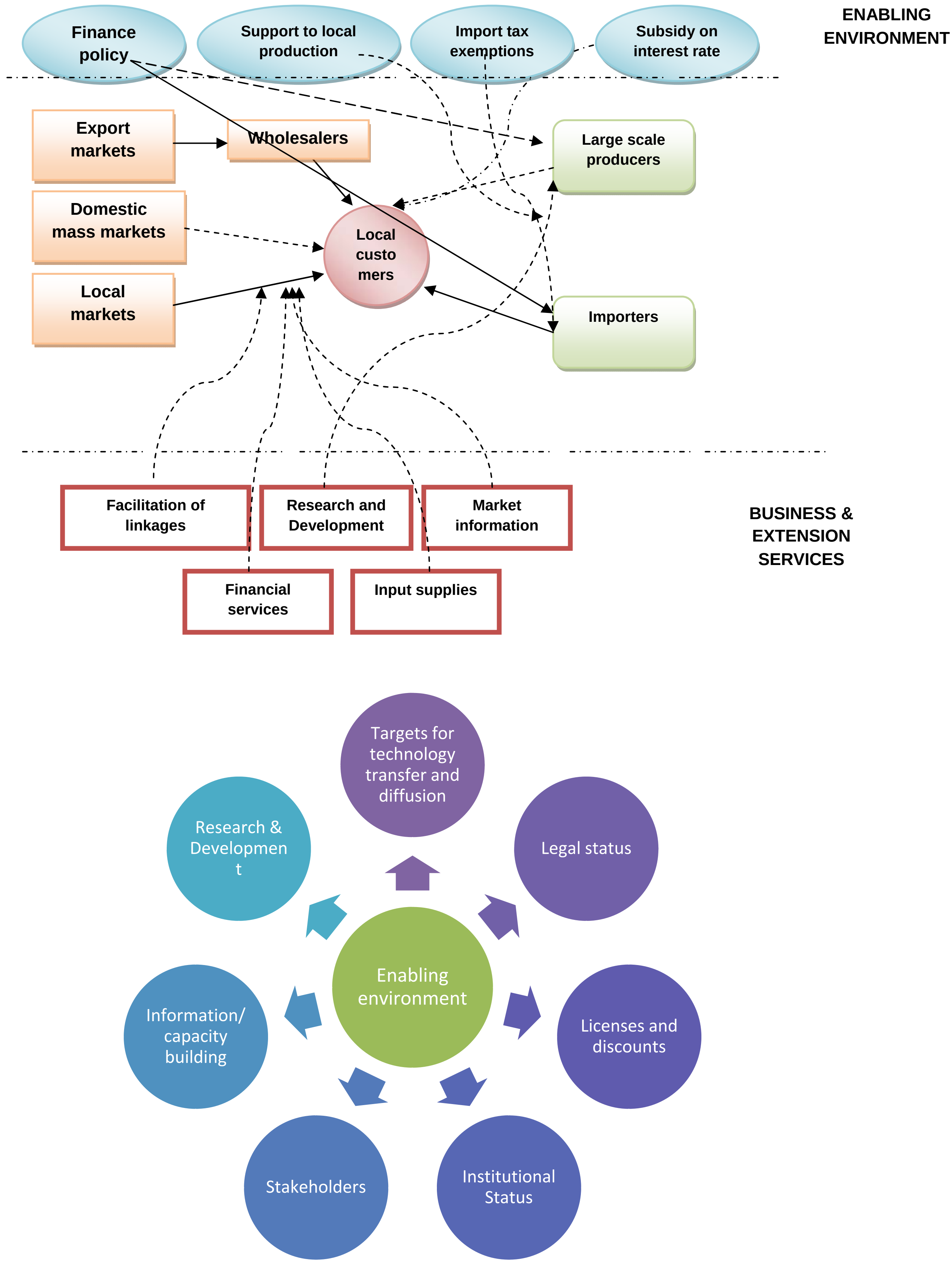
