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STRATEGY

FOR THE MANAGEMENT OF FIREWOOD COLLECTION AND DISTRIBUTION FROM THE FORESTS

STRATEGY

FOR THE MANAGEMENT

OF FIREWOOD

COLLECTION AND DISTRIBUTION

FROM THE FORESTS

Yerevan 2020

The strategy was developed under the auspices of the Ministry of Environment of the Republic of Armenia by UNDP and GEF financial support within the framework of the “Mainstreaming Sustainable Land and Forest Management in the Mountainous Landscapes of Northeastern Armenia” project.

The views expressed in this publication are those of the author and do not necessarily reflect the views of the United Nations Development Programme

The study was conducted by the EA Energy Advisory LLC

This study aims to define an alternative strategy to address the managment of firewood collection and distribution from th eforest. For this purpose the relevant policy, legal and regulatory framework was anlaysed at first hand, than field investgations were performed to find the local people needs, options and use of alternative sources of energy, feasibility of alternative options of energy to fuelwood in terns of policy, supply and demand, technival, economic and social aspects. Finally road map is developed with recommedations to deal with alternative energy needs of local communities, including options for improved managment of fuel wood harvest and collection, alternative sources of energy and mechanisms for their implementation. The results of this study are intended for a wide range of professionals in the fields of forestry, agriculture, environment, engineering, economics and related fields, as well as students and researchers

CONTENT

ABBREVIATIONS

AMD	Armenian Dram
CBA	Cost benefit analysis
CSO	Civil Sociality Organization
EA	EA Energy Advisory LLC
EAEU	Eurasian Economic Union
EE	Energy Efficiency
EN	European Standart
ESCO	Energy service company
EU	European Union
FDGs	Focus Group Discussions
GEF	Global Environment Facility
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HH	Household
ILCS	Integrated Living Conditions Survey
ISO	International Organization for Standardization
MoTAI	Ministry of territorial administration and infrastructures
NE	North-Eastern
NEEA	National energy efficiency action plans
NGO	Non-Govermental Organization
PPP	Public Private Partnership
RA	Republic of Armenia
RA NSS	National Statistical Service of Republic of Armenia (now Statistical Committie of Armenia)
RE	Renewable Energy
RIL	Reduced Impact Logging
SNCO	State Non-Commercial Organization
SNPO	State Non-Profit Organization
SWH	Solar Water Heaters
TFC	Total fixed cost
UDC	Urban development committee
UNDP	United Nations Development Programme
USD	United State Dollar
VAT	Value Added Tax

COLLECTION, TRANSPORT AND USE OF **FIREWOOD**

1. REVISED CURRENT POLICY, LEGAL, REGULATORY FRAMEWORK (INCLUDING IMPORT, TAX AND CUSTOM REGULATIONS) AND GOVERNANCE ASPECTS ON COLLECTION, TRANSPORT AND USE OF FIREWOOD; HISTORICAL PATTERNS OF FIREWOOD USE AND POTENTIAL IMPACTS ON THE FOREST AND BIODIVERSITY

1.1. INTRODUCTION

1.1.1. Authorization

Client and Initiator of the project is:

The United Nations Development Programme (UNDP).

Implementing Partner of UNDP: The UNDP/GEF "Mainstreaming Sustainable Land and Forest Management in Mountain Landscapes of North-eastern Armenia".

The long-term solution sought is to facilitate shift from unsustainable to sustainable forest management in NE Armenia. The target area contains 65% of Armenia's forest resources and provides essential ecosystem services including water provision (for urban use and food production), land slide control and carbon storage and sequestration. The project will promote an integrated approach towards fostering sustainable forest management – seeking to balance environmental management with development and community needs.

The project major objective is sustainable land and forest management in the North-eastern Armenia to secure continued flow of multiple ecosystem services (such as water provision, land slide control and carbon storage /sequestration) and to ensure conservation of critical wildlife habitats through the removal of the aforementioned barriers will ensure sustainable land and forest management to secure continued flow of multiple ecosystem services. This would be achieved through two main components, namely: (i) Integration of sustainable forest and land management objectives into planning and management of forest ecosystems to reduce degradation and enhance ecosystem services in two marzes covering 0.65 million hectares; and (ii) Sustainable Forest Management practices effectively demonstrating reduced pressure on high conservation forests and maintaining flow of ecosystem services.

It will attempt to reduce conflicting forest land-uses and improve the sustainability of forest management to maintain the flow of vital ecosystem services and sustain the livelihoods of local forest-dependent communities (and downstream users). This platform will be underpinned by a robust forest management planning support system and monitoring framework that will inform plans for the forest estate.

Consultant of the Project is:

EA ENERGY ADVISORY LLC (EA)

EA is a private consulting company which offers comprehensive Consulting and Technical Services, Design and Engineering, environmental, and specifically new energy facility construction supervision services to support public and private sector clients with bringing energy projects to the market of the Republic of Armenia. The company strongly support and enable environments for successful implementation of large-scale investment projects in the energy sector, including the projects based on PPP model of partnership. EA assists its clients in relevant capacity building and transaction-specific support throughout the project life cycle.

1.1.2. Objective and Background of the Project

With the elimination of the subsidized energy following independence, the dependency on firewood for household energy has placed a greater burden on the remaining forests in Armenia. The government policy to provide each household with 8m3 of firewood (2011, Governmental decision 1535-Ն) has further

placed heavy burden on the forestry sector to find solutions to meet this need without compromising on the efforts to manage forest degradation. The issue of firewood demand and supply is hence a complex issue that would require an integrated management approach that takes into consideration options for provision of alternative sources of energy on the one hand and the sustainable forest management on the other.

1.1.3. Objectives of the Consultancy Services

The objective of this task is to define an alternative strategy to address the management of firewood collection and distribution from the forest

EA Energy Advisory LLC (EA) -The Consultant will:

- review of current policy, legislation, existing regulatory framework (including import, tax and custom regulation related to wood and wood products) and practice governing the collection, transport and use of firewood;
- assessing the historical patterns of firewood use and potential impacts on the forests and biodiversity;
- desk review on previous similar studies, set up clear methodology/approach for understanding the needs of the local people and options and perceptions of local community on the provision and use of alternative sources of energy;
- review feasibility of alternative options of energy to fuelwood and implications in terms of policy, supply and demand, technical feasibility, economic and social aspects;
- provide road map with recommendations for dealing with alternative energy needs of local communities, including options for improved management of fuel wood harvest and collection, efficient isolation of houses, alternative sources of energy and mechanisms for their implementation

The current report covers: **Report on revised current policy, legal, regulatory framework (including import, tax and custom regulations) and governance aspects on collection, transport and use of firewood; historical patterns of firewood use and potential impacts on the forest and biodiversity.**

1.2. LEGAL FRAMEWORK

The suggested approach for the review of existing regulatory framework is to perform the analysis which is performed in two phases. The first current phase is primarily a "desk-top" exercise involving the identification, analysis and classification of relevant legal rules and the identification of the agencies responsible for implementing and enforcing the rules. The second phase would involve field research, primarily by interviewing various participants in the system of wood harvesting and forest use including local self-governing and state bodies / officials and consumers. The second part of the study would be aimed at identifying how the law actually functions, including the responses of participants to it.

Provisions directly or indirectly related to wood harvesting and forest use are defined in the RA Constitution, the RA Forest Code, RA Tax Code, RA Code of Administrative Offenses, the RA Criminal Code and Customs Code of the Eurasian Economic Union (EAEU), as well as in a number of RA Government decrees and ministerial orders.

The following legislative changes related to wood harvesting and forest use implemented during the last ten years, can be mentioned:

- The RA Government Decree N1535-N, dated 27.10.2011 defines that in case of harvesting waste-wood on non-commercial purposes, a privilege shall be granted on the use of bio-resources fees in relation to the families residing in the forest adjacent settlements, as per the actual volume quantities and limitations, which are considered object of natural resources utilization fee, at the amount of 100%.
- In accordance with the RA Tax Code, which came into force on 01.01.2018, the tariffs for nature use fee have increased, which nevertheless, do not apply to the cases, specified in the above mentioned item.
- In accordance with the Amendments to the RA Criminal Code and RA Code of Administrative Offences (came into force in 2019), a more severe punishment and fine has been foreseen for causing damage to a forest.

The detailed description of the provisions, regulating the above mentioned and other legal norms is presented below.

The Constitution of the Republic of Armenia

In accordance with Article 12 of the Constitution of the Republic of Armenia:

- The State shall promote the preservation, improvement and restoration of the environment, the reasonable utilization of natural resources, guided by the principle of sustainable development and taking into account the responsibility before future generations.
- Everyone shall be obliged to take care of the preservation of the environment.

Forest Code of the Republic of Armenia

Forest Code regulates relations connected with sustainable forest management – guarding, protection, rehabilitation, afforestation and rational use of forests and forest lands of the Republic of Armenia as well as relations related to with registration, monitoring, supervision of forests and forest lands.

In accordance with Article 10 of Forest Code of the Republic of Armenia The forests of the Republic of Armenia irrespective of the form of ownership shall be classified by their main operational significance as follows:

- *forests of protection significance*
- *forests of special significance*
- *forests of production (industrial) significance*

In the forests of protection significance implementation of forest regeneration cuttings shall be prohibited. In the forests of protection significance, only intermediate (maintenance) and sanitary cuttings shall be carried out.

In the forests of special significance, those forestry activities shall be prohibited and limited, that do not comply with the regime set force in the legislation of the Republic of Armenia related to the protection of those areas.

In the forests of production (industrial) significance, the wood harvesting shall be implemented based on forest management plans, through intermediate (maintenance), sanitary and forest regeneration cuttings, considering the cutting age, for the purpose of improving the biological features of the forest, preventing adverse impact on the environment, and, in case of impossibility, eliminating the consequences of negative impacts.

Tax Code of the Republic of Armenia

In accordance with Article 200 of Tax Code of the Republic of Armenia, which has come into force in 2018 - the utilization of biological resources (wood and secondary forest product) shall be objects of natural resources utilization fee.

The wood harvesting organizations registered as VAT payers, shall also pay a VAT at the amount of 20% in relation to the tax base (including the environmental tax fee).

The wood harvesting organizations not registered as VAT payers, shall pay a turnover tax at the amount of 5% of the turnover.

Customs Code of the Eurasian Economic Union (EUEA)

EAEU Customs Code prescribes a 10% customs duty on the firewood imported to the EAEU area.

Code of Administrative Offences of the Republic of Armenia

In accordance with Article 65 of the Code, the violation of the procedure on use of wood-harvesting area, wood harvesting and extraction, as well as transportation of illegally acquired wood shall cause imposition of a fine in the amount of 100 to 200 times the minimum salary for the citizens and in the amount of 200 to 400 times the minimum salary for officials.

In accordance with Article 66 of the Code, illegal forest cuttings, damaging trees, bushes, which are as well not part of the forest stock or not subject to cutting, damaging vegetation considered to be state, communal or private (other persons') property to the extent to destroy or stop their growth, shall be punished with a fine at the amount of 100 to 200 times minimum salary for the citizens, and at the amount of 200 to 300 times the minimum salary for officials.

In accordance with Article 66 of the Code, the forest use not complying with the requirements or purposes foreseen by the documents issued for forest use, shall be punished with a fine at the amount of 100 to 200 times minimum salary for the citizens, and at the amount of 200 to 400 times the minimum salary for officials.

Criminal Code of the Republic of Armenia

The amendment entered into force on 03.08.2019, and foresees a more severe punishment for illegal cutting of trees, bushes, vegetation, or

transportation of trees, and bushes without permission.

Pursuant to amended Article 296 of the Code, which came into force on 03.08.2019:

1. Illegal forest cuttings, damaging trees, bushes, which are as well not part of the forest stock or not subject to cutting, damaging vegetation considered to be state property, to the extent to stop their growth, transportation of trees and bushes without permission, if these actions inflicted a major damage, or have been committed after imposing an administrative penalty for the same offence within a one year period, shall be punished with a fine at the amount of 500 to 1000 times the minimum salary, or with deprivation of the right to hold certain posts or practice certain activities for 2 to 5 years, or correctional labor for up to 3 months, or with imprisonment for the term of up to 2 months.
2. The same actions which have been committed
    1) by abusing one's official position;
    2) in specially protected natural areas or in ecological disaster or ecological emergency areas;
    3) by causing harmful damage;
    4) towards the trees and vegetation registered in the Red Book of Plants of the Republic of Armenia;
    5) by a group of individuals or by an organized group;
    6) in order to make profit;

shall be punished by a fine at the amount of 1000 to 2000 times the minimum salary or with deprivation of the right to hold certain posts or practice certain activities for 5 to 7 years, or correctional labor for up to 3 months, or with imprisonment for the term of 2 to 5 years with or without deprivation of the right to hold certain posts or practice certain activities for up to maximum 3 years.

3. The same actions that have inflicted a particularly harmful damage, shall be punished with imprisonment for the term of 3 to 8 years with or without deprivation of the right to hold certain posts or practice certain activities for up to maximum 3 years.

Decrees of the Republic of Armenia Government

In accordance with the RA Decree N1535-N "on granting privileges for nature use fees to extract waste firewood for non-production (non-industrial) purposes by families residing in the forest adjacent settlements of the Republic of Armenia" dated 27.10.2011, *in case of harvesting waste firewood for non-commercial purposes, a privilege shall be granted on the use of bio-resources in relation to the families residing in the forest adjacent settlements, as per the actual volume quantities and limitations, which are considered object of natural resources utilization fee, at the amount of 100%.*

RA Government Decree on "Defining the procedure of forest use and conservation in forests of industrial significance, on withdrawal of Government Decree N49, dated 23.01.2001 and on making amendments to the Decree N1412-N, dated 07.09.2006" approves the procedure of use and conservation of the forests of industrial significance. *The Decree specifies, that in the forests of industrial significance, it shall be permitted to carry out all forest use types, set forth in Article 35 of Forest Code of the Republic of Armenia. These types are as follows:*

- *Wood harvesting;*
- *Harvesting of secondary wood products;*
- *Use of non-wood forest product;*
- *Forest use for the purpose of organization of fauna reproduction and use;*
- *Use for scientific-research purposes;*
- *Forest use for cultural, health, sport, recreation and tourism purposes*

In the forests of industrial significance, forest regeneration cuttings shall be carried out in the procedure set forth in the RA Government Decree N1412-N on "Defining the Procedure on forest regeneration cuttings in the forests of industrial significance", dated 07.09.2016.

RA Government Decree N1316 on "Defining the Procedure for the use and conservation of forests of protection significance", dated 08.11.2007 approves the procedure for the use and conservation of forests of protection significance. The decree specifies, that only intermediate (maintenance) and sanitary cuttings shall be carried out in the forests of protection significance. *The Decree defines, that in the forests of protection significance only intermediate (maintenance) and sanitary cuttings shall be carried out.*

The maintenance and sanitary cuttings in the forests shall be carried out in accordance with the RA Government Decree N 897-N on "Defining the Procedure of the maintenance and sanitary cuttings", dated 22.06.2006.

Orders of the Ministers of the Republic of Armenia

The decree N80-N of the RA Minister of Agriculture, dated 06.05.2013, approves the Procedure of the wood harvesting in state and community forests.