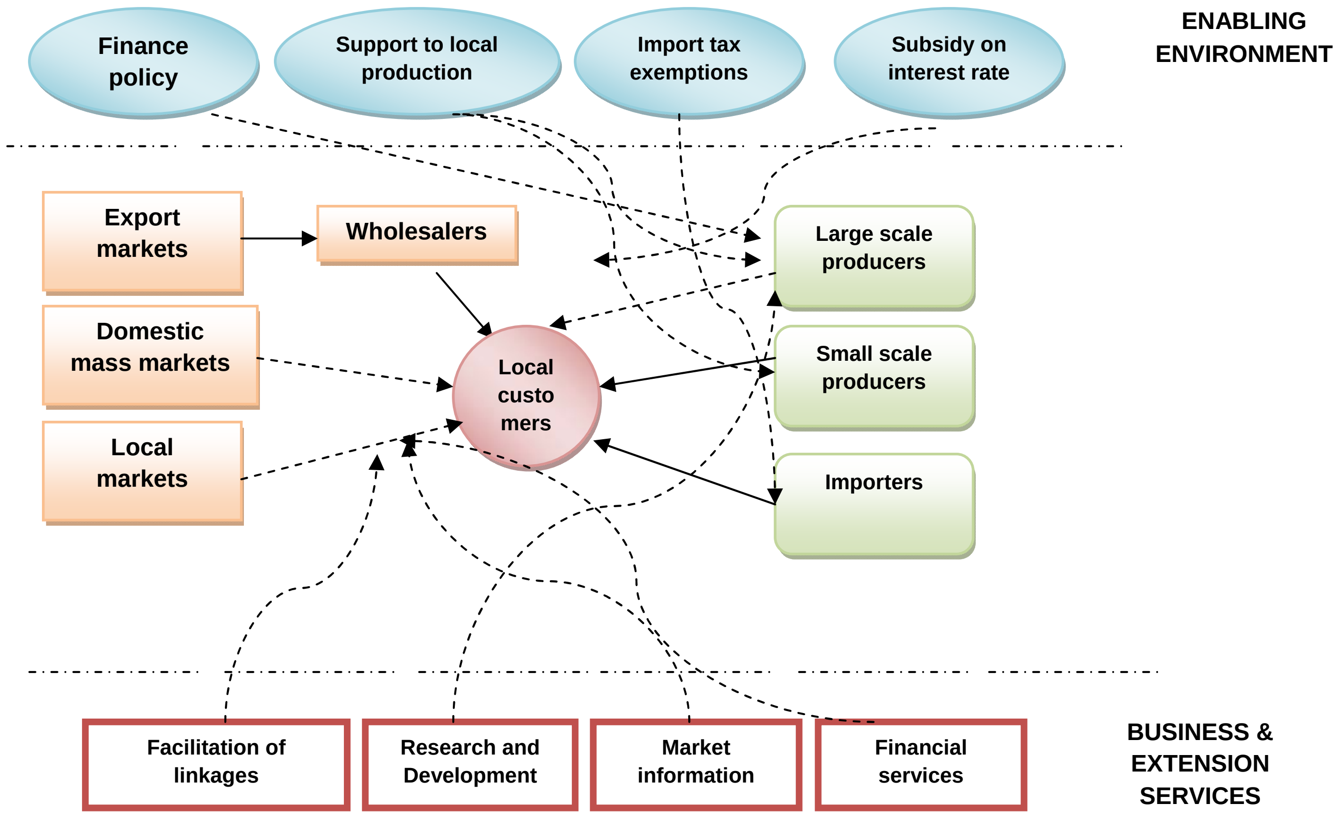


Figure 29: Market mapping for biogas technology



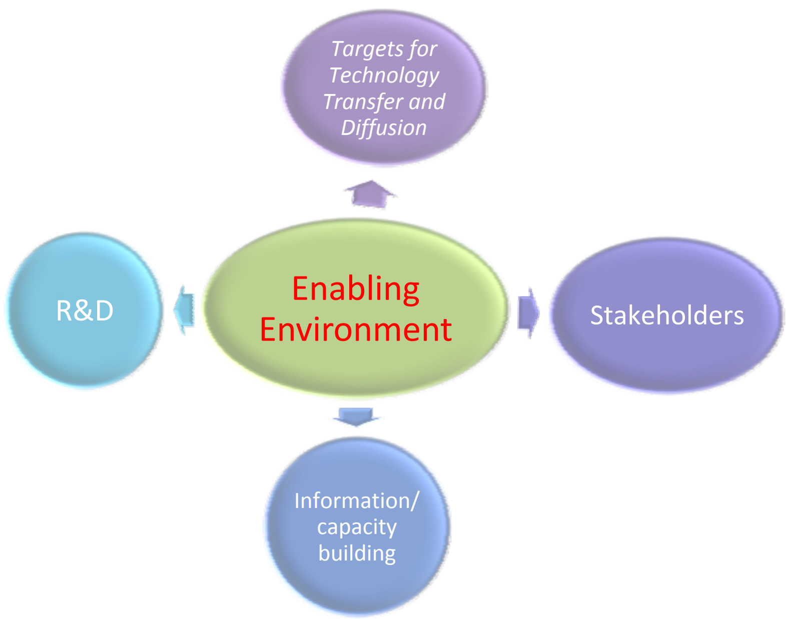
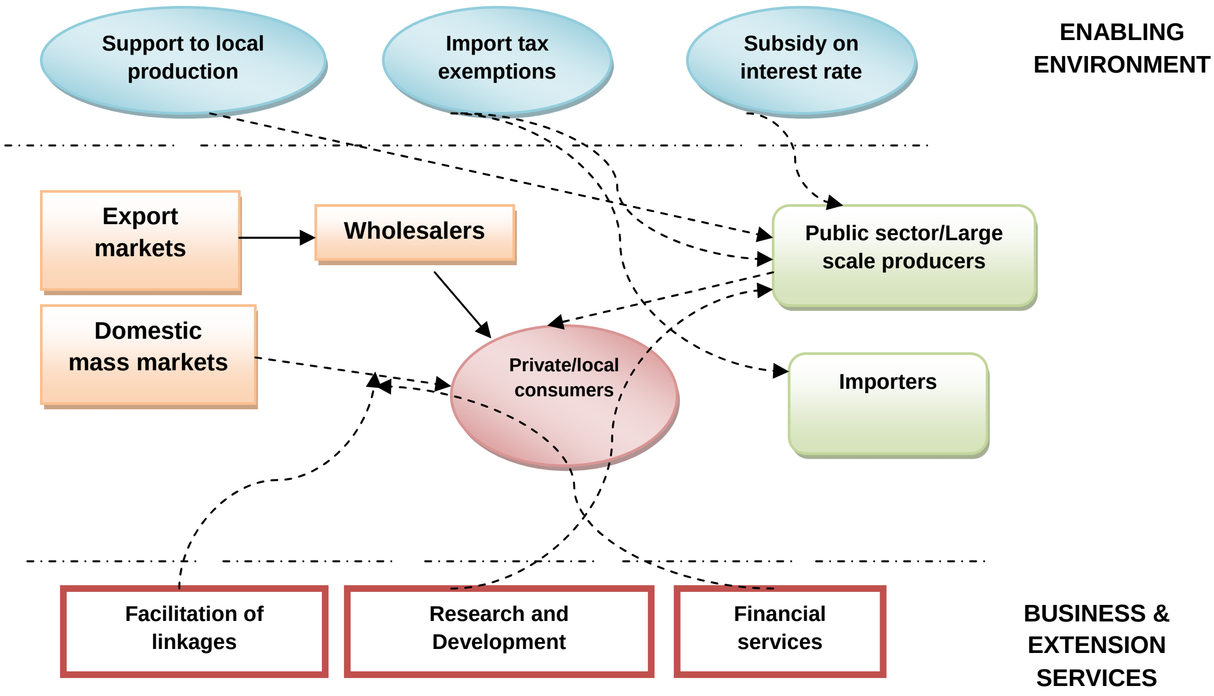


Figure 30: Market mapping for small hydro-power stations technology


Support to local production
Import tax exemptions
Subsidy on interest rate
ENABLING ENVIRONMENT
Export markets
Wholesalers
Domestic mass markets
Public sector/Large scale producers
Private/local consumers
Importers
Facilitation of linkages
Research and Development
Financial services
BUSINESS & EXTENSION SERVICES

Annex II. Technological Fact Sheets

Alternative energy sources technological fact sheets

Technological fact sheet (1)

Sector	Alternative energy sources
Sub-sector	Wind power plants
Technology name	Grid-connected wind power
Option name	
Scale	Large-scale
Availability	Available

Background/notes

Wind energy has great resource potential in most of the territories of Azerbaijan. The average annual wind speed of Absheron Peninsula, which is considered the windiest area, ranges from 5.8–8.0 m/s. The number of windy days in this area is between 245-280 days. The average annual wind speed of Nakhchivan Autonomous Republic is 1.9-2.7 m/s. The increase in the annual course of wind regime is recorded in the summer. The wind speed reaches 3.4-5.5 m/s from June to September. The average annual wind speed in the western regions of the Greater Caucasus is 0.8-2.3 m/s, while in the eastern regions it is 1.9-3.2 m/s. Annual increase in wind speed is recognized in the western regions from December to April, and from November to March in the eastern regions. The average annual wind speed is 1.8-2.4 m/s in the Lesser Caucasus. A slight increase in annual wind speed is observed at 2.8-3.2 m/s from April to December. The average annual wind speed is 1.8-2.4 m/s in the Central and lowland areas.

There are relevant governmental programs for the development of wind energy in the country. Azerbaijan has adopted State Program on utilization of alternative energy, including the wind energy sources (2005 – 2013). The objective of this State Program is to promote power generation from renewable and environmentally sound sources and to more efficiently utilize hydrocarbon energy sources. According to the program, Azerbaijan has set a target to have 20% share of renewable energy in electricity and 9.7% share of RE in total energy consumption by 2020. On 29 December 2011, the President of Azerbaijan Republic issued an order on preparation of National Strategy on the use of alternative energy for the period of 2012-2020. The main objectives of the strategy are to identify main directions of electricity from wind energy sources and legal framework for usage of wind energy sources.

- The State Company on alternative energy was recently established by Presidential Decree;
- There is cooperation with international companies on the production of wind techniques;
- The technology of wind turbines was implemented, as 2 MW turbines were constructed recently by SOCAR and private companies;
- There is experience on preparation of national technical specialists.