The joint Orders N226-A of the RA Minister of the Agriculture and N253-A of the RA Minister of Nature Protection, dated 29.11.2011 approves the Procedure of free wastewood harvesting and extraction for non-commercial (non-industrial) purposes. *The Procedure specifies that the wood collection and transportation shall be carried out based on the wood use coupon, issued by the forest running organizations.*

The joint orders N227-A of the RA Minister of Agriculture, N254-A of the RA Minister of Nature Protection, and N144-A of the RA Minister of Territorial Administration, dated 29.11.2011 approve the list of forest adjacent communities to be granted privilege in acquiring free waste firewood for the non-commercial purposes. _

Table 11: *Matrix of Assessment Criteria for Legal Instrument*

Legal Instrument	Project Related Legal Act Objective	Compliance Incentives & Sanctions	Implementation (I) & Enforcement (E) Agencies
The Constitution of the Republic of Armenia	Stipulates, that - the State shall promote the preservation, improvement and restoration of the environment, the reasonable utilization of natural resources, guided by the principle of sustainable development and taking into account the responsibility before future generations. - everyone shall be obliged to take care of the preservation of the environment.	***No Incentives*** ***No Sanctions***	All state and local self-government bodies within the scope of their competence
The Codes			
Forest Code of the Republic of Armenia	Forest Code shall regulate relations connected with sustainable forest management – guarding, protection, rehabilitation, afforestation and rational use of forests and forest lands of the Republic of Armenia as well as relations with forest registration, monitoring, supervision of forests and forest lands.	***No Incentives*** ***No Sanctions***	RA Government RA Ministry of Environment Forest Committee "Hayantar" SNPO Regional Administrations Local self-governments
Tax Code of the Republic of Armenia	Stipulates that the utilization of biological resources (wood and secondary forest product) shall be objects of natural resources utilization payment.	***No Incentives*** ***Sanctions:*** imposes a fine for non-payment of taxes or fees within the time period as	Tax Service of the Republic of Armenia

Legal Instrument	Project Related Legal Act Objective	Compliance Incentives & Sanctions	Implementation (I) & Enforcement (E) Agencies
	The wood harvesting organizations registered as VAT payers, shall pay also a VAT at the amount of 20% in relation to the tax base (including the environmental tax fee). The wood harvesting organizations not registered as VAT payers, shall pay a turnover tax at the amount of 5% of the turnover.	prescribed by the Code or for payment later than the specified deadline.	
Customs Code of the EAEU	EAEU Customs Code prescribes a 10% customs duty on the firewood imported to the EAEU area.	***No Incentives*** ***No Sanctions***	Tax Service of the Republic of Armenia
Code of Administrative Offences of the Republic of Armenia	Imposes a fine for damaging forest fauna	***No Incentives*** ***Sanctions:*** the illegal wood harvesting, transportation, tree and bush cutting, and forest use cause imposition of a fine in the amount of 100 to 200 times the minimum salary for the citizens and in the amount of 200 to 400 times the minimum salary for officials.	The Inspectorate for Nature Protection and Mineral Resources
Criminal Code of the Republic of Armenia	Sets a punishment for illegal cutting of trees, bushes and vegetation or movement of trees and bushes without permission.	***No Incentives*** ***Sanctions:*** Illegal forest cuttings, damaging trees, bushes, which are as well not part of the forest stock or not subject to cutting, damaging vegetation considered to be state property, to the extent to stop their growth, movement of trees and bushes without permission, if these actions inflicted a major damage, or have been committed after imposing an administrative penalty for the same offence within a one year period,	The Inspectorate for Nature Protection and Mineral Resources The Police of the Republic of Armenia The Investigative Committee of the Republic of Armenia Prosecutor General of Armenia Courts of the Republic of Armenia

Legal Instrument	Project Related Legal Act Objective	Compliance Incentives & Sanctions	Implementation (I) & Enforcement (E) Agencies
		shall be punished with a fine at the amount of 500 to 1000 times minimum salary, or with deprivation of the right to hold certain posts or practice certain activities for 2 to 5 years, or correctional labor for up to 3 months, or with imprisonment for the term of up to 2 months. (see the details above, in the description of the RA Criminal Code)	
RA Government Decrees			
N 1535-N, dated 27.10.2011	In case of harvesting waste-wood on non-commercial purposes, a privilege shall be granted on the use of bio-resources fees in relation to the families residing in the forest adjacent settlements, as per the actual volume quantities and limitations, which are considered object of natural resources utilization fee, at the amount of 100%.	***Incentives:*** privilege on the use of bio-resources fees as per the actual volume quantities and limitations, which are considered object of natural resources utilization fee, at the amount of 100%. ***No Sanctions:***	RA Ministry of Environment Forest Committee "Hayantar" SNPO
N 1412-N, dated 29.11.2007	The Decree specifies, that in the forests of industrial significance, it shall be permitted to carry out all forest use types, set forth in Article 35 of Forest Code of the Republic of Armenia.	***No Incentives*** ***No Sanctions***	RA Ministry of Environment Forest Committee "Hayantar" SNPO
N 1412-N, dated 07.09.2006	Defines the Procedure on forest regeneration cuttings in the forests of industrial significance	***No Incentives*** ***No Sanctions***	RA Ministry of Environment Forest Committee "Hayantar" SNPO
N1316-N, dated 08.11.2007	The Decree specifies, that only intermediate (maintenance) and sanitary cuttings shall be carried out in the forests of protection significance. *The Decree defines, that in the forests of protection significance only intermediate (maintenance) and sanitary cuttings shall be carried out.*	***No Incentives*** ***No Sanctions***	RA Ministry of Environment Forest Committee "Hayantar" SNPO

Legal Instrument	Project Related Legal Act Objective	Compliance Incentives & Sanctions	Implementation (I) & Enforcement (E) Agencies
N 897-N, dated 22.06.2006	Defines the Procedure on maintenance and sanitary cuttings	***No Incentives*** ***No Sanctions***	RA Ministry of Environment Forest Committee Hayantar SNPO
Orders of RA Ministers			
Decree of the RA Minister of Agriculture, dated 06.05.2013	Approves the procedure on wood harvesting in state and community forests	***No Incentives*** ***No Sanctions***	Forest Committee "Hayantar" SNPO
The joint Orders N226-A of the RA Minister of the Agriculture and N253-A of the RA Minister of Nature Protection, dated 29.11.2011	Approves the Procedure of free wastewood harvesting and extraction for non-commercial (non-industrial) purposes. *The Procedure specifies that the wood collection and transportation shall be carried out based on the wood use coupon, issued by the forest running organizations.*	***No Incentives*** ***No Sanctions***	Forest Committee "Hayantar" SNPO
The joint orders N227-A of the RA Minister of Agriculture, N254-A of the RA Minister of Nature Protection, and N144-A of the RA Minister of Territorial Administration, dated 29.11.2011	Approve the list of forest adjacent communities to be granted privilege in acquiring free waste wood for non-commercial purposes. _	***No Incentives*** ***No Sanctions***	Forest Committee "Hayantar" SNPO

Draft Law on Making Amendments and Supplements (addenda) to RA Forest Code

Currently the draft law on making amendments and supplements (addenda) to RA Forest Code (hereinafter referred to as "draft law") has been put into circulation. The draft law aims at provision of legal basis for preservation and use of forests and forest lands, clarification of forest restoration processes in terms of time frames, provision of legal basis for wood processing on economic purposes as a separate procedure during the forest maintenance, without harming the forest areas, review of forests significance as per their operational significance, as well as provision of the legal basis for development of a new national forest program, definition of some key concepts, strengthening of the competences of the employees involved in the conservation of forests, creation of opportunities for forest lands (with no forest cover) to be provided for construction purposes, as well as implementation of institutional reforms, as a result of which a single structural unit will be responsible for the maintenance of forestry.

The draft package proposes to dissolve the Forest Committee operated under RA Ministry of Environment transferring its competences to the Authorized Body for the purpose of optimalization of the ministry system.

The forest priority issues and the solutions proposed in the Draft Law are presented below:

Table 12: Priority issues and proposed solutions

N	Forest-sector priority issues	The solutions proposed by the Draft Law	Nature of the proposed amendment
1	Enhancement of efficiency of forest conservation and struggle against the illegal forest use	It is proposed to withdraw Article 26 of the Code, which specifies the competences of the State Forest Service. The draft Law also proposes to assign some competences of State Forest Service to the foresters.	Institutional
2	Human resources (professional) and sector capacity building	It is proposed to assign the competences of establishing Specialized Commissions (specified in Article 36 of the Code) to the forest running organization, instead of Authorized Body.	Institutional/ human resources
3	Forest use efficiency enhancement	A new Article 41.1 has been added to the Code and Article 6 has been edited. The goal of the proposed amendments is to inventory those forest lands (without forest cover), where it is impossible to implement forest regeneration activities, however in case of effective use, it will be possible to generate additional income, at the same time keeping it as a forest land. These will also include the possibility of cooperation between the state and private sector.	Organizational
4	Optimalization of institutional units with current management and forest-running competences	It is proposed to dissolve the Forest Committee under the Ministry of Environment, by transferring its competences to the Authorized Body.	Institutional
5	Availability of high firewood demand in the Republic	It is proposed to consider the possibility of alternative wood production, which can be considered as an additional source of wood, without over-exploiting the forest potential.	Forest use

RA Forest Sector Development Policy and Strategy, National Action Program (2020-2030)

The necessity for the review of RA Forest Policy and Strategy (RA FPS) (2020-2030)

The availability of relevant strategy framework and legislative package in the forest sector has contributed to the solution of the sector issues as well as its progress.

However, the current state of the forest sector, the resources allocated to it, the complicated and unclear management system, the low capacities to implement long-term projects in current conditions, do not contribute to the realization of the goals, set forth in the strategic documents.

The management system has practically for a long time resisted the social-economic pressures outside the sector – the continuous over-exploitation of the forests due to poverty, unemployment, and direct dependance on natural resources.

Under the growing negative impact of climate change, the increase of forest eco-system vulnerability and natural disaster risks, loss of bio-diversity, and habitat reduction require a new assessment of directions of sector activities.

In this regard, it is especially important "the Republic of Armenia Strategic Program of Prospective Development 2014-2025", approved by RA Government decree of 2014, a separate section ("Environmental issues and expected measures") of which specifies, that "national forest program will be developed and implemented for the purpose of forest regeneration, afforestation, as well as the improvement of forest qualitative features, and establishment of new forests".

Directions of forest policy

Considering the RA forest sector main issues and thematic elements of sustainable forest management (SFM), proposed by the UN Conference, the proposed strategic directions of the national forest policy are presented in the following main groups:

a/ Forest conservation and regeneration/ restoration - *maintenance of forest bio-diversity, mitigation of climate change impact, promotion of afforestation and forest regeneration, improvement of forest productivity;*

b/ Management system efficiency – *legislation improvement and enforcement, structural reforms, planning and information management;*

c/ Multi-purpose forest use – *provision of eco-systematic services, improvement of forestry, insurance of forest social function;*

d/ Cooperation, awareness raising and engagement – *inter-sector cooperation, scientific research, education and awareness raising, public participation, engagement.*

National Forest Program NFP (2020 – 2030)

NFP goals

The main goal of the NFP is the development and implementation of activities arising from RF FPS.

The baseline approaches of project activities planning are based on long-term strategic goals on the one hand, and the realistic assessment and balancing of financial and implementation capacities of the sector on the other.

NFP is considered the most significant document of the strategic framework of the forest sector, which defines the implemented activities, time periods and responsibilities as well as the expected results and performance indicators for the purpose of sustainable forest management.

NFP problems

NFP problems are the planning of 10-year measures/actions for forest sustainable management – conservation, protection, regeneration, afforestation, and effective use, implementation of activities aimed at enhancement of forest productivity, maintenance of forests biodiversity, effective use of forests environmental, social and economic potential.

Improvement of management system, mitigation of climate change impact, promotion of afforestation and forest regeneration, insurance of ecosystem services, improvement of inter-sector cooperation, provision of information on forest lands and forests, and other issues require planning of effective actions.

The restoration of the degraded forest landscape in RA, increase of forest cover, maintenance and development of environmental, social and economic significance of the forests, continuous and effective use of resources are considered to be priority issues.

The activities specified in the Program, outline the necessary steps for the implementation of the issues arising from RA FPS.

They are included in the following main directions arising from RA FPS:

- *Forest conservation and regeneration*
- *Management system efficiency*
- *Multi-purpose forest use*
- *Cooperation, awareness raising and engagement*

Institutional Framework and stakeholders

The following institutions are the main stakeholders involved in the process of wood harvesting and forest use.

Table 13: *Stakeholder Matrix*

N	Stakeholder	Role / Responsibility
1	RA Government	RA highest executive body, responsible for the implementation of RA state policy.
2	The Inspectorate for Nature Protection and Mineral Resources	a state institution under the RA Government, that exercises supervision and other functions as prescribed by law, and in the name of the Republic of Armenia may apply sanctions in the field of environmental protection and mining.
3	RA Ministry of Environment	State authorized body in the field of sustainable forest management
4	Tax Service of the Republic of Armenia	• Exercises supervision in relation to state taxes and fees • Ensures the collection of customs duties and taxes subject to payment to the customs body, and their transfer to the RA state budget.
5	The Forest Committee	Ensures the sustainable management of state forests – their conservation, protection, rehabilitation, afforestation and efficient use.
6	"Hayantar" SNPO	Conservation, protection, reproduction, use, registration, maintenance of forest cadaster of RA Forest fund (hereinafter referred to as "forest fund"), observation (monitoring), enhancement of forest productivity and forest fund lands fertility, as well as sustainable use of forest reserves.
7	Regional administrations	State territorial administrations in the field of sustainable forest management
8	Local-self governments	• Possession, use, management of communal forest and running of forestry in accordance with the Forest Code of the Republic of Armenia; • Participation in the state programs development, and their implementation in their administrative areas in the procedure defined by law • Other functions as prescribed by RA Forest Code and other legal acts
9	Forest users	Users gaining the useful natural values of forests, forest reserves and forest lands, as well those gaining benefit this activity.
10	CSOs (NGOs)	Organizations that pursue environmental, social, charitable, cultural, educational or other public benefit objectives

The competences of state and local self-governing bodies are presented in more detail below:

The competences of the Government of the Republic of Armenia in the sphere of sustainable forest management are as follows:

- management of the state forests according to the RA Forest Code and other legal acts;
- insurance of state policy implementation;
- implementation of supervision in state and non-state forests;
- approval of state programs;
- coordination of the activities of the state management bodies in the sphere of sustainable forest management;
- approval of annual allowable areas for wood harvesting in state forests;
- classification of forests as per their main operational significance;
- adoption of legal acts regulating the forest sector;
- other competences prescribed by the RA

Forest Code and the legislation of the Republic of Armenia.

The Inspectorate for Nature Protection and Mineral Resources

is an institution under the RA Government, that exercises supervision and other functions as prescribed by law, and in the name of the Republic of Armenia may apply sanctions in the field of environmental protection.

The competences of the RA Ministry of Environment (state authorized body) in the sphere of sustainable forest management are as follows:

- possession and use of the state forests according to the RA Forest Code and other legal acts;
- development and implementation of state policy;
- classification of forests as per functional significance;
- organization of the running of the state forestry of the Republic of Armenia;
- approval of the state forests management plans;
- maintenance of the state forest cadaster of the Republic of Armenia and state registration of forest lands;
- development of goal-oriented programs aimed at the improvement of forest productivity, forest rehabilitation, afforestation and maintenance;
- improvement and maintenance of forest lands fertility, insurance of their intended use;
- organization of the implementation of fire safety measures, detection and prevention of forest fires, prevention of the harmful impact of forest pests and diseases;
- implementation of forest monitoring;
- organization of identification and prevention of activities not related to forest use, such as illegal cuttings, damaging and destruction of trees, bushes, young plantations and forest cultures, pollution of forest by chemical, radioactive substances, wastewater, communal-domestic waste and other infringements of forest legislation as well as immediate provision of the acquired information to law-enforcement bodies in the procedure, set forth in the legislation of the Republic of Armenia;
- implementation of international cooperation in the field of sustainable forest management;
- issuing permit to change the operational significance of lands and carry out engineering-geological studies for the activities not related to forest use and management in the community forest lands, such as construction, blasting, extraction of useful minerals, installation of cables, pipe-lines and other communications, drilling, etc.
- supervision over the enforcement of forest legislation;
- other competences as prescribed by the RA Forest Code and the legislation of the Republic of Armenia

The environmental supervision is implemented by the state institution authorized in the given field.

Forest Committee

The goals of the Committee are:

- Safeguarding the sustainable management of the state forests – their conservation, protection, rehabilitation, afforestation and efficient use.

The problems of the Committee are:

- Securing the implementation of measures aimed at increase of state forests productivity;
- Securing the preservation of the state forests bio-diversity;
- Ensuring the efficient use of the environmental, social, economic potential of the state forests;
- Provision of complete and reliable information to the public related to forest lands and forests.

"Hayantar" SNPO

The subject of the organization's activities and its goal is the conservation, protection, reproduction, use, registration, maintenance of forest cadaster of RA Forest fund (hereinafter referred to as "forest fund"), observation (monitoring), enhancement of forest productivity and forest

fund lands fertility, as well as sustainable use of forest reserves.

The competences of the RA regional administrations (territorial bodies) in the sphere of sustainable forest management are as follows:

- participation in state programs development and their implementation at regional level;
- involvement of specialized services, forest users and population in extinguishing forest fires in the administrative area of the region (marz);
- implementation of state programs for the purpose of forests and forest lands protection and use;
- other competences as prescribed by law.