Advantages of the technology:

- The technology can be used in regions located far from the industrial centers;
- The technology can be used to supply electricity to individual households or used with combined regime with electricity grid;
- The technology can reduce grid electricity consumption and decrease use of organic fuels, thereby minimizing environmental effects due to emission reductions to soil, water and atmosphere air (CO_2, SO_2, NO_x etc.);
- The technology is ready for industrial application;
- Modern wind turbines have a low speed (20-40 rotations per minute) and their air-dynamics is very rigorously projected, following the goal of reducing the noise level to a minimum.

***Disadvantages of the technology**:*

- Relatively high cost of equipment;
- There is need for financial support;
- Weak development of the national industry for production of wind techniques;
- Weak public awareness on wind energy advantages;
- As there are some negative effects related to electromagnetic and phonic pollution, there may be disruption to planted lands and landscape change;
- Requires environmentally sound location.

Implementation assumptions

According to evaluation conducted by various experts, Azerbaijan has 800-1500 MW annual wind energy resources. This reserve means 2.4 billion kW/h of electric power, which in turn can result in up to 1 million tons of conditional fuel economy annually. As a result of investigations carried out, based on long-term observations, it was determined that the most favorable wind conditions of Azerbaijan are in Absheron Peninsula, Caspian Sea coastal zone and in its islands.

- Installed capacity of the WPP with 3 MWt;
- Air generator (AG) type deWind D6;

- Yearly energy volume produced by the power station -- 11,037 kWh/year; - Actualized energy volume W_a produced during the entire period of the power stations life – 83,947 kWh; - Investment in the WPP -- 4,117 Euro; - Specific investment in the WPP – 1.37 Euro/ kW; - Price of the produced energy – 0.052 Euro/ kWh.	
Impact statements (How the options impact countries development priorities)	
Countries social development priorities	• Creates employment opportunities. Typically a capacity of 1 kW of wind energy creates work for 15-19 persons. • The growth of wind energy could contribute considerably to state energy security consolidation. • The implementation of wind energy sources would have a positive influence on public opinion, which would realize the necessity to protect the environment and reduce consumption of energy resources.
Countries economic development priorities	• External costs of electricity generated by wind energy were about 0.05-02 Euro/kWh. The production cost of grid electricity in Azerbaijan is 0.04 AZN/kWh. • Development of the national wind energy industry will decrease the initial capital investment.
Countries environmental development priorities	• Decreases SO_2 and NO_x emissions, which have a negative impact on woods, crops, generally on vegetation and particularly on the endangered species, by replacing grid electricity conception. • Technology is zero emission. • Technology is environmentally sound.
Reduction in GHG emission over 30 years	Total GHG emission reduction for the year 2030 will be 3.96 mln ton CO_2.
Costs	
Capital costs	Based on rough calculations, there is a potential for producing 800 MW of wind energy in Azerbaijan. Taking into account that the production of 3 MW of energy requires a 4,117,000 Euro investment, total capital costs will be around 1,097,000,000 Euro.
Operational & maintenance costs	Amortization costs of the equipment may be considered as 10% of total cost per year.
Cost of GHG reduction	- Emission factor of the grid is 0.62 kg CO_2 /kWh (in 2006) - Price of the produced energy is 0.052 Euro/kWh Therefore, cost effectiveness for mitigation is 0.052/0.62 Euro per kg (CO_2) = 0.084 Euro per kg (CO_2) or 1.25 x 0.084 USD per kg (CO_2) = 0.105 USD per kg (CO_2).
Other costs	Additional costs may be needed to provide awareness-raising activities among local population and commercial sector in order to promote application of wind energy.

Technological fact sheet (2)

Sector	Alternative energy sources
Sub-sector	Solar energy
Technology name	Passive solar energy (hot water) and solar photovoltaic (electricity)
Option name	
Scale	Small-scale
Availability	Available

Background/notes

Solar energy has great resource potential in most of the territories of Azerbaijan. The number of annual sunshine hours in Azerbaijan is 2400-3200 hours. The quantity of solar energy received by each square meter of the earth's surface during a year is 1500-2000 kWh/m^2. Annual electric energy production of photovoltaic unit is 246 kWh/m^2 in the Nakhchivan AR area and 230 kWh/m^2 in the Kur-Absheron area, while the number of annual sunshine hours in Nakhchivan AR is 3200 and 2500 in the Kur-Absheron area. The quantity of annual solar energy per square meter is 2200-2600 kWh in Nakhchivan AR and 1900-2200 kWh in the Kur-Absheron area. There are relevant governmental programs for the development of solar energy in the country. Azerbaijan has adopted State Program on utilization of alternative energy, including the solar energy sources (2005 – 2013). The objective of this State Program is to promote power generation from renewable and environmentally sound sources and to more efficiently utilize hydrocarbon energy sources. According to the program, Azerbaijan has set a target to have 20% share of renewable energy in electricity and 9.7% share of RE in total energy consumption by 2020. On 29 December 2011, the President of Azerbaijan Republic issued an order on preparation of National Strategy on the use of alternative energy for the period of 2012-2020. The main objectives of the strategy are to identify main directions of electricity from solar energy sources and legal framework for usage of solar energy sources.

- The State Company on alternative energy was recently established by Presidential Decree;
- Technical capacity for solar energy is developed. Newly established company Sumgait Technology Park produced the solar collectors for production of hot water;
- There is cooperation with international companies on the production of solar energy techniques;
- The technology of solar collectors and panels was implemented, as solar collectors used by SOCAR are now widely used by the population for private purposes;
- There is experience on preparation of national technical specialists.

Advantages of the technology:

- The technology can be used in regions located far from the industrial centers;
- The technology can be used to supply electricity and heat to individual households or used with combined regime with electricity grid;
- The technology can reduce grid electricity consumption and decrease use of organic fuels, thereby minimizing environmental effects, due to emission reductions to soil, water and atmosphere air (CO_2, SO_2, NO_x etc.);
- The technology is ready for industrial application.

Disadvantages of the technology:

- Relatively high cost of equipment;
- There is need for financial support;
- Weak development of the national industry for production of solar techniques;
- Weak public awareness on solar energy advantages;
- Dependent on weather conditions;
- Does not work during night period;
- Requires combined regime of operating.

Implementation assumptions (How the technology will be implemented and diffused across the sub-sector)	a) Solar installations for hot water production - area of the collector – 219 m^2 - volume of the reservoir – 5 m^3 - specific price – 637 USD/m^2 - volume of the produced energy – 2.25 MWh/year - price of thermal energy -- 0.102 USD/kWh By 2030, for the use of collectors with the area of 10,000 m^2 there will be a need for 637 USD/m^2 x 10,000 m^2 = 6,370,000 USD b) photoelectric system - investment -- 3700 – 6800 USD kW - price of produced energy – 0.12 – 0.53 USD kWh at 3% By 2030, investment for construction of 3000 kWh average 5,000 USD = 15,000,000 USD.

Impact statements (How the options impact countries development priorities)	
Countries social development priorities	• Creates new employment opportunities. • The implementation of solar energy sources would have a positive influence on public opinion, which would realize the necessity to protect the environment and reduce consumption of energy resources.
Countries economic development priorities	• The economic effects depend on technological application (solar stations for water heating, installations for drying fruits and vegetables, photovoltaic electricity).
Countries environmental development priorities	• Technology is zero emission. • Technology is environmentally sound. • Produced thermal or electricity substitutes the organic fuel use in grids.
Reduction in GHG emission over 30 years	417 thousand ton CO_2.
Costs	
Capital costs	21,370,000 USD
Operational & maintenance costs	Amortization costs of the solar equipment may be considered as 10% of total cost per year.
Cost of GHG reduction	- Emission factor of the grid is 0.62 kg CO_2 /kWh (in 2006) - Price of the produced energy: a) Solar installations for hot water production are 0.102 USD/kWh - Cost effectiveness for mitigation is 0.102/0.62 = 0.16 USD per kg (CO_2) b) photoelectric system Cost effectiveness for mitigation is (0.12÷0.53)/0.62 = 0.19÷0.85 USD per kg (CO_2)
Other costs	Additional costs may be needed to provide awareness-raising activities among local population and commercial sector in order to promote application of solar energy.

Technological fact sheet (3)

Sector	Alternative energy sources
Sub-sector	Small hydro-power plants
Technology name	Small hydro-power plants at mountain rivers
Option name	
Scale	Medium-scale
Availability	Available
Technology to be included in prioritization?	Yes

Background/notes

Small hydro-power potential in Azerbaijan is about 5 bln kWh. Economically efficient resources are about 1.7 bln kWh. Currently, small HPPs are partially running in different regions of the country, such as the 1.6 MW Sheki HPP, 1.2 MW Gusar HPP, 3.0 MW Chichekli HPP, 0.8 MW Chinarly HPP, 8.8 MW Zeykhur HPP, 0.8 MW Nyugedi HPP and 3.8 MW Mugan HPP. These small HPPs have been provided for privatization in 2001 by AR Presidential Decree; three small HPPs are already privatized. In general, the operating life of these small HPPs is over as they had been erected between 1950-1960 and are currently over 70-80% deteriorated. Some of them are fully dismantled. Future construction of 173 small HPPs with an annual output of 3.2 bln kWh of electric energy is in the works. More reasonable is the construction of 61 small HPPs, which are efficient and economical in the short-term perspective. These HPPs may be erected on irrigation canals, trained (control-flow) rivers, or near the water-storage reservoirs.