The competences of the RA local self-governments in the sphere of sustainable forest management are as follows:

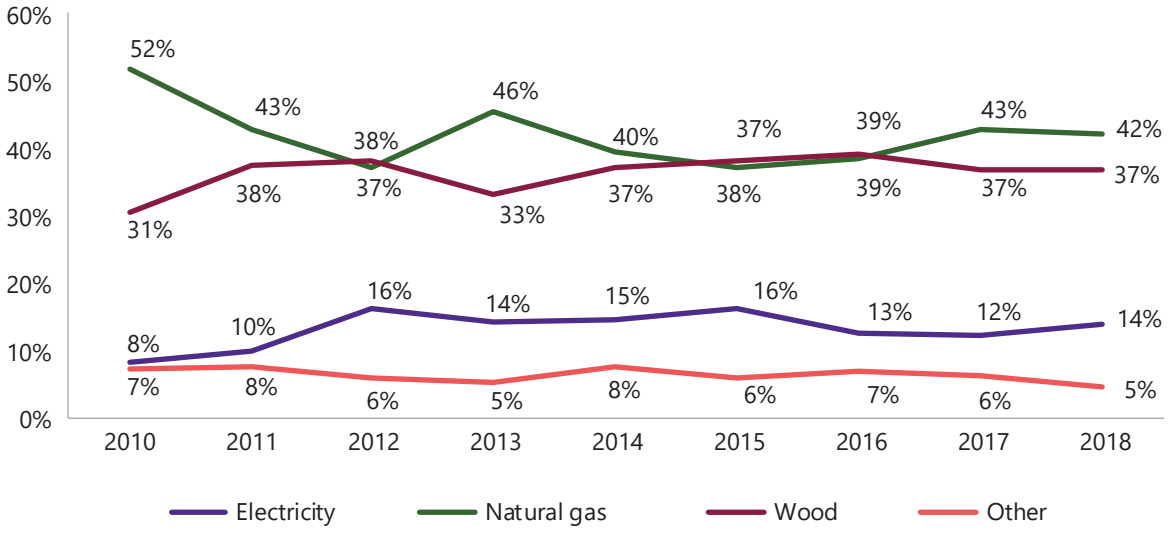
- possession, use, management and running of forest enterprises in accordance with the Forest Code of the Republic of Armenia;
- participation in the state programs development, and their implementation in their administrative areas in the procedure defined by law;
- involvement of specialized services, forest users and population in extinguishing forest fires in the administrative area of the region (marz);
- the management of state forests handed over for community management;
- issuing permit to change the operational significance of lands and carry out engineering-geological studies for the activities not related to forest use and running of forest enterprises in the community forest lands, such as construction, blasting, extraction of useful minerals, installation of cables, pipe-lines and other communications, drilling, etc.

1.3. PATTERNS OF FUELWOOD USE IN ARMENIA

Households is Armenia rely both on gas and fuelwood to fulfill their energy needs. As illustrated in Figure 11, the consumption of fuelwood during the last decade developed in parallel and was linked to the use of natural gas.

The number of households that used fuelwood as the primary source of heating during the last decade fluctuated between 31 to 39 percent. Consumption of fuelwood by households in 2018 was higher than the 2010 levels. In 2010, 31 percent of the Armenian households indicated to use fuelwood as the main source of energy for heating while this grow to 37 percent in 2018.

Figure 1-1: *Household Use of Firewood as primary source of Heating*



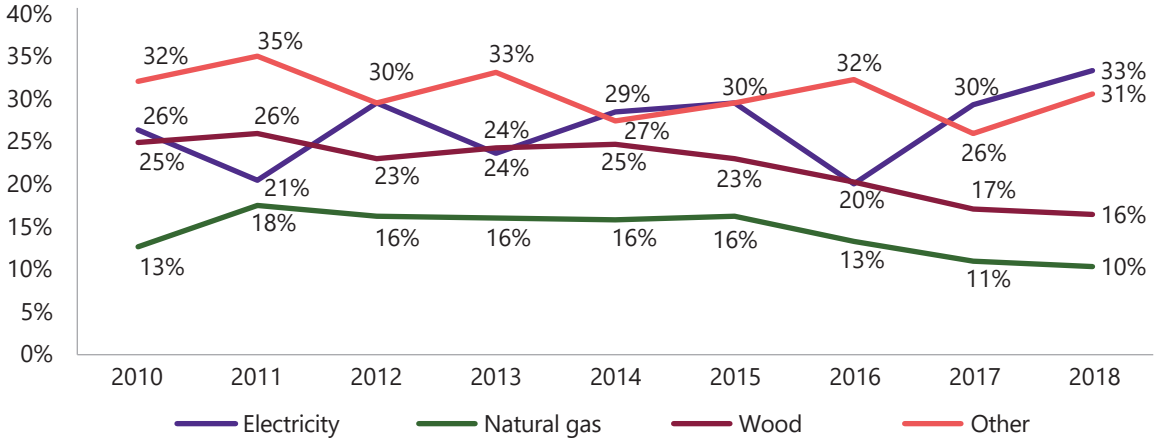
Source: RA *NSS*

At the same time the use of natural gas as the main source of energy decreased by about ten percent. In 2010, 52 percent of the households indicated to use natural gas as the primary source of fuel for heating while this percent decreased to 42 percent in 2018. This could have been caused by the rise of natural gas prices which in 2010 increased by 27 percent compared to 2009. The price of a cut tree is about 30% cheaper as compared with the price of gas.[1]

In 2010, retail consumers (monthly consumption < 10.000 m3) purchased gas at a regulated tariff equal to AMD 132,000 per 1.000 m3 (VAT inclusive). Prices for firewood and construction materials were approved in 2016: the harvesting fee for stumpage was USD 22/m3, and the harvest fee for road side was USD 30/m3. The price of wood after transportation for storage was USD 45/m3.[2]

During the same period the use of fuelwood as the second source of heating decreased significantly. Compared to 2010, in 2018 the share of the households that indicate to use fuelwood for heating decreased from 26 percent to 16 percent. Also the use of natural gas as the secondary use of hearing decreased during the recent years.

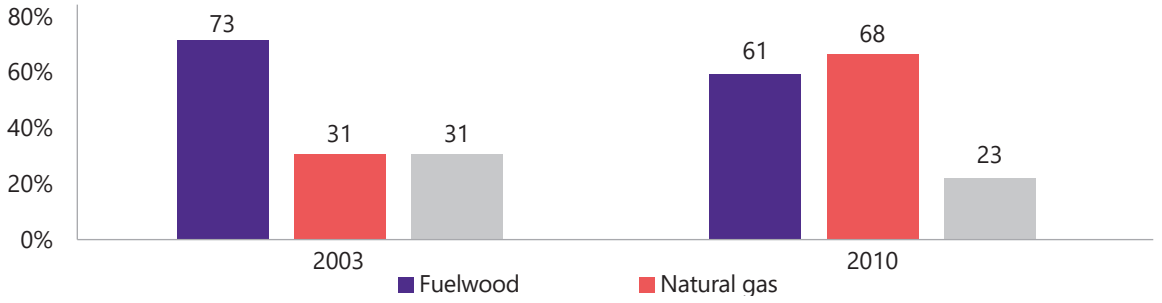
Figure 1-2: *Household Use of Firewood as secondary source of Heating*



Source: RA *NSS, ILCS*

In terms of a historic overview, the data collection methodology of the ILCS changed since 2010 consequently no comparisions are possible using the results of the ILCS before that. Nevertheless non official stattics such as FLEG ENPI survey do exisit which can be used for this prupose. However due to the various methodoloic differences these data do not provide for a sound ground for comparison with the official statisics of the ILCS (the RA Statistical Services).

Figure 1-3: *Household Use of Firewood (Non-Official)*



Source: *FLEG-ENPI survey*

1 Sixth National Report to the Convention on Biological Diversity

2 South Caucasus: Armenia, Azerbaijan and Georgia Private Enterprises in the Forest Sector: A Survey of Private Sector in Wood Production and Processing. The World Bank, Washington D.C., USA.

Earlier studies that offer a longitudial perspective on use of fulewood point to a household use of 73 percent in 2003. As ilustrated in Figure 3-3, the reported fuelwood use in 2010 reduced to 61 percent. Resultys of the the FLEG-ENPI survey make it clear that the use of fuel wood fell during the same time. This is expected to have been caused by the gas delivary program to rural areas in 2004 as it is assumed that availablility of gas will serve as a subsitutue for fuelwood and the increased prices of fuel wood in the same period.[1]

Fuelwood consumption also reflects regional disparities and socioeconomic vulnerability levels in Armenia. Fuelwood remains the cheapest and most easily accessible energy source for rural households who rely on fuelwood to meet their heating and energy needs.[2] Rural households consume as much as 15 m^3 of fuelwood annually in mountainous areas, while the national average consumption is estimated at 6.8 m^3. [3]

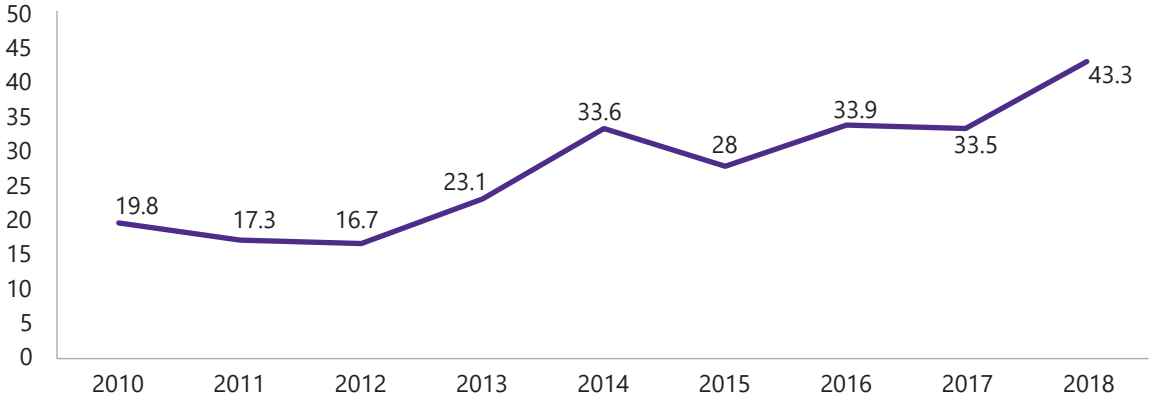
Currently there are no productive forest plantations. In absence of formal production harvesting, cutting is only conducted for sanitary purposes and intermediate thinning with the intent of preventing damage due to pests and diseases or that is justified for other forest protection reasons is permitted.[4]

Communities can extract timber for their own consumption. In accordance to the RA Government decree (N-1535), household from forest-dependent communities are allowed to annually collect up to 8 m^3 of free of charge fuelwood (debris) from the regional Hayantar (regional forestry organization). Other households which do not fall under this category may use specific tickets to cut wood and or purchase wood at the market. Nevertheless, only a minority of rural households collect their own fuelwood.

There is a large gap between reported fuelwood consumption and official fuelwood supply which as specified restricted by national legislation. Results of surveys conducted among the population by the State Forest Monitoring Center revealed that the demand for fuelwood used in households exceeds the volume of timber produced from legal felling more than 20 times. The officially reported quantity of felled timber increased significantly during the previous years.[5]

Compared to 2010 the officially registered quantity of felled timber more than doubled reaching 43.3 thousand m^3.

Figure 1-4: *Officially Reported Felled Timber (1000 m3)*



Source: RA *NSS*

Also the total cutting area of the country doubled during the same period. The total cutting area increased from 985 ha in 2010 to 2,015 ha in 2018.

1 Nils Junge and Emily Fripp. April 2011. "Understanding The Forestry Sector of Armenia: Current conditions and choices".

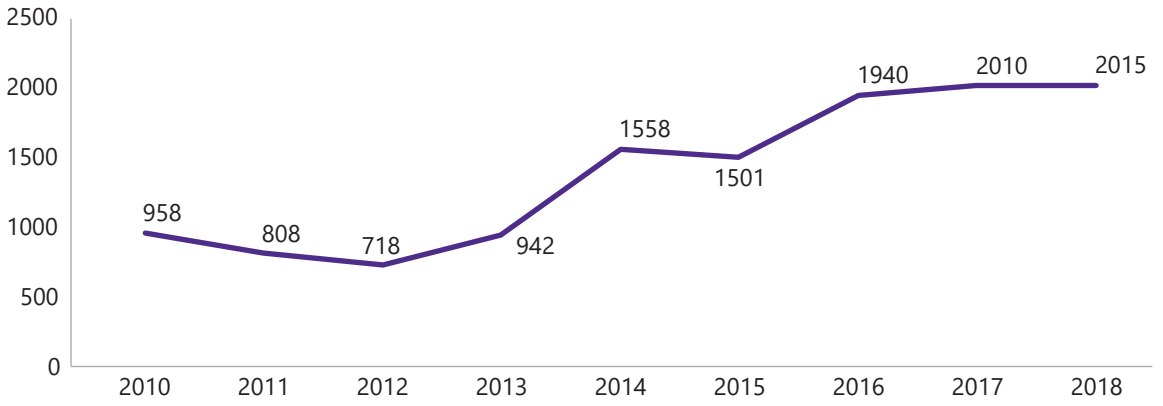
2 Sixth National Report to the Convention on Biological Diversity,

3 Fripp, E. (28 June 2010). Socio-economic impact of illegal logging Consultancy Report for the World Bank. Trip 1: Initial findings and briefing note for project update meeting. EFECA: Economics, Climate, Environment.

4 Mkrtchyan and Grigoryan, E. 2014. "Forest Dependency in Rural Armenia." FLEG II (ENPI East) Programme.

5 Sixth National Report to the Convention on Biological Diversity, available at: https://ace.aua.am/files/2019/05/2019-6th-National-Report-CBD_eng.pdf

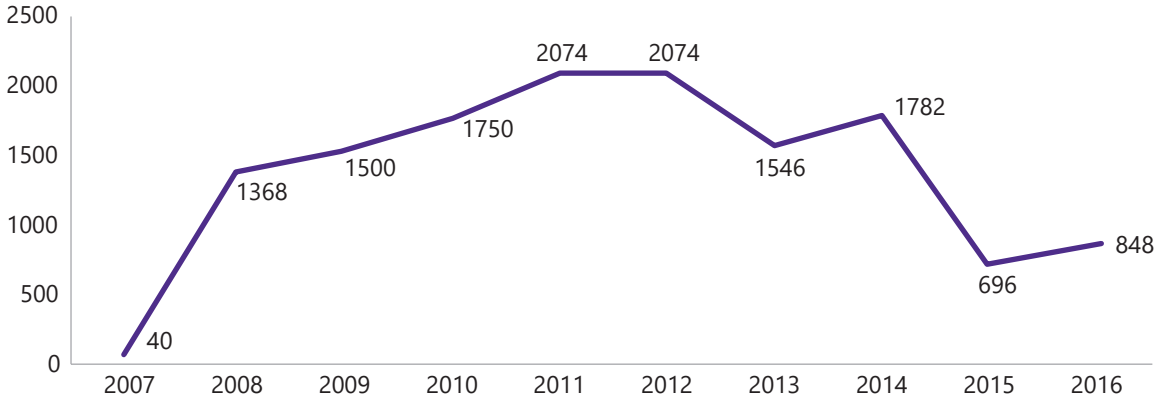
Figure 1-5: *Official Cutting Area ha*



Source: RA *NSS*

Yet, while the official production volumes increased in recent years the estimates on actual harvesting volumes from non-official sources are higher. Although data on production volumes largely vary depending on the source of the data and data collection methodology, nevertheless un-official source all show harvesting volumes that are by order of magnitude higher that the officially sanctioned harvesting and this demonstrates severe challenges in the sustainability of forest use and governance of the sector.[1]

Figure 1-6: *Fuel Wood Production Thousand cu. Meters*



Source: *Tilasto.com*

1.4. IMPACTS OF FIREWOOD USE PATTERNS ON FOREST AND BIODIVERSITY

1.4.1. Introduction

Each year, wood valued over US$100 billion is removed from forests globally, mainly accounted for by industrial roundwood, and also including fuelwood. Around 10 million people are employed in the forestry sector and the livelihoods of many more depend on forests. Preserving forest biodiversity without harming economic interests is a big challenge for nations with forests. Local biodiversity loss due to timber extraction activities can disrupt the long-term resilience of forests, which may in turn cascade into an impoverished delivery of ecosystems services, ultimately affecting also human well-

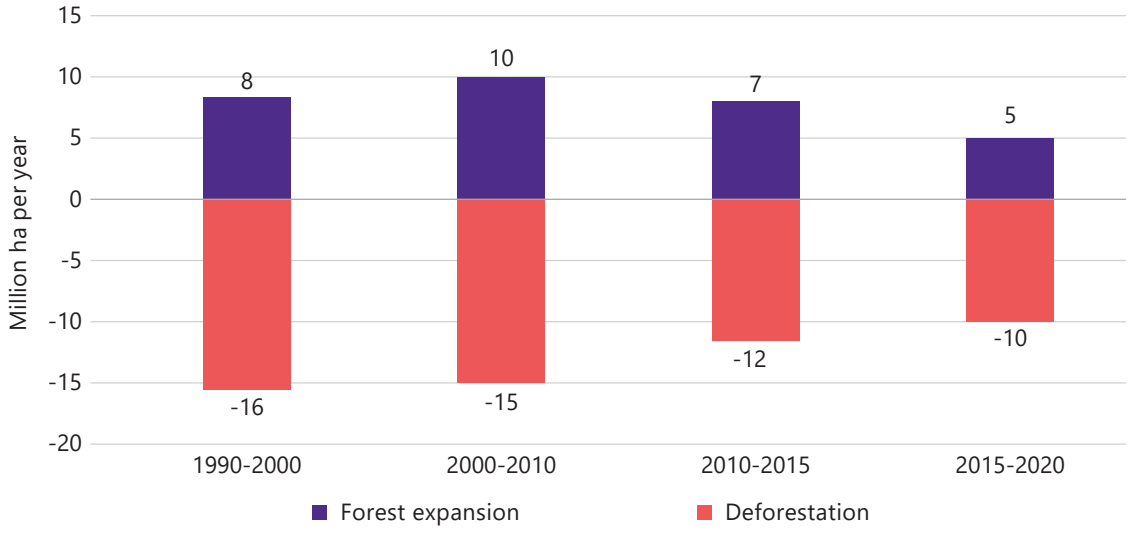
1 Cerbu,Gillian Ann; Perge,Emilie Bernadette; Behal,Raisa Chandrashekhar.2020. Fuelwood Dependence and Forests in Armenia (English). Washington, D.C.. World Bank Group.

being.