There are relevant governmental programs for the development of small hydro-power energy in the country. Azerbaijan has adopted State Program on utilization of alternative energy, including the small hydro-power energy sources (2005 – 2013). The objective of this State Program is to promote power generation from renewable and environmentally sound sources and to more efficiently utilize hydrocarbon energy sources. According to the program, Azerbaijan has set a target to have 20% share of renewable energy in electricity and 9.7% share of RE in total energy consumption by 2020. On 29 December 2011, the President of Azerbaijan Republic issued an order on preparation of National Strategy on the use of alternative energy for the period of 2012-2020. The main objectives of the strategy are to identify main directions of electricity from small hydro-power energy sources and legal framework for usage of small hydro-power energy sources.

- There is cooperation with international companies on the production of small hydro-power plants;
- The practices of small hydro plants were gained;
- There is experience on preparation of national technical specialists.

Advantages of the technology:

- They may be located close to energy consumers;
- Losses occurring during the long distance transportation of the energy are low;
- Smaller HPPs conserve the natural landscape;
- Smaller HPPs eliminate the possibility of GHG emissions.

Disadvantages of the technology:

- The technology depends on the geographical climate and relief conditions.

Implementation assumptions (How the technology will be implemented and diffused across the sub-sector)	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. The technical potential for energy production is 4.9 billion kW-hours and economic cost-effective potential is 1.7 billion kW-hours. The amount of fuel economy is 0.57 million tons. There are sample opportunities to use small HPPs to supply power to establishments that are lacking permanent electric energy as well as those located far from the State energy system.
Impact statements (How the options impact countries development priorities)	
Countries social development priorities	•Creates employment opportunities. •The implementation of small hydro-power energy sources would have a

	positive influence on public opinion, which would realize the necessity to protect the environment and reduce consumption of energy resources.
Countries economic development priorities	• There is investment opportunity for 8-10% of bank interest annually. • The price of 1 kWh energy ranges from 1.5-5.7 USD.
Countries environmental development priorities	• Technology is zero emission and environmentally sound.
Reduction in GHG emission by 2030	• Reduction of carbon dioxide emissions by 2030 is 3.24 mln ton CO_2.
Costs	
Capital costs	By 2030, 164 small HPPs with an average power of 2 MW are planned on being established. Taking into account that the investment cost for production of 1 kW of electricity is around 2000 USD, total capital costs will be around 656,000,000 USD.
Operational & maintenance costs	There will be a need for operation and maintenance costs to establish small hydro-power stations, such as salary for staff, repair and protection, etc.
Cost of GHG reduction	- Emission factor of the grid is 0.62 kg CO_2 /kWh (in 2006) - Price of the produced energy power is 25 – 75 USD/kW - Price of the produced energy (0.011÷0.078) USD/kWh Therefore, cost effectiveness for mitigation is (0.011÷0.078)/0.62 = (0.018÷0.126) USD per kg (CO_2).
Other costs	***

Commercial and residential sector technological fact sheets

Technological fact sheet (4)

Sector	Commercial and residential sector
Sub-sector	
Technology name	High efficiency lighting systems
Option name	
Scale	Small-scale
Availability	Available
Technology to be included in prioritization?	Yes

Background/notes

Lighting generates greenhouse gas emissions of 1,900 Mt of CO_2 per year, which is the equivalent of 70% of the emissions from the world's light passenger vehicles. According to the IEA, lighting ranks among the major end-uses in global power demand. Lighting represented 650 mtoe of primary energy consumption and 2550 TWh of electricity consumption in 2005. Therefore, grid-based electric lighting is equivalent to 19% of total global electricity production. Statistics supplied by the IEA report (2006) show that lighting requires as much electricity as is produced by all gas-fired generation or 1265 power plants. Of this amount, the major consumption sectors are commercial at 43%, residential at 31%, industrial at 18% and outdoor stationary sources at 8%.

Advantages of the technology:

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.

Disadvantages of the technology:

Initial costs of the bulbs are high. However, due to other savings, they provide additional future benefits. Consumers may need to be provided with awareness-raising activities to understand this trend.

Implementation assumptions (How the technology will be implemented and diffused across the sub-sector)	Commercial and residential sector is a major part of consumer segment in electricity. Statistical numbers of 2010 show that total electric energy consumption of the residential sector was 5.075 million kWt/hours, and 3.478 million kWt/hours in the commercial sector. The replacement of existing bulbs with 20-25 W compact fluorescent ones will result in 7.800 million kW-hours or 73% of electric power economy.
Impact statements (How the options impact countries development priorities)	
Countries social development priorities	• Improved livelihood of population by reducing energy costs.
Countries economic development priorities	• Contributes to security of energy supply. • Generates new manufacturing sector leading to the reviving of that economic sector.
Countries environmental development priorities	• Contributes to government strategy to provide more environmentally sound energy supply.
Reduction in GHG emission by 2030	• Rough estimate of GHG reduction is 90 MT.
Costs	
Capital costs	Price of one bulb depends on quality and manufacturer. On average, price of one bulb is about 2-3 USD. Total capital costs in the case of full replacement (312 million bulbs) will be 936 million USD.
Operational & maintenance costs	none
Cost of GHG reduction	0.087 USD per kg CO_2.
Other costs	Additional costs may be needed to increase awareness level of consumers in order to promote the application of high efficiency lighting systems.