Forest ecosystem is the primary aid to the sustainable livelihood of rural populations which provides valuable livelihood goods and services in regulating, provisioning, supporting and cultural aspects. The fuel wood consumption at large scale is related to the severe environmental problems including deforestation, land degradation, loss of biodiversity, climate change and adverse health effects due to the indoor air pollution. Firewood accounts for over 54 % of all global harvests per annum which results in the huge amount of forest loss.

An estimated 420 million ha of forest has been lost worldwide through deforestation since 1990(in 2020 total forest area of the world is about 4.06 billion hectares), but the rate of forest loss has declined substantially. In the most recent five-year period (2015–2020), the annual rate of deforestation was estimated at 10 million ha, down from 12 million ha in 2010–2015.

Annual rate of forest expansion and deforestation, 1990-2020



Source: *Global Forest Resources Assessment Report 2020*

Armenia is a sparsely forested country, but today a significant part of the population's heat demand is met by wood.

Based on data of GIZ in 2011 through remote sensing method the forest cover of the Republic of Armenia makes 332.333 ha or 11.17 % of the total territory of Armenia, including about 283 thousand ha natural forests and about 50 thousand ha artificial forests.

During 2017, it was ordered to carry out harvesting of 90 596 cubic meters of wood in the forests under the control of „Hayantar" SNCO, but in reality, only 29 926.5 cubic meters were harvested, including 2326.8 cubic meters of timber. In addition, 66 614 cubic meters of residual fuel-wood was provided to the residents of forest adjacent communities free of charge.

Overall, the volume of wood harvested by „Hayantar" SNCO for the last four years is as follows: 2014 - 29 023 cubic meters of wood, of which 1986 cubic meters of timber; 2015 - 25 977 cubic meters of wood, of which 3174 cubic meters of timber; 2016 - 25 641 cubic meters of wood, of which 2595 cubic meters of timber; and 2017 - 29 926.5 cubic meters of wood, of which 2326.8 cubic meters of timber.

The results of surveys conducted among the population by the State Forest Monitoring Center SNCO have revealed that the demand for fuelwood used in households exceeds the volume of timber produced from legal felling more than 20 times.

According various data illegal logging in Armenia exceeds 10 to 20 times the legal cuttings. According to data of FLEG I project firewood consumption in Armenia made up 457 000 cubic meters in 2010. According to ,'State Forest Monitoring Center'' SNCO during the period of 2017-2018, the amount of consumed firewood in the republic was evaluated to be 842 477 cubic

meters. During 2013-2016, the number of illegal logging has doubled. According to the National Statistical Service of the Republic of Armenia, 179 cases of illegal logging were registered in 2013. In the next three years the number of cases has increased and amounted to 231 in 2014, 315 in 2015 and 513 in 2016.

1.4.2. Impact on Forest and Biodiversity

The main impact of the forest industry considers as forest degradation. Harvesting and extracting timber or other products changes the tree age structure, composition of tree species and vertical stratification, thereby affecting local temperature, light, moisture, soil, and litter conditions. This results in changes or complete removal of microhabitats (such as dead wood, cavities, root plates or mature trees) that host forest biodiversity. Change and loss of natural habitats and important ecosystems is the main risk of forest industry. The magnitude of impact on biodiversity depends on many factors. It depends on climatic zones with different native biodiversity, food web structures, ecosystem properties and etc. Besides, some types of forest management may have a larger influence on forest species than others, due to differences in habitat structure and continuity, or microclimatic conditions after the harvest. Additionally, some management regimes might have stronger secondary impacts on biodiversity, such as through increased rates of hunting or fire occurrence and etc.

The extensive and uncontrolled deforestation has a negative impact on different species especially in the northern parts of Armenia. For example, as a result of selective cuttings (high-value oak and beech), the variety of forest species is reduced, which primarily refers to the species nesting in tree hollows, such as woodpeckers, owls, treecreepers, nuthatchs and tits. According to not regular bird observations, the quantity of accipitere gentilis has significantly decreased.

Investigation of overall impacts from forest industry, identification of opportunities to reduce the air pollution, loss of significant biodiversity habitat or other impacts (climate change, health, pollution of water, soil, and etc) on environment will be discussed in the future phases of the Project.

1.4.3. Forest Management System

A quantitative understanding of the impacts of different forest management regimes on biodiversity in different regions of the Armenia is crucial to any efforts to reconcile biodiversity conservation and economic interests. Analyze of the forest management systems is one of the further steps for identification of model for improvement of fuel wood harvest and collection management.

Below presented some of typical forest management types that might be useful to investigate taking into consideration existing management plans in Armenia.

Clear-cut

Clear-cutting is historically the most common example of even-aged silviculture practice in temperate and boreal biomes. It is technically easy to execute, as the entire stand overstorey is removed in one harvest. Clear-cutting has been criticized for simplifying forest structure and reducing biological diversity, leading to homogeneous forests. Many countries are now abandoning this practice. The reduction of clear-cut areas is also a part of regulations and standards under many forest certifications schemes.

Retention system

In recent decades, silvicultural practices that combine timber harvesting and biodiversity preservation have been promoted to mitigate the impacts of clear-cuts. This has led to other variations of even-aged silviculture, in which individuals (dispersed retention) or groups of trees (aggregated retention) are left on-site to maintain structural diversity (such as patch-cut or green tree retention systems), supply seeds for the next crop (seed tree retention) or to protect the regenerating understory (shelterwood system).

Selection systems

Selection system is a silvicultural program aimed to maintain uneven-aged stands and is applied as an alternative to clear-cutting. It is designed to remove individual mature trees (single-tree selection), groups of mature trees (group-selection), or a combination of the two to create small openings scattered throughout the stand. This results in heterogeneous stand structures, which are assumed to be less damaging to forest biodiversity than traditional clear-cuts. Selection systems place unique emphasis on maintaining

species and structural diversity and regard such non-commodity values as a necessary foundation to achieve sustainable provision of timber and other ecosystem services.

Conventional selective logging

Selective logging involves the removal of the largest, highest quality trees from a forest stand, leaving the remaining vegetation standing. The term selective logging encompasses a very broad range of interventions, varying in, for example, the intensity of extraction (ranging from <5 m^3ha-1 to almost 200 m^3ha-1), the use of bulldozers or cables to extract timber, legality, and ground disturbance. On the one hand, high intensity selective logging can disturb as much as 30–40% of the area (through extensive skid trails and log landings), and damage 40–70% of remaining unlogged trees. On the other hand, in areas with low density of commercially valuable trees, such operations can have a relatively low impact on the remaining forest stand.

Reduced impact selective logging

Reduced Impact Logging (RIL) techniques have been proposed in an attempt to manage forests for timber in a more sustainable way by reducing the damage to soil, future crop trees, residual stands, and workers. RIL includes preparation of detailed harvest plans, worker education, training and supervision, demarcation of log extraction paths, directional felling to reduce collateral damage to surrounding trees and canopy, and protection of riparian areas. RIL has been conceived to achieve a sustainable level of harvest, but also to improve sustainability in terms of biodiversity, carbon retention and ecosystem services.

Timber plantations

Timber plantation as the important forest management items shall be considered and discussed during overall Project implementation.

Timber plantations are becoming increasingly popular in some regions as an alternative to extracting timber from natural forests. Whereas some timber species are relatively easily grown in plantations, others have a very low survival rate in plantations (e.g. mahogany, rosewood). There are likely important differences, in terms of biodiversity, between monoculture and mixed timber plantations, plantations of native *vs*. exotic species, and in the way, timber is harvested (clear-cutting, selective logging).

Non-timber plantations

Industrial clearing of tropical forests for non-timber plantations is one of the items of biodiversity loss. Monoculture rubber plantations are now the most rapidly expanding tree crop in South-East Asia, due to an increasing global demand. Current area of rubber plantations is equivalent to 57% of oil palm area globally, with more than 2 million hectares established during last decade. Often, forest is first logged to extract commercially valuable species, and subsequently converted to these non-timber plantations.

Agroforestry

Agroforestry maintains a structural diversity that imitates the native forest better than conventional pastures, row crops, and monoculture plantations. In agroforestry systems, perennial tree crops such as coconut, rubber, coffee or cacao replace the original forest understory but some canopy trees are left for shade. Timber from agroforestry systems is rarely sold on international markets, therefore we do not include this management type in our case studies. There are many different ways in which agroforestry can be implemented (such as row planting or companion cropping and etc.), and this may also have different effects on biodiversity.

Slash & burn

Also referred to shifting agriculture, slash-and-burn describes an agricultural system in which forest is periodically cleared and burnt to create fields for crops such as rice, cassava, maize, and papaya. After several years of production, the fields are left fallow, and forest typically regenerates to some extent. Whereas slash-and-burn management rarely contributes timber to international markets, it does provide wood for local subsistence.

Identification of biodiversity impacts

In the scope of the next deliverales of the Project the identification of the areas where field activities can be performed by taking into consideration following criterias will be performed:

- Areas for implementtion of the detailed surveys shall be located near the selected communities (will be identified during preparation of D2)
- Forests that consists of sensitive natural habitats, endengered species, etc. - with high conservation value.

- Damaged forests with loss of natural habitats, with landslides and etc. caused by anthropogenic impacts.

After collecting data from field activities, information will be compared with available data (forest management plans and ongoing biodiversity studies) and presented in D2.

COLLECTION, TRANSPORT AND USE OF **FIREWOOD**

2. FINDINGS OF THE LOCAL PEOPLE NEEDS, OPTIONS AND PERCEPTIONS ON PROVISION AND USE OF ALTERNATIVE SOURCES OF ENERGY; FEASIBILITY OF ALTERNATIVE OPTIONS OF ENERGY TO FUELWOOD IN TERMS OF POLICY, SUPPLY AND DEMAND, TECHNICAL, ECONOMIC AND SOCIAL ASPECTS

2.1. INTRODUCTION

Currently households in Armenia rely both on gas and fuelwood to fulfill their energy needs. According to ILCS the use of alternative sources of energy by households has not significantly changed during the previous decade. With the elimination of subsidized energy following the independence, and increased gas prices, the dependency on firewood for household energy increased and by it also the burden on the remaining forests in Armenia.

Against this backdrop, the assessment in this section uses both secondary data along with primary household survey data to complement the already available information on local people needs, options and perceptions on provision and use of alternative sources of energy in rural areas of Armenia. With the survey developed as part of this analytical work, an attempted was made to paint an updated picture of the local people needs, options and perceptions on provision and use of alternative sources of energy; feasibility of alternative energy options to fuelwood.

2.2. PRIMARY DATA COLLECTION METHODOLOGY

A mixed methodology was chosen for the purpose of the study which combines both quantitative and qualitative data gathering and analysis approaches. This allowed gathering of information from a larger target population and at the same made it possible to clarify and verify quantitative data through the qualitative data that was obtained through more in depth discussions with the target respondents.

For this purpose, a survey was designed for this study specifically to gather data on Households (HHs) in September 2020. The quantitative assessment is implemented with 90 HHs in two Marzes (regions) of Armenia, namely Lori and Tavush. From each Marz both three types of communities were selected based on the criteria of geographic proximity to forests and gasification. The selected communities, along with the selection criteria and the number of questioned households are presented in the following table.

Table 21: *The number of questioned HHs` in accordance with the type of Community and the respective Marz*

Type of Community	Lori		Tavush		Total
	Community	N	Community	N	
Close to a Forest	Vahagni (Gasified)	15	Voskevan (Gasified)	15	**30**
Far from a Forest	Shirakamut (Gasified)	22	Azatamut (Gasified)	22	**44**
Not-gasified	Chkalov (Not-gasified)	8	Berkaber (Not-gasified)	8	**16**
Total		45	Total	45	90

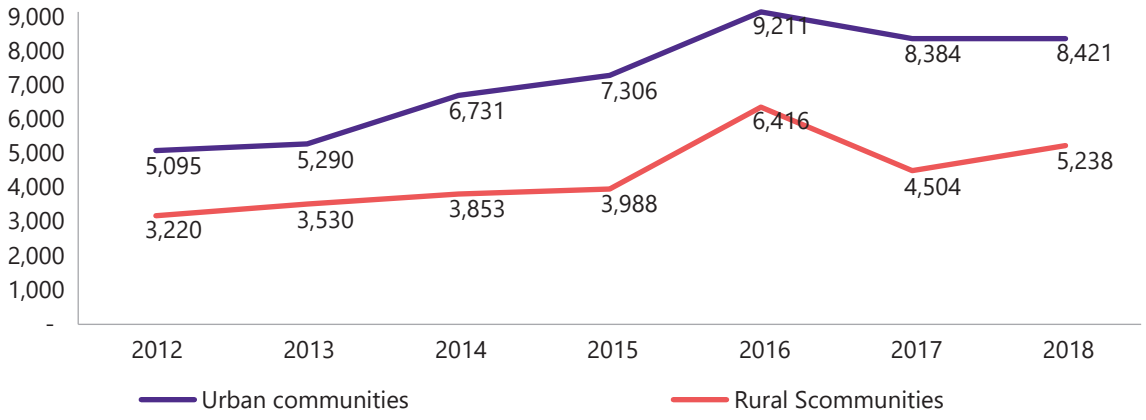
The selection of the HHs is done based on the principle of Targeted Random Walks. Such a design involves a procedure where the sample is selected by adaptively following links from one node to another. The HHs heads were the ones who responded to the survey questions. The latter were considered as decision makers within the HH.

Moreover, three Focus Group Discussions (FDGs) were carried out in the target communities. These involved one community that fulfilled each target community criteria in terms of gasified, not-gasified, close proximity to forests and a community which is situated further away from forests. Each FGD involved 8-12 participants.

2.3. BACKGROUND

Armenia's energy consumption currently represents only a small fraction of the level prior to collapse of the Soviet Union due to the de-industrialization of the economy. The residential sector is currently the largest energy consumer responsible for over one third (33.6%) of total final energy consumption in the country, followed by the industry with a share of 23% in 2018. There is however a considerable difference in the share of "housing services" including fuel in the total expenditure of households in rural and urban areas of Armenia. As show in the following figure, households in urban areas spend more on utility services including fuel and heating costs (8,421 AMD or 17.7% of total their total expenditure) than households in rural areas (5238 or 12.2% of total expenditure).

Figure 2-1: *Average Monthly per Capita Expenditures for Housing services, water, electricity, gas and other types of fuel (AMD)*



Source: *RA Statistical Committee*

The lower energy costs of rural households is among others linked to the fact that fuelwood remains the cheapest and most easily accessible energy source in rural areas. Based household survey data rural households are the largest consumers of domestic forest products due to their reliance on fuelwood for heating. In fact, the Integrated Living Conditions Survey shows that fuelwood has become and fundamentally established itself as a fuel of choice for nearly every rural HH and many urban citizens.

The use of fuelwood in rural areas as main heating option is usually explained with socio-economic issues existing in regions.[1] Existent studies also show that a large majority of households in Armenia prefer gas as an alternative fuel source to firewood. Yet, at the same time its relative cost and, in rarer cases, availability discourage households particularly those who live in proximity of forests from adopting this source of fuel.[2]

Other available and more used alternatives in terms of renewables are solar heating and fuelwood alternatives from biomass such as briquettes or pellets. The solar water heaters (SWH) market has been evolving rapidly. The growing energy prices, and the availability of loan financing from green lending programs have jointly lead to an expansion of the SWH capacities throughout Armenia in various

1 A. Pasoyan N. Sakanyan. 2019. Baseline data collection and analysis: energy demand, supply and efficiency, Armenia. GIZ

2 Fripp, E. 2010. Socio-economic impact of illegal logging Consultancy Report for the World Bank. Trip 1: Initial findings and briefing note for project update meeting. EFECA: Economics, Climate, Environment.

consumer groups. [1]

Existent evidence show that a crucial factor in terms of buying decisions regarding energy remains to be price. Gas in Armenia has in general been a more expensive energy source than fuelwood. Currently in Armenia, rural residents in gasified communities often cannot afford gas. As a result, both forest and non-forest households in rural areas continue to depend on fuelwood for their heating and cooking needs.[2]

The high price elasticity of energy substitution was also made evident by the fact that - unlike the expectations of many the large substitution of fuelwood by natural gas did not take place after gasification of many villages. Since 2004, Armenia increased its gas coverage in rural areas with the assumption that rural households would correspondingly reduce their consumption of fuelwood. However while Armenian households' connection to gas increased from 31 percent to 94.8 percent between 2003 and 2018; between 2003 and 2010 fuelwood use fell from 73 percent to 61 percent – only 12 percentage points.[3] Consequently, this shows that there was a substitution from fuelwood to gas, nevertheless, this occurred on a much smaller proportions than expected. Research in this regard confirmed this pattern also by showing that in cases when gas prices increased, the Armenian population increasingly switched to fuelwood.[4]

The above mentioned also supports the assumption that households with more liquidity constraints are less likely to use alternative options to fuelwood and the other way around. The opposite is also true as with households who know that they will receive regular transfers do not face such liquidity constraints, which encourage them to use alternative sources of fuel. Households without improved housing amenities are more likely to use fuelwood. Lack of hot running water doubles the likelihood of fuelwood usage in comparison to households who have hot running water; households without hot running water might use fuelwood for heating water.

Next to the low affordability of alternative heating options, another important issues that existent studies point to is the very low efficiency of used heating devices and major energy losses from building envelopes. Inefficient use of energy, high energy prices and ecosystem degradation continue to perpetually impoverish rural communities. Women and children are at most risk – exposed to indoor air pollution, burdened with heavy housework related to fuelwood combustion, constrained in time for other household and personal chores.[5]

2.4. PRIMARY DATA COLLECTION RESULTS

This section presents the results of the primary data collection. In the first section the socio-demographic characteristics of the respondents including family composition, sources of income and expenses are presented which will allow to discuss the problems related to heating and approaches to alternative energy sources in this context. Subsequently, the patterns of energy use in the assessed communities including heating sources and methods, efficiency and costs of different means will be discussed. This section also discusses energy conservation and energy saving measures, their importance and application. In the last part of this section the population's perceptions of and needs for alternative energy sources are presented which also summarizes the perceptions on main advantages and disadvantages of various energy saving means, the possibilities and the difficulties of application, based on quantitative and qualitative findings.

2.4.1. Socio-demographic Characteristics of Survey Respondents

The survey involved household heads as individuals who are decision-makers in the HHs and/or are aware of heating problems, therefore the respondents of average and above average age make a large number in the respondents. The representatives of older generation also make a relatively large group. Four out of ten

1 Econoler. 2015. Second national energy efficiency action plan for Armenia. Armenia renewable resources and energy efficiency fund

2 Ann Cerbu Gillian; Perge,Emilie Bernadette; Behal, Raisa Chandrashekhar.2020. Fuelwood Dependence and Forests in Armenia (English). Washington, D.C. World Bank Group.

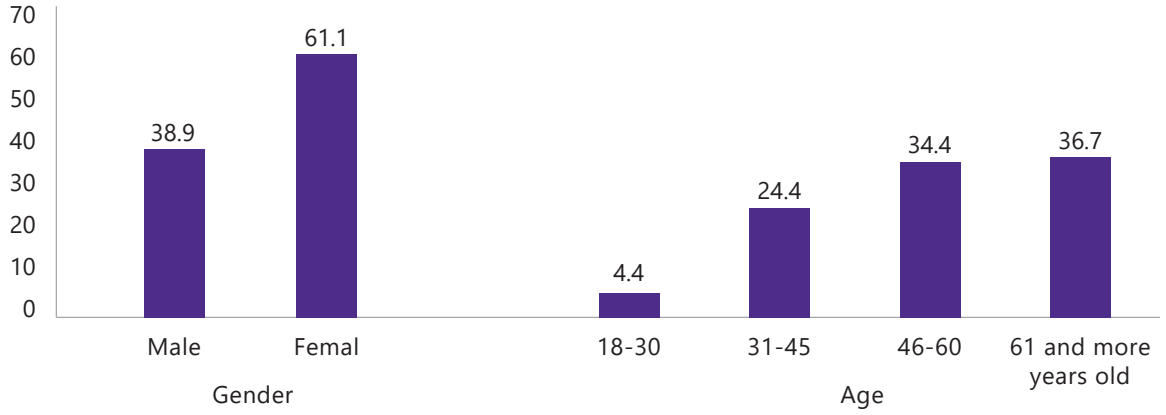
3 Junge and Fripp 2011. Understanding the forestry sector of Armenia: Current Conditions and Choices

4 Mkrtchyan and Grigoryan, E. 2014. "Forest Dependency in Rural Armenia." FLEG II (ENPI East) Programme.

5 A. Pasoyan N. Sakanyan. 2019. Baseline data collection and analysis: energy demand, supply and efficiency, Armenia. GIZ

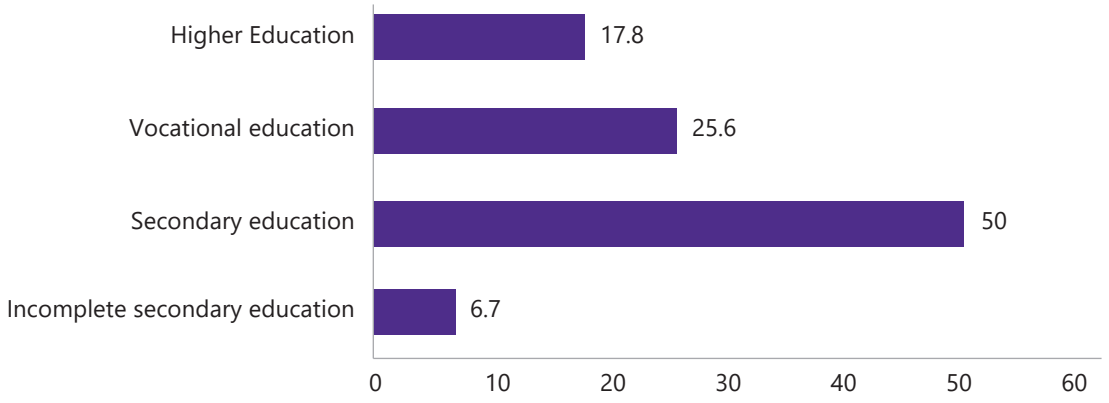
respondents are men and six are women. The gender and age composition of the respondents is presented in Figure 22.

Figure 2-2: *Gender and age composition of the respondents, %*



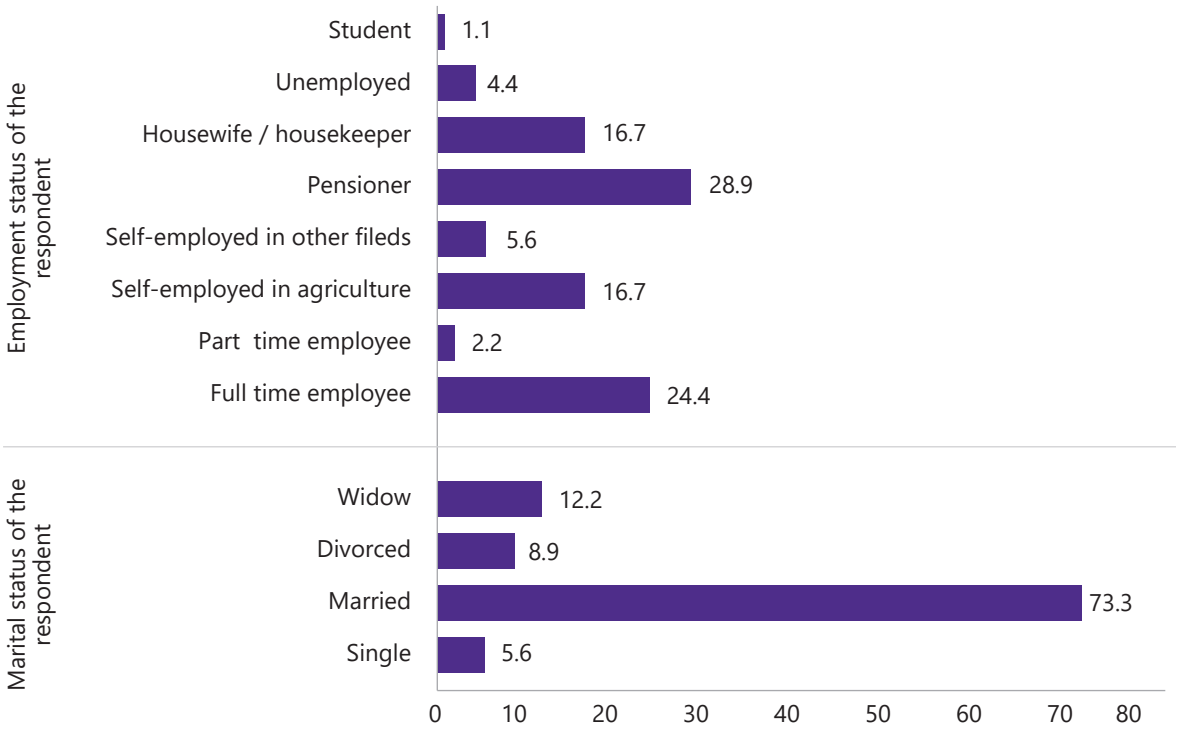
As for the level of education, 50% of the respondents have secondary education. The second large group consists of those with secondary vocational education, followed by individuals with higher education (25.6% and 17.8% respectively, see Figure 23).

Figure 2-3: *Education level of the respondents, %*



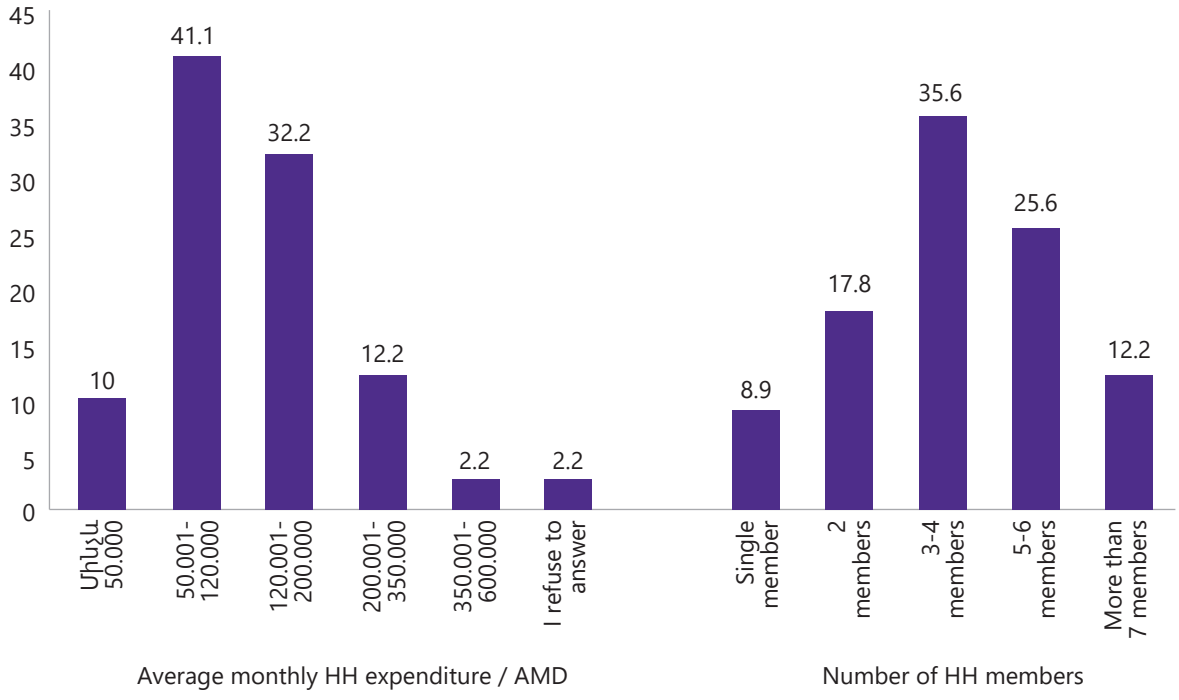
Another important indicator regarding the socio-demographic character of the respondents is their employment status. As illustrated in Figure 24 almost half of the respondents (48.9%) are economically active. Many of them work full-time or part-time, are self-employed in agriculture or in other sectors (24.4%, 2.2%, 16.7% and 5.6%, respectively). In the socio-economically passive group, a large number are pensioners, followed by housewives and the unemployed (28.9%, 16.7% and 4.4% respectively. About 3/4 of the respondents are married. There are also divorced and unmarried (8.9% and 5.6% respectively. Also 12.2% of the group was consisted of widows.

Figure 2-4: *Status of the respondents, %*



Most of the surveyed HHs, 35.6%, consist of 3-4 members, followed by the next large group consisting of families of 5-6 people (25.6% of total, see Figure 24. In general, the average number of family members is 4.09, with a maximum of 10 people. In about 80% of families with one or two people, the age of the members is over 61, mostly pensioners.

Figure 2-5: *Status of the respondents, %*



The distribution of average monthly expenses of the respondents indicates that their income was lower than average income in Armenia. The vast majority of households (the first three groups together make up about 83%) spend a maximum of 200,000 drams a month. Although in most cases their source of income is more than one, the main source both in Lori and Tavush marzes is salary (48.9% and 51.1% respectively, see also Table 22). The next main source of income of the surveyed households is pension, with a slight higher percentage in Tavush than in Lori marz (28.9% and 24.4% respectively). Subsequently, the types and ratios of income sources change in the two regions, with the main source of income being the agriculture and work abroad in Lori (13.3% and 6.7% respectively) and the income and benefits from self-employment in Tavush marz (8.9% and 6.7% respectively). Other details of HH income sources are presented in Table 22.