Technological fact sheet (5)

Sector	Commercial and residential sector
Sub-sector	
Technology name	Heating pumps
Option name	
Scale	Small-scale
Availability	Available
Technology to be included in prioritization?	Yes

Background/notes

According to IEA Heat Pump Centre, in February 2006, a 30% market penetration of heat pumps into existing heating markets would reduce global CO_2 emissions by 6%. This is equivalent to 1,500 Mt of CO_2 per annum (IEA Heat Pump Centre, 1997 and 2006).

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 up front capital costs are higher. Heat pumps can be applied in the following places:

- Swimming pools and other large-scale low-temperature uses (*e.g*. greenhouses);
- Hotels;
- Schools;
- Government buildings;
- Commercial buildings;
- Apartment buildings;
- Domestic space and water heating.

In the year 1990, 21,399 Gcal of thermal energy was produced in Azerbaijan. Statistical data shows that by 1998 this volume decreased by 68%, 12% of which was due to the housing sector.

Advantages of the technology:

The system is more energy efficient.

Disadvantages of the technology:

Although running costs are lower, investment costs for the equipment are high.

Implementation assumptions (How the technology will be implemented and diffused across the sub-sector)	During the economic transition period (1995-2005) most heating systems were completely destroyed or not operated properly. There have been developments in this sector in recent years and most of the newly constructed buildings are equipped with modern heating systems. However, additional assessments are required in order to estimate current level of application of the system. 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 CO_2 emissions, on average.

Impact statements (How the options impact countries development priorities)	
Countries social development priorities	• Improved livelihood of population by reducing energy costs.
Countries economic development priorities	• Contributes to security of energy supply.
Countries environmental development priorities	• Contributes to government strategy to provide more environmentally sound energy supply.
Reduction in GHG emission by 2030	Rough estimate of reduction of GHG is 8 MT.
Costs	

Capital costs	Heat pumps are considerably more expensive than boilers, although running costs are much lower. Costs of the equipment depend on size of house or building. Rough estimates for application of combined heating system throughout the country is 1 billion USD (considering 4,000 USD cost per equipment).
Operational & maintenance costs	Amortization costs of the equipment may be considered as 10% of total cost per year.
Cost of GHG reduction	0.06 USD per kg CO_2.
Other costs	**

Technological fact sheet (6)

Sector	Commercial and residential sector
Sub-sector	
Technology name	Biogas for heating and electricity and efficient stoves
Option name	
Scale	Small-scale
Availability	Available
Technology to be included in prioritization?	Yes

Background/notes

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

Biogas is a gaseous mixture generated during anaerobic digestion processes using wastewater, solid waste (e.g. at landfills), organic waste (e.g. animal manure), and other sources of biomass. Biogas can be produced on a very small scale for household use, mainly for cooking and water heating.

A small domestic biogas system will typically consist of the following components:

- Manure collection: raw, liquid, slurry, semi-solid and solid manure can all be used for biogas production;
- Anaerobic digester: the digester is the component of the manure management system that optimizes naturally occurring anaerobic bacteria to decompose and treat the manure while producing biogas;
- Effluent storage: the products of the anaerobic digestion of manure in digesters are biogas and effluent. The effluent is a stabilized organic solution that has value as a fertilizer and other potential uses. Waste storage facilities are required to store treated effluent, as the nutrients in the effluent cannot be applied to land and crops year round;
- Gas handling: piping; gas pump or blower; gas meter; pressure regulator; and condensate drain(s);
- Gas use: a cooker or boiler.

Advantages of the technology:

Biogas can make a positive contribution to multiple goals in government programmes. It has the potential to become one of the most efficient and economical sources of renewable fuel with anaerobic digestion, and economically viable technology for small-scale rural applications in developing countries.

Disadvantages of the technology:

Possible negative aspects of the biogas installations are the potential reduction in soil fertility since animal dung is now used as feedstock for the biogas installation instead of for fertilization. Another potential problem is related to the possible build-up of pathogens (worms, protozoa and some fatal bacteria such as salmonella) in the biogas system.

Implementation assumptions (How the technology will be implemented and diffused across the sub-sector)	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. There are a number of initiatives under different projects for the application of biogas in rural areas of the country. Alten Group, a private company, is pioneering biogas plant production in Azerbaijan.

Impact statements (How the options impact countries development priorities)	
Countries social development priorities	• Improves livelihood of rural population. • Provides sustainable energy supply.
Countries economic development priorities	• Contributes to socio-economic development program in various regions of the country. • Improves security of energy supply.