Table 2-2: *Main income sources of HHs, %*

Marz	Income sources	Type of community			Total
		Peri-forest	Non peri-forest	Without gas supply	
Lori	Salary	60.0	40.9	50.0	48.9
	Income from self-employment	0.0	9.1	0.0	4.4
	Income from agriculture	0.0	18.2	25.0	13.3
	Income from work abroad	0.0	13.6	0.0	6.7
	Pension	33.3	18.2	25.0	24.4
	Social allowance	6.7	0.0	0.0	2.2
	Total	100.0	100.0	100.0	100.0
Tavush	Salary	80.0	40.9	25.0	51.1
	Income from self-employment	13.3	4.5	12.5	8.9
	Income from agriculture	0.0	0.0	12.5	2.2
	Pension	6.7	36.4	50.0	28.9
	Social allowance	0.0	13.6	0.0	6.7
	Relief from abroad	0.0	4.5	0.0	2.2
	Total	100.0	100.0	100.0	100.0

2.4.2. Heating Resources and Efficiency

According to the results of the study (as summarized in Table 23), the main source of heating (80% of cases) in the target settlements is firewood. Other used heating sources which are used far less compared to fuelwood are gas, electricity and manure (11.1%, 5.6%, 2.2%, respectively). The indicator of firewood use on the province (Marz) level is the same for both Marzes. The main Marz level differences involves the relatively higher use of electricity in Tavush and the use of manure which was only identified in Lori. The latter could have been caused by the larger focus of the Lori Region on Animal husbandry which is also reflected in the double size of existent cattle in the Lori Region.[1]

1 In 2019 the Lori region had a cattle headcount of 67.8 thousand and the cattle in Tavush equaled 30.2 thousand.

Table 2-3: *Main source of heating by community and marz, %*

Marz	Main source of heating	Type of community			Total
		Peri-forest	Non peri- forest	Without gas supply	
Lori	Natural gas	13.3	13.6	0.0	11.1
	Electricity	0.0	4.5	0.0	2.2
	Firewood	86.7	72.7	87.5	80.0
	Manure	0.0	9.1	0.0	4.4
	No heating in the house	0.0	0.0	12.5	2.2
	Total	100.0	100.0	100.0	100.0
Tavush	Natural gas	0.0	22.7	0.0	11.1
	Electricity	0.0	18.2	0.0	8.9
	Firewood	100.0	59.1	100.0	80.0
	Total	100.0	100.0	100.0	100.0
Total	Natural gas	6.7	18.2	0.0	11.1
	Electricity	0.0	11.4	0.0	5.6
	Firewood	93.3	65.9	93.8	80.0
	Manure	0.0	4.5	0.0	2.2
	No heating in the house	0.0	0.0	6.3	1.1
	Grand total	100.0	100.0	100.0	100.0

Nevertheless, peculiarities did exist regarding the choice of heating sources, depending on the type of settlement. This involved the following:

- In general, the use of firewood is predominant in communities without gas supply and in peri-forest communities (93.8% and 93.3%, respectively, see Table 23), while in non peri-forest communities, diversity of heating sources is observed, reducing the indicator of firewood use to 65.9%. Here 18.2% of households use natural gas, 11.4% use electricity, and 4.5% use manure.
- The comparison of the data of the two marzes shows the prevalence of the use of gas and electricity as the main sources of heating in Tavush marz, particularly in the non peri-forest communities, which directly indicates the use of the privileges granted to the border communities. According to the RA Law "On Social Assistance to Border Communities", among other assistance the government reimburses 50% of the consumed electricity and natural gas bills. It is to be added that there is a certain limit to the consumption volume.

Out of the 90 households surveyed, 18 HHs (20%) use second additional heating source in addition to the main source, for the most part electricity 44.4%, followed by manure, gas and firewood (27.8%, 16.7% and 11.1% respectively). Electricity and gas as secondary sources are again used more in Tavush, and firewood and manure as additional means are used only in Lori. The main heating source/system provides the main part of the necessary heat of the HH, and the additional equipment or source is used far less, for maintaining the temperature of a separate part of the house and/or add to the general temperature of the house during colder months.

Albeit to a small extent, the transition from firewood to other heating sources in these communities year after year has had its advantages, which are mainly expressed at the individual / family level:

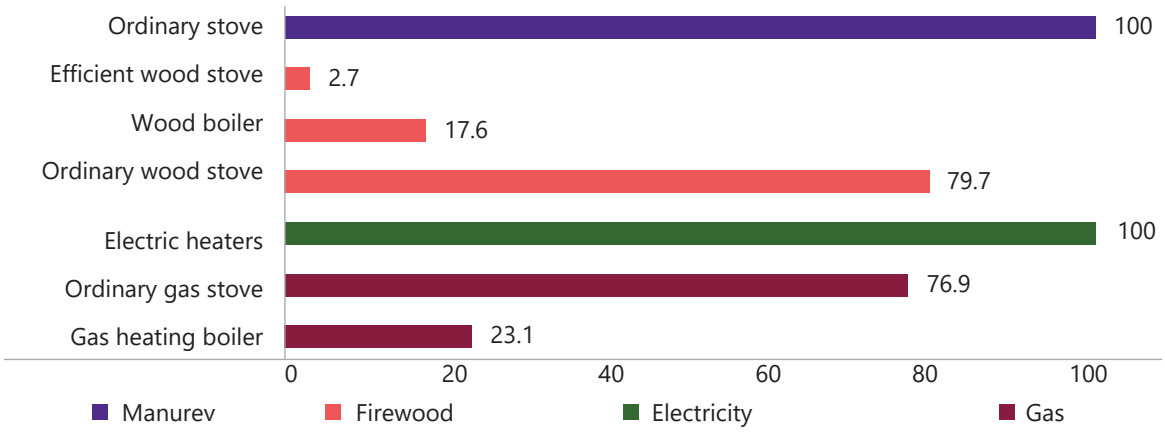
- Avoiding problems with acquiring and/or purchasing firewood.
- Reduced effort and time spent on breaking/cutting the firewood to size and taking it into the house, burning the stove, etc.
- Improvement of living conditions in terms of cleaner and smoke-free living environment.

In some households, gas is still inaccessible and unavailable as a source of heating. This is primarily due to:

- the lack of natural gas infrastructure in the communities,
- high costs of laying gas supply pipelines in some districts of the community;
- Inability to pay for gas consumed in the absence of a stable monthly income, as well as due to high gas tariffs.

In addition to the main source of heating in terms of types of fuel/energy the study also set out to identify the main heat systems used for generation and/or transfer of heating. As summarized in Figure 26, when using firewood, conventional stoves are the most widely used (79.7%) type of burners in the target communities. On the other hand, conventional gas stoves are utilized in over majority (76.9%) of the gas-using HHs, whilst boilers are installed only in a relatively small share (23.1%) of these HHs. Firewood boilers, compared to gas boilers, are less common (17.6%) in the surveyed communities, and the share of the households who indicated to use efficient stoves is very small (2.7%). In terms of marz level comparison it can be noted that gas and firewood boilers are used more in Tavush marz, and efficient stoves are used almost equally in both marzes.

Figure 2-6: *Heating applications, %*



The energy efficient firewood stoves referred to by the respondents are provided to the target households in the framework of the "Mainstreaming Sustainable Land and Forest Management in Mountain Landscapes of North-Eastern Armenia" project implemented by UNDP Armenia. Some of the questioned households also indicted that they so far did not have the opportunity to replace their conventional stoves with the energy efficient stoves provided by the project. The widespread use of these stoves has also been hampered by the presence of already used boilers. When asked how likely they are to use such stoves in their HH, 6.7% of respondents mentioned it was very likely. This indicator is higher in Tavush (8.9%) than in Lori marz (4.5%).

The large scale use of gas and firewood heating, like the widespread use of conventional electric heaters and manure stoves, indicates the use of local heating systems in most of these communities, which provide heat for an individual room or 1-2 rooms only.

In terms of the perceived benefits of different types of heating systems the results of the assessment highlighted the possibility of equal heating of the entire house/apartment through a (central) heating system. In addition to equal heating within the house the results of the group discussion with the residents pointed towards the following advantages of (firewood/gas) gas boilers:

- Joint use of gas and firewood through one boiler, which will provide the apartment with the appropriate temperature, by heating with firewood during the day and with gas at night.
- A cleaner living environment within the house/apartment, avoiding additional repair costs and problems due to smoke from firewood / manure stoves.
- Higher efficiency and cost-benefit ratio.
- In the case of firewood boilers, efficient use of uncut firewood that does not fit in

ordinary stoves.

Firewood, as the main means of heating, is used longer during the season. The data in Table 24 show that the heating season in the surveyed communities lasts a maximum of 7.5 months. In general, the average duration of the firewood heating season is 5.9 months. Manure is also used for a relatively long heating period, followed by gas and electricity. Heating costs for the whole season are consequently higher in the case of firewood, reaching a maximum of 400 thousand drams. On average, the HHs using firewood have to spend about 143 thousand drams a year to purchase the necessary quantity of wood. A relatively less amount is payed for gas (about 112 thousand drams for 4.8 months on average) and less for electricity (about 46 thousand drams for 4.5 months on average). In the case of manure, as we see, the cost is very small.

Table 2-4: *Statistics of heating months and costs*

	Number of heating months			Heating costs throughout the season, AMD		
	Minimum	Maximum	Average	Minimum	Maximum	Average
Gas	1,0	7,5	4,8	14 000	330 000	112 076,9
Electricity	1,0	7,0	4,5	10 000	150 000	45 642,9
Firewood	2,0	7,5	5,9	10 000	400 000	142 554,1
Manure	4,0	7,0	5,6	0,0	10 000	1 428,6

The total cost of heating in HHs varies from community to community. For example, the majority of the residents of not gasified communities in Lori spend up to 50 thousand drams (71.4% (see Table 25). In a peri-forest community of the same marz, they mostly spend up to 150 thousand drams (the three ranges of paid amounts make 86.7% together). In a non peri-forest community, most HHs pay starting from 151 thousand drams (the last three ranges together make up 63.6%).

Compared to Lori, in a Tavush marz's community without gas supply, higher expenses are required for the general heating season. A relatively small amount - up to 150 thousand drams - is required in a non peri-forest community in Tavush, where the housing stock consists mostly of apartment buildings, and the cost of heating in apartments is lower than in private houses.

Heating expenditures are relatively low in small households, for example, most of the people living alone - 71.4%, and 62.5% of families with 2 members pay up to 100 thousand AMD for heating all year round. In addition, for example, in most HHs with 5-6 members - 86.9%, those expenses start from 101 thousand drams, reaching up to 250 thousand drams.

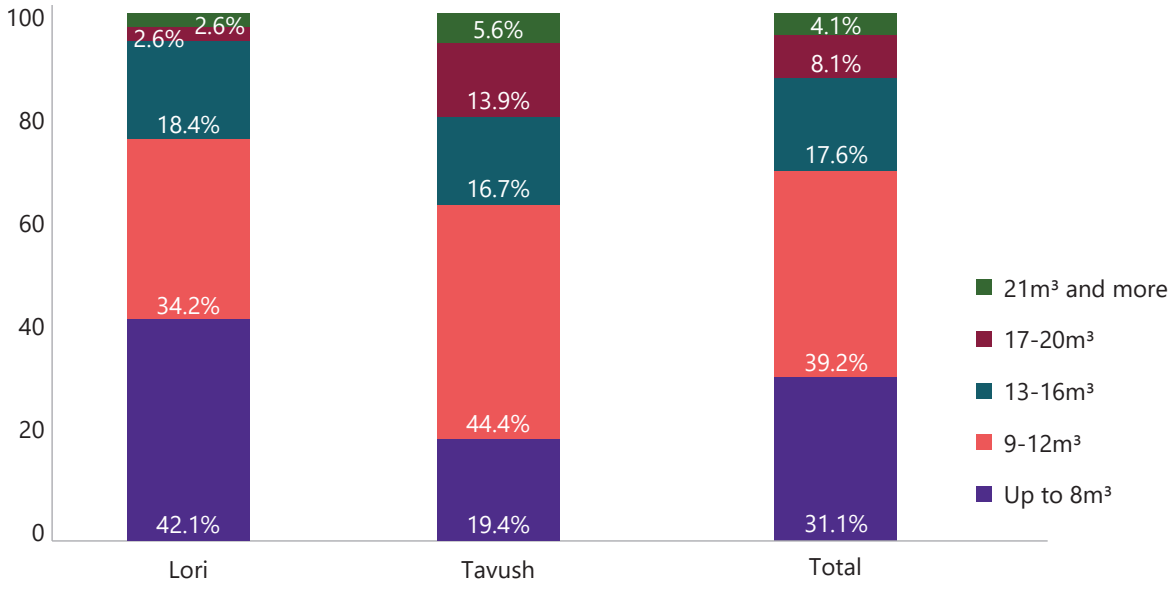
Table 2-5: *Total cost in heating season by community and Marz, %*

Marz	Total heating cost of HH, AMD	Type of community			Total
		Peri-forest	Non peri-forest	Without gas supply	
Lori	0 AMD	0.0	4.5	0.0	2.3
	Up to 50 000	20.0	4.5	71.5	20.5
	51 000 -100 000	40.0	9.1	14.3	20.5
	101 000 - 150 000	26.7	18.2	0.0	18.2
	151 000 - 200 000	6.7	27.3	14.3	18.2
	201 000 - 250 000	0.0	22.7	0.0	11.4
	More than 251 000	6.7	13.6	0.0	9.1
	Total	100.0	100.0	100.0	100.0

Tavush	Up to 50 000	6.7	31.8	0.0	17.8
	51 000 -100 000	20.0	13.6	12.5	15.6
	101 000 - 150 000	20.0	31.8	12.5	24.4
	151 000 - 200 000	20.0	13.6	37.5	20.0
	201 000 - 250 000	20.0	4.5	25.0	13.3
	More than 251 000	13.3	4.5	12.5	8.9
	Total	100.0	100.0	100.0	100.0

In terms of the volume of firewood used - as presented in Figure 27 – the largest share of the questioned households uses 9 to 12 m^3 of firewood for heating, the second largest group (31.1%) of HHs indicates to use up to 8 m^3. The analysis by marz reveals that the use of firewood reaches a higher level in Tavush marz, mostly (44.4%) starting from 9 m^3 and reaching up to 20 m^3 and more. The majority of respondents found it difficult to provide average figures for the volume of electricity and gas consumed.

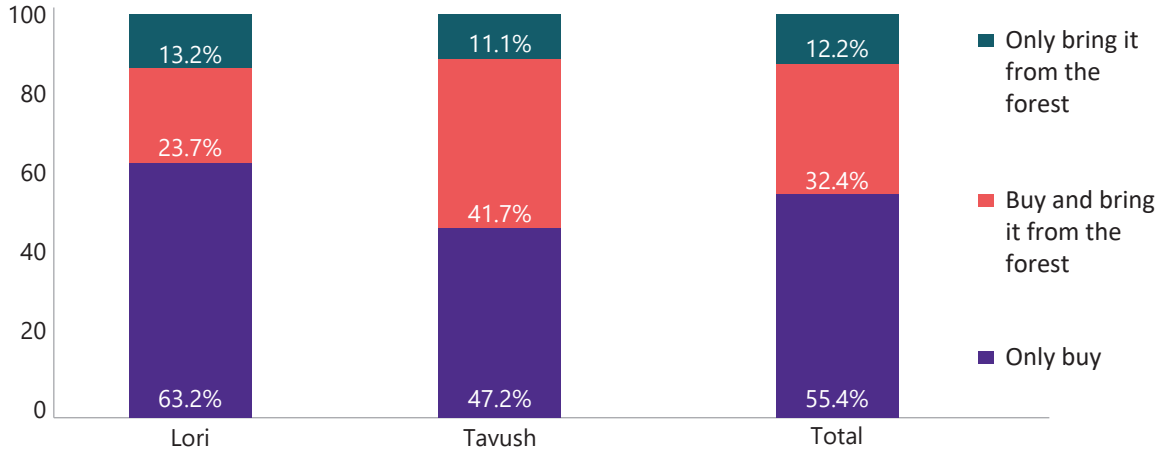
Figure 2-7: *Amount of firewood used throughout the season by marz*



Just over half of all respondents indicated to buy fire wood. a considerable share of the respondents (32.4%) also indicated to both buy and collect firewood. In Tavush as compared to Lori a relatively large number of consumers indicated to buy and also collect firewood from the forest (Tavush - 41.7%, Lori - 23.7%. Depending on the marz and the community, the price of firewood varied between 10,000 to 20,000 drams per m3.

Overall, every one of three households (32.4%) uses both options at the same time, i.e. takes advantage of the opportunity to acquire up to 8 m^3 of free firewood, and also buy firewood, since 8 m^3 is not enough for the whole season. 12.2% use only this opportunity, paying for transportation costs to get the waste wood from the forest to the house and other possible costs. The indicator of firewood purchase in Lori marz is relatively higher, since Shirakamut community does not benefit from the program of collecting up to 8 m^3 of waste wood per year by the decision of the Government of the Republic of Armenia because of being far from the forest.

Figure 2-8: *Options for obtaining firewood by marz, %*



In general, according to the data summarized in Table 26, the community without gas supply in Lori region makes the use of this opportunity - 75.0%, followed by the peri-forest the community of Tavush marz- 46.7%. 46.7% of the wood-burning peri-forest community of Lori marz are aware of the opportunity to collect wood but have never used it, followed by 45.5% of non peri-forest community of Tavush marz.

Table 2-6: *Awareness of opportunity to acquire waste wood by marz and community, %*

Marz	Awareness	Type of community			Total
		Peri-forest	Non peri-forest	Without gas supply	
Lori	I am aware, I use it almost every year	33.3	-	75.0	47.8
	I am aware, and I have used it several times	13.3	-	25.0	17.4
	I am aware, but I have never used it	46.7	-	0.0	30.4
	I am not aware	6.7	-		4.4
	Total	100.0	-	100.0	100.0
Tavush	I am aware, I use it almost every year	46.7	22.7	0.0	26.7
	I am aware, and I have used it several times	13.3	27.3	37.5	24.4
	I am aware, but I have never used it	33.3	45.5	62.5	44.4
	I am not aware	6.7	4.5	0.0	4.5
	Total	100.0	100.0	100.0	100,0

Along with quantitative indicators, focus group discussions revealed the main difficulties and hidden problems that exist when using food collection program:

- Lack of manpower in HHs,
- labor intensive nature of the work
- Cost-consuming, resulting in costs equal to the purchasing price of firewood,
- Absence of waste wood / far from settlements;
- Corruption risks, as when the population can be provided with firewood instead of waste wood, at a price lower than the selling price;
- The potential risk of tree theft in the sense that more than 8 m^3 of waste wood can be

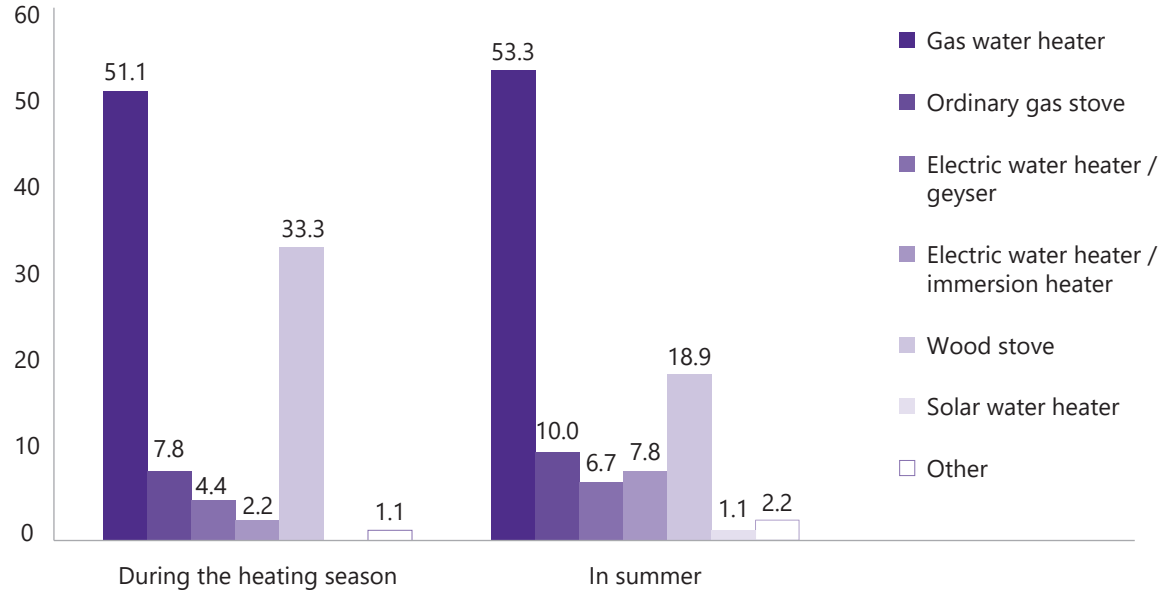
collected by residents.

Because of these difficulties and problems, the villagers indicate that there interest in the program becomes less and less every year and, according to their estimates, "one or two out of 10 HHs use the program". Nevertheless, they also indicate that there are only very few who consider other heating sources, such as the possibility of using/production of briquettes. It was noted during one of the discussions that it is simply not common. People find it difficult to apply new methods and "consider their familiar way to be the shortest way to solve the problem", considering the forest as their property.

The issue of hot water supply was also considered during the survey. As can be seen from the results in Figure 29, HHs have taken various measures to meet their hot water needs. The most common means is gas water heater, which is used in more than half of households (51.1% in the heating season, 53.3% in summer). It not only reduces the cost of firewood, but also increases the level of comfort for women. Electric water heater / geyser, is used in less HHs. In winter period when firewood stoves are also used for hot water, the use of electric water heaters is also reduced to some extent (4.4 % during the heating season, 6.7% in summer).

The second most commonly used means for heating water involves using firewood stoves. This is understandably significantly higher during the heating season compared to the summer period. Ordinary gas stoves and ordinary electric water heaters are also used as hot water sources.

Figure 2-9: *Hot Water Source, %*



Energy Efficiency (EE) measures such as efficient windows and doors play an important role in the thermal modernization of HHs. The results of the survey as illustrated in Table 7 show that less than half of the respondents had any kind of energy efficient these conditions in their houses/ apartments.

In terms of implementation of any EE measures in the near future, more priority is given to the replacement of doors than windows, particularly in Lori marz. These measures are more likely to be implemented among the economically active group where the main source of income is from entrepreneurship and from the work abroad (the quantitative indicator in each case is 33.3%), while 4.2% of HHs with the main source of income being pension intend to save energy by replacing the windows.

Very few HHs have implemented thermal insulation of walls and roof (wall insulation is 2.2% more in Tavush marz, as compared to Lori marz). From the point of view of implementation in the near future, the insulation of roof is considered more important than the insulation of walls. The latter is planned to be implemented twice as much in Lori marz as in Tavush.

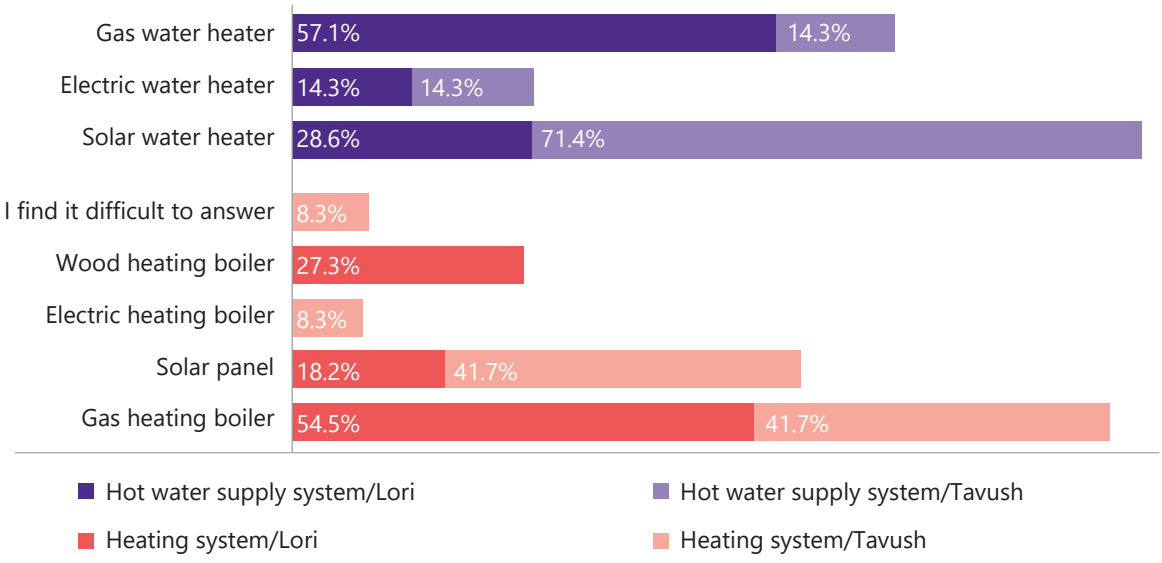
Table 2-7: Implementation of energy saving measures and its probability by marz, %

Measures	Implemented		Planned to be implemented	
	Lori	Tavush	Lori	Tavush
Modernization of heating system	11.1	8.9	24.4	26.7
Modernization of hot water supply system	42.2	57.8	15.6	15.6
Replacement of windows	44.4	46.7	15.6	17.8
Replacement of doors	35.6	28.9	26.7	22.2
Thermal insulation of walls	6.7	8.9	8.9	4.4
Thermal insulation of roof	8.9	8.9	15.6	15.6

The use of hot water supply system by the surveyed HHs is significantly more common (Lori - 42.2%, Tavush - 57.8%) than the use of heating system (Lori - 11.1%, Tavush - 8.9%, see Table 7), since the latter requires higher costs. In terms of heating systems, Lori marz is in a slightly better condition than Tavush, and in the case of hot water supply, the picture is the opposite. However, in order to reduce costs, the modernization of the heating system is given almost equal importance in both marzes. 24.4% of households in Lori marz and 26.7% in Tavush marz plan to install a new, efficient heating system in the next five years. Both the replacement of windows and the modernization of these systems are directly related to the main source of income for HHs, for example, only 8.3% of pensioners plan to replace the heating system in the near future, as compared to 66.7% of those having income from working abroad, i.e. about 8 times higher indicator.

In terms of improvement of the heating system, gas heating boiler was considered first, followed by firewood heating boiler, and finally solar panels in Lori marz (54.5%, 27.3%, and 18.2%, respectively). As for Tavush marz, excluding the firewood boiler option, gas boilers and solar heating panels are equally preferred (41.7% in each case). Electric boiler is considered as an alternative option.

Figure 2-10: Preferred options for replacement of systems by marz



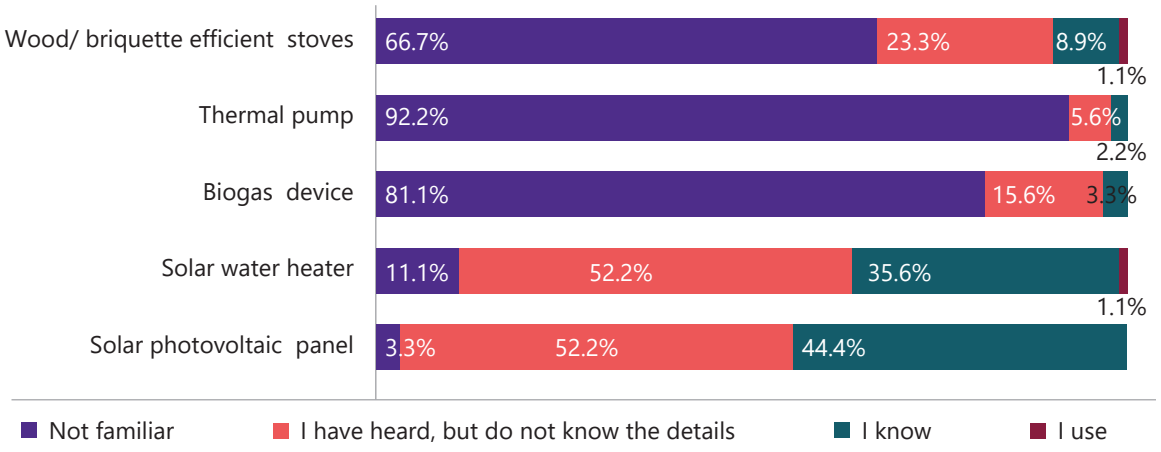
In both Marzes, most of the respondents indicated to apply to banks for obtaining loans to implement any such measure. Having a rough estimate of the prices, especially the HHs without gas supply prefer solar panels as a more efficient way to avoid double costs.

According to the survey results, solar water heaters, as a means of hot water supply, will be widely used in the coming years in Tavush marz, and to a lesser extent in Lori marz (71.4% and 28.6%, respectively see Figure 210). Gas water heater, on the contrary, is more preferable in Lori marz than in Tavush (57.1% and 14.3%, respectively, ibid).

2.4.3. Approaches to Alternative Energy Sources

In terms of Renewable Energy (RE) the respondents were relatively familiar with solutions such as solar photovoltaic panels and solar water heaters. In the first case, 44.4% of respondents indicated to be aware, and the larger 52.2% just heard about this technology and were unaware of application possibilities and other technical characteristics. In terms of solar water heaters, awareness levels were similar nevertheless there were also limited cases of application of such solutions.

Figure 2-11: *Awareness of alternative energy equipment, %*



Both solar panels and water heaters are better known in Tavush marz; in the first case, the ratio is 40.0% -60.0%, in the second case it is almost the same - 40.6% -59.4%. Solar panels are better known in communities without gas supply, followed by non peri-forest, and finally peri-forest communities (50.0%, 45.5%, and 40.0% respectively). This pattern is also observed in the case of solar water heaters; moreover, this equipment is used in the community without gas supply. For the installation of the latter, 430 thousand drams were spent by the resident at the expense of loan, just three months before the survey.

The group unfamiliar with solar panels is primarily consisted of retirees. In the case of solar water heaters, the latter again form a large group. In the group of unfamiliar people, 60% of the total are retirees. In terms of gender differences, male respondents are better aware of alternative resources.

Among other energy sources, the surveyed communities are relatively more familiar with biogas generators than heat pumps. The participants of the focus group discussions assessed the possibility of its application as very complicated, due to both technological and economic reasons. This is among other based on previous experiences as there has been an attempt to use a biogas device in a peri-forest community of Tavush marz, which, however, has not succeeded.

In terms of likelihood of application of solar panels and water heaters in general, the pros and cons, were also discussed during the focus group discussions. Findings of the more in-depth discussions with regard to possible application of various RE technologies is presented below.

2.4.3.1 Solar Panels

The perceived probability of installing solar panels in the studied communities is not high. About a quarter of respondents (23.3%) think, it is likely these will be installed sometime in the future. Such a probability of installing solar panels is the lowest in the community without gas supply in Lori marz (12.5%), and, on the contrary, is the highest - four times higher in the community without gas supply in Tavush marz (50.0%). In Lori marz, the probability of its use is assessed higher in non peri-forest communities (36.4%).

Table 2-8: *Probability of using solar panels by Marz and community type, %*

Marz	Probability	Type of community			Total
		Peri-forest	Non peri-forest	Without gas supply	
Lori	Unlikely	80.0	63.6	87.5	73.3
	Likely	13.3	36.4	12.5	24.4
	I find it difficult to answer	6.7	0.0	0.0	2.3
	Total	100.0	100.0	100.0	100.0
Tavush	Unlikely	80.0	77.3	50.0	73.3
	Likely	13.4	18.1	50.0	22.2
	I find it difficult to answer	6.6	4.6	0.0	4.5
	Total	100.0	100.0	100.0	100.0
Total	Unlikely	80.0	70.5	68.8	73.3
	Likely	13.3	27.3	31.2	23.3
	I find it difficult to answer	6.7	2.2	0.0	3.4
	Total	100.0	100.0	100.0	100.0

In this regard, men again consider installing solar panels almost twice as likely as women (quantitative indicators were 34.3% and 16.3%, respectively). Only women found it difficult to answer the question. Also younger population groups consider the probability of application of such a technology more likely as 36.3% of 31-45-year-old respondents indicated to find this likely.

This question is also largely related to the employment status of the respondents. The probability of installing solar panels was highly rated by self-employed people in different sectors and by hired workers, (the quantitative indicators were 60.0% and 45.4%, respectively). It was assessed as average by those engaged in agriculture - 26.6%, and as the lowest among retired people and housewives (7.7%, and 6.7% respectively). The probability of using this equipment among the unemployed is zero.

In addition to these indicators, the vast majority of respondents - 66.7% - do not have information on how much money is needed to use this method of obtaining energy. In addition, most of them imagine the implementation of all this through loans - 62.0%. 19.0% of the respondents mentioned their own resources as a source, and another 19.0% just found it difficult to answer the question.

In terms of the pros and cons of the solar panels results the following were perceived to the be positive and negative aspects of the application of Solar panels by the respondents.

- are modern, efficient and economical,
- Are less pollutant
- Reduce the use of firewood, therefore, forests are preserved,
- have great technological capabilities, which allows the remote control of the operation of the equipment, ensuring the appropriate temperature of the house,
- have special credit terms, which is an

additional incentive to apply it,

The residents also singled out a number of issues that concern them, in particular:

- High initial costs required in case of individual use.
- Lack of initial financial investment.
- Complex regulations, in particular on the purchase and sale price of energy. According to the current RA regulations, physical persons can install photovoltaic stations with a capacity of up to 150 kV for personal use.
- Equipment warranty period and terms.
- Low quality panels.
- Lack of experience, example in communities.
- Being innovative, which does not allow fully mastering the information and evaluating the efficiency.
- Local climatic conditions, due to which, according to them, the cost will be covered in 7-10 years, while in other regions this period varies in a range of 3-4 years.
- Difficulties in installation on roofs, supposed problems.