Countries environmental development priorities	• Keeping manure and waste in a confined area and processing them in the digester reduces the amount of pollutants in the immediate environment and increases sanitation; • Households no longer need to extract wood for cooking, which can reduce deforestation levels in areas where people heavily rely on wood fuel; • The sludge remaining after digestion is a good fertilizer, increasing land productivity and farm incomes; • The release of methane is avoided, thus contributing to climate change mitigation.
Reduction in GHG emission by 2030	Rough estimate of reduction of GHG is 1.7 MT.
Costs	
Capital costs	A rough estimate of costs of a simple, unheated biogas plant, including all essential installations but not including land, is between 75-100 USD per m^3 capacity. About 35 - 40% of the total costs are for the digester. Price estimates for the cost of a small household unit is somewhere between 2000-2500 USD. Rough estimates for capital costs will be 1,800,000.000 USD.
Operational & maintenance costs	The equipment requires, on average, 10% operational or maintenance expenses – 180,000,000 USD.
Cost of GHG reduction	0.055 USD per kg CO_2.
Other costs	Additional expenses will be needed for raising awareness of rural population on application of the technology.

Annex III. List of stakeholders involved and their contacts

Institutions	Representative	Contacts
State organizations		
Ministry of Ecology and Natural Resources	G.Suleymanov	gulmali.cliamte@gmail.com
Ministry of Ecology and Natural Resources, Forest Development Department	A.Guliyev	azad_guliyev1960@box.az
Ministry of Economic Development	A.Cafarov	altay.cafarov@gmail.com
Ministry of Industry and Energy	F.Muradov	feyzulla.muradov@gmail.com
Climate change and Ozone centre under the Ministry of Ecology and Natural Resources	A.Mehtiyev	m_anar78@yahoo.com
National Academy of Sciences, Head of Radiation Division	I.Mustafayev	i_mustafayev@mail.ru
Public and private companies		
Azenerji Open Joint-Stock Company	A.Heydarov	Abdulkhaliq38@mail.ru
State Oil Company (SOCAR)	H.Ahmadov	Hamlet.axmadov@socar.az
State Oil Company (SOCAR)	M.Mehtiyev	m.mehtiyev@mail.ru
State Company of Alternative and Renewable Energy Sources of Azerbaijan Republic	C.Melikov	cmelikov@abemda.az
State Water Agency under Ministry of Emergency Cases	S.Hasanzade	sahib540@mail.ru
Sumgayit Technological Park	S.Musayev	s.musayev@gmail.com
Housing and Community Services of Baku	S.Mustafayev	togrul@mail.ru
Municipality of Sabitr settlement	N.Gadirov	nadgadirov@box.az
NGOs		
Azerbaijan Branch office of REC Caucasus	I.Aliyev	Issa.aliyev@rec-caucasus.org
"Ecooil"	M. Gurbanov	m_gurbanov@mail.ru
"Ecolife"	S.Hasanov	h.sadiq@mail.ru
Idependent expert (on energy and renewable energy sources)	Sh.Movsumov	movzumov@yandex.ru

Annex IV. Policy Fact Sheets

Policy: Promote application of renewable energy sources	
Name of field	**Content**
Date Effective:	
Date Announced:	21/10/2004
Date Promulgated:	-
Date Ended:	-
Unit:	Renewable energy sources
Country:	Azerbaijan
Year:	2004
Policy Status:	In force
Agency:	Ministry of Industry and Energy, State Agency on Renewable Energy Sources (renamed State Company on Renewable Energy Sources)
Funding:	State budget, international donor funding
Stated Objective:	Assess potential of renewable energy sources and promote application and local production
Description:	Program aims to promote application of renewable energy sources, such as solar, wind energy and biogas, by increasing awareness-level and supporting local production

Policy: Development of energy and fuel complex of Azerbaijan	
Name of field	**Content**
Date Effective:	
Date Announced:	14/02/2005
Date Promulgated:	-
Date Ended:	2015
Unit:	Energy industry
Country:	Azerbaijan
Year:	2005
Policy Status:	In force
Agency:	Ministry of Industry and Energy
Funding:	State budget, international donor funding
Stated Objective:	Develop energy supply and assess potential of renewable energy sources and promote application and local production
Description:	Program aims to develop energy production, supply and enhance application of modern technologies, including promotion of renewable energy sources, such as solar, wind energy and biogas, by increasing awareness-level and supporting local production

Policy: Development of alternative energy sources in Azerbaijan	
Name of field	**Content**
Date Effective:	16/11/2009
Date Announced:	16/11/2009
Date Promulgated:	-
Date Ended:	2010
Unit:	Energy industry
Country:	Azerbaijan
Year:	2009
Policy Status:	In force
Agency:	Ministry of Industry and Energy, SOCAR
Funding:	State budget, international donor funding
Stated Objective:	Provide additional studies in development of alternative energy sources, assess potential of renewable energy sources and promote application and local production
Description:	Program aims to identify current potential of the country in renewable energy sources, especially in small hydro-power stations