2.4.3.2. Solar water heaters

As compared to solar panels, the likelihood of installing solar water heaters is almost twice as low in the surveyed communities (12.3%). It became clear from the focus group discussions that the residents are not very interested in this way of hot water supply. They consider it a more efficient option for guesthouses, restaurant business, in which case, according to them, the costs are reduced by about one third. Based on the experience of others, they spoke about the quality of the equipment, in particular that in the case of solar heaters, it takes a long time for water to reach the required temperature, and that additional action must be taken to always have the right amount of water.

Representatives of peri-forest communities and those without gas supply in Lori marz exclude its installation. It is considered possible only in non peri-forest communities. As for Tavush marz, the probability of installing equipment was assessed relatively high in the community without gas supply. The case of using the water heaters mentioned above referred to this community, and in fact, this factor had a great impact on the opinions of the residents. The lowest probability was assessed in the non peri-forest Azatamut community, where, as already mentioned, the housing stock consists largely of apartment buildings, and people, among other reasons, do not technically imagine its implementation.

Table 2-9: *Probability of using solar water heaters by marz and community type, %*

Marz	Probability	Type of community			Total
		Peri-forest	Non peri-forest	Without gas supply	
Lori	Unlikely	100.0	72.7	100.0	86.7
	Likely	0.0	22.7	0.0	11.1
	I find it difficult to answer	0.0	4.6	0.0	2.2
	Total	**100.0**	**100.0**	**100.0**	**100.0**
Tavush	Unlikely	86.6	86.4	71.4	84.1
	Likely	13.4	9.1	28.6	13.6
	I find it difficult to answer	0.0	4.5	0.0	2.3
	Total	100.0	**100.0**	**100.0**	**100.0**
Total	Unlikely	93.6	79.5	86.6	85.3
	Likely	6.4	15.9	13.4	12.3
	I find it difficult to answer	0.0	4.6	0.0	2.4
	Total	100.0	100.0	100.0	100.0

According to socio-demographic indicators, the following patterns were observed:

- In case of both panels and water heaters, the probability of application is considered higher by men - 17.1% than by women -9.3%. Here again, women found it difficult to answer the question.
- As an alternative method of obtaining energy, the probability of using this equipment is considered highest among 18-30 years olds - 25.0%. The upper-middle and older generation considered its use relatively unlikely. It was 9.7% among 46-60 year olds and 9.1% among those over 61 years old.
- Like in case of solar panels, in this case too the probability of application is considered the highest in families with 3-4 members - 18.8%, and the lowest in multi-member families (5-6 members) - 4.3%.

And again, the use of this resource is considered probable by the members of the socio-economically active group, largely self-employed in various fields, hired workers, as well as those engaged in agriculture (quantitative indicators were 40.0%, 18.1% and 21.4% respectively). Housewives and the unemployed generally rule out, and only 3.8% of retirees consider the use of solar water heaters more likely.

2.5. FIREWOOD USE IMPACT ON BIODIVERSITY (FOREST ECOSYSTEMS OF SURVEYED COMMUNITIES)

2.5.1 Itroduction

Armenia is a mountanous country with rich biodiversity. The landscape diversity, natural and geological specifics, rich geological history, wide range of climate zones and the impact of various man-made factors have resulted in the development of a broad diversity of forest communities. The forest cover makes up the 11,17% of the total area of Armenia. Forests are important habitats, they are noted for their rich biodiversity, and they have considerable impact on environment and the quality of life of the populations residing in the areas surrounding forests. Deforestation and forest degradation pose a serious threat for Armenia. Meanwhile, a *sustainable governance of forests* may ensure purveying of *forest resources* without damaging the biodiversity or reducing the reproductive capacities of forests, without causing a substantial infringement to the forest ecology, and at the same time bringing social benefits for local communities. It has been scientifically substantiated that the 20% of any forest area has to be exempt from exploitation and left untouched in order to preserve the function of the entire biodiversity and ecosystem of the forest.

The objective of the presented report is to find out the impact on the environment, notably on forests caused by the firewood use pattern, incurred by the populations of the two north-eastern regions of Armenia, the border villages of Voskevan, Berkaber and Azatamut of the region of Tavush and the villages of Vahagn, Chkalov and Shirakamut of the region of Lori. The surrounding areas of the above mentioned settlements, the legislative framework have been investigated, photographs have been taken, and conversations have been held with the heads and residents of the communities.

2.15.2. North-Eastern Forests of Armenia

Armenia is a typical mountainous country where landscapes and ecosystems make up a complex and multifunctional system, which contributes to the development of rich and unique biodiversity. The complexity of the relief, upland zoning, substantive differences of heights, diversity of natural conditions (climate, geology, hydrology, etc.) have enabled rich biodiversity and high endemism. The investigated area is located in a floristic territory in Ijevan which includes the entire region of Tavush and the eastern part of the region of Lori. Nearly all the zones of vertical zoning are typical of the floristic region of Ijevan. The territory mostly occupies the lower and medium mountainous forest zone (800-2300 m) of the uphill zonings of the landscape.

Forests are distributed very unevenly in Armenia. In general, the 62,5% of forests (207,000 ha) are located in the north-eastern regions of Armenia, the 13,5% (45,000 ha) are located in the central regions, the 2,4% (8,000 ha) in the southern regions, and the 21,6% (72,000 ha) in the south-eastern regions of Armenia.

Closed (lush) forests, deciduous and sparse mixed forests, as well as river-bed forests and artificial (plantation) forests were investigated during the field works. Closed /lush/ forests occupy significant areas in the region of Lori, in the surroundings of the Chkalov and Vahagni communities. Deciduous and sparse mixed forests prevail in the surroundings of the Voskevan,

Berkaber, and Azatamut communities, whereas riverbed and artificial /plantation/ forests are mostly located in the surroundings of Shirakamut and to some extent in the surroundings of the Berkaber, Voskevan and Azatamut communities. An area of a few hectares of deserted gardens is located in the surroundings of the Vahagni community, which makes a unique landscape.

2.5.2.1. Closed (lush) forests

Closed (lush) forests are located on a 800-2000 m height in the north-eastern part of Armenia, generally on the northern mountain hillsides, their canopy closure cover is 0,6-1,0. The main tree species that contribute to the formation of forests in closed forests are Fagus orientalis, Quercus machratera, and Carpinus Iberica. Aside from these tree species, Tilia caucasica and T. cordata, Fraxinus, Acer and several types of such forests. In those forests one can come across such relicts of the Armenian flora as Taxus baccata and Castanea sativa trees. Cotynus coggigria and Sorbus aucuparia can be found close to the forest edges.

Oak forests are sub-types of closed (lush) forests. They can be found at a 600-2.200 m height. Depending on the height, three types of oak tree prevail.

2.5.2.2. Deciduous and sparse mixed forests

Deciduous and sparse mixed forests are typical of north-eastern lowlands and southern hillsides of Armenia. Deciduous and sparse mixed forests species are diverse. Carpinus orientalis, Quercus macranthera, certain types of Pyrus, sometimes also Amygdalus can be found here. Various types of Malus oriental is, Prunus, Berberis, Cratageus, and Sorbus aucuparia can also be found here. Sometimes different types of Pyrus form clean sparse forests – pear groves. Often ripe individual trees of Pyrus growing alone or in small groups can be found in glades. Xerophile sparse forests are common on bare, rocky, and sloping hillsides and gorges with 700-2200 m height above the sea level. Both plant coexistence typical of deciduous forests and drought resistant plant coexistence grow in that area. Plant coexistence typical of deciduous forests are made of Paliurus spina-christi, spirea/meadowsweets, hackberry, honeysuckle, buckthorn, Jasmine/ Privet, Georgian maple species: Pistachio tree and smoke tree can also be found there. Celtis caucasica individual trees can be found on rocky areas. The first floor of deciduous and sparse mixed trees is made up of frigant grass – gases, Feathergrass, Fescues, and Hedgenettles, etc. Thorn forests or Junipers are sub-types of Xenophile sparse forests, which practically do not exist in investigated area.

Juniperus trees which are typical of open deciduous forests were not considered during the field investigation in open deciduous forests. Ficus carica tree grove was found in the village of Berkaber, in the area adjacent to the reservoir which is probably a remnant of a garden that has become wild.

2.5.2.3. River-bed forests

There are numerous rivers and streams in the area investigated during the field works on the shores of which the river-bed forest system has developed where the species composition is different from that of closed forest species. In fact, the riverbed vegetation of highland tributaries is quite different from that of valleys. The main tree species of river-bed forests include Hippophae rhamnoides, Salix triandra, Salix elbrusensis, Salix carpea, and several types of Populus. Very often Rubus caesius (Rubus fruticosus) and Rosa shrubs grow in river-bed forests.

2.5.2.4. Artificial (plantation) forests

Artificial (plantation)/ forests mostly spread in the northern hillsides surrounding northern hillside areas of the surroundings of the village of Shirakamut, in the Chichkhan river gorge, they generate copses in properly dried-up lands and steep slopes. They are 40-50-year-old Pinus silvestris; the trees have 25-30 cm trunk thickness and 12-15m canopy closure height.

2.5.2.5. Herbaceous steppe vegetation

Mountain steppe lanscapes are the most common in the surroundings of Shirakamut village. Mountain steppes are one of the most common landscape types in Armenia which take 1200-2000m, and in special cases up to 500-2700m height. Steppe vegetation is very diverse in Armenia and it is divided into multiple subspecies, from which, based on the vegetation cover the following subspecies can be distinguished: Herbivorous, Acantholimon festucaceum, Feather grass, Seasonal, Sedge, Wormwood, Herbaceous, Herbaceous of cereal family, Tragacanth (with cushion plants - mostly gases, etc.). The vegetation cover of Shirakamut hillsides and highlands belongs to the steppe subspecies of herbaceous belonging to the cereal family. Greenswarm generating plants, mostly

from cereal family, prevail in this species, such as individual and mixed covers of Acantholimon festucaceum, Panicum turgidum Forssk/desert grass, Brome-grass, Goat grass, and Meadow grass, etc., prevail in this species, among which plants of meadow origin can be found.

For many years the highlands and the hillsides of Shirakamut, Voskevan, Berkaver, and Azatamut have been cultivated or pastured. As a result, natural vegetation coexistences have partially been degraded and become scarce in those areas.

2.5.2.6. Useful wild plants, herbs and edible plants

The field investigation area of the regions of Lori and Tavush is abundant with plants that have proved useful as herbs, are used with food (both raw and cultivated: marinaded, cooked, fried, used for making preserves and jams, as spices) or are of technical significance. Various wild self-fertile trees and shrubs can be found in the forests of the region, such as Cornus mas, Pyrus, Cratageus, plum, Prunus spinosa, Juglans regia, Corylus avelliana, Rosa. From berries, the following are common: Rubus, Fragaria veska, Rubus idaeus, Ribes, also some wild edible plants, such as Thymus, Solomon's seal, Falcaria vulgaris, Rumex crispus, Urtica, Malva neglecta, etc. From herbs, the following can be found: Origanum vulgare, Hypericum perforatum, Taraxacum officinalis, Cichorium intybus, etc.

Besides these plants, others that are widely common for all the territories of Armenia can be found in this region as well.

2.5.2.7. The fauna

Many fauna species of the north-eastern regions of Armenia are common for other regions as well. Nevertheless, there some which are typical to this particular area only. The investigated area is unique by its diverse fauna. In particular, invertebrates are quite diverse here.

The fauna of lush/closed forests is quite rich and diverse. From mammals, Capreolus capreolus (Roe deer), Caucasian bear, Sus scrofa (Wild boar), Lepus (Hare), Operimentum pellem melis (Badger), Vulpes (Fox), Ericius (Hedgehog), Fui draconum (Jackal), Apodemus (Field mouse), Agitare lyncas (Lynx), Ferret, dormouse, Inamabilis sciurus (Squirrel), and Wildcat inhabit in these forests. Also, a number of birds, reptiles, insects, and fish in rivers, can be found here.

Rodents in particular are quite typical of the fauna of mountainous steppe, from which Arvicolinae, Dipodidae, Mus caecus, Cricetinae, Saltus martes, Spermophilus citellus, Canis lupus, and Vulpes are the most common. From birds the following can be found most: Perdix cinerea, Erithacus rubecula, Corvus corone, Columba palumbus, Turdus morula, Cuculus canorus, Phoenicurus phoenicurus, Carus caeruleus, Garrulus glandarius, Perdix perdix and Dendrocopus syriacus, Dendrocopus minor, Picus viridis, and Lullula arborea. As for rocky locations and high-trunk tree forests, Sitta europaea is the most common, whereas titmouse is common in plateaus/highlands. As for feathered predators, Strix aluco, Bubo bubo, and Marsh harrier, etc. are common.

Reptiles mostly occupy lower set locations, xerophile sparse forest vegetation covers and rocky locations in the investigated area, which are good for nesting and rich with food.

Near Alpine and Alpine zone has scarce fauna, the reason for which are unfavorable climatic conditions. Animals typical of mountainous steppes can be found here, such as Vulpes (Fox), Lupus (Wolf), Leporidae, Mustella nivalis, Arvicolinae peculiaris, and Saltus martes. Due to the development of cattle farming many wolves penetrate into this area.

Numerous rivers flow down in the investigated area (Aghstev, Pambak, Qarhat, Voskepar, Chichkan), Berkaber's reservoir and Tsover pond are also situated here. These water bodies have rich biodiversity, different type of species of fish can be found here: Caucasian Squalius orientalis, Cyri loach, Chondrostoma, Barbus Cyri and Varicorhinus capoeta, Zoobenthos, Megabenthos, and Macrobenthos.

As for amphibious, Rana ridibunda, Bufo viridis are quite common in the area, and the northern forest zone is widely inhabited by Hyla arborea shelkovnikovi.

From birds, Corvidae, Passer domesticus, Columbidae, and Anas americana can be found on Debed shore, Grey partridge, Dendrocopos nanus, and Rhodopechys githaginea – in Debed gorge, and Lullula, Coturnix coturnix, and Cyanistes caeruleus – in the highlands. As for feathered predators, Strigidae, Bubo bubo, and Marsh harrier, etc. are common. Waterfowl bird species composition is not quite rich; the area lacks large water surfaces, however, you can find here certain bird species which find food at river banks.

Figure 2-12: *Voskepar river*

Figure 2-13: *Chichkan river*

As a result of the reduction and transformation of natural living conditions, many species (Corvoidea, Pica pica, Turdus merula, Streptopelia turtur, and Lanius minor, etc.) have adopted to the coexistence with the human neighborhood. Considering the mild climate, Debed and Aghstev valleys can serve as a migration route and serve as temporary shelter for certain waterfowls in early spring months.

The fauna of the region has become quite scarce due to the economic activities of humans.

2.5.2.8. Special protected nature areas

The investigated areas do not intersect with any specific special protected area. Sarigyush sosin monument is situated in the administrative region of Sarigyugh, village of Berkaber, located on the right side of Ijevan-Noyemberyan highway.

2.5.3. Assessment of Impact of Local Comminities of Forest Neighbouring Areas on Forest Ecosystems

Forest ecosystems have significanyly positive impact on the living environment, quality of life, mentality, and economy of the neighbouring communities. Forests improve and mitigate the climate, protect the hillsides from erosion, clean the air from hazardous substances, preserve the surface water, create rich biodiversity, raise the aesthetic value of landscapes and panorama, and supply the local population with forest resources. Nevertheless, the existing man-made pressure on forests causes reduction of forested areas, changes in forest type composition and forest structures, and reduction of forests' natura restorative capacity and productivity.

2.5.3.1. Types of anthropogenic impact on forest ecosystem

Anthropogenic impact directly or indirectly affects all components of forest ecosystem, including tree-shrub vegetation (flora), fauna, surface water, ground cover, and landscape. Those types of activities that cause impact on environment include:

a/ lumber (firewood and timber) production;

b/ utilizing forrest areas for agricultural purposes (sheep-breeding, cattle-breeding and bee keeping);

c/ berry and seed picking;

d/ herb and edible wild plant picking;

e/ fodder production from hay;

f/ activities not related to forestry management;

g/ wildfire;

f/ poaching;

g/ forest pollution and littering;

h/ utilizing of forests for cultural, health, sport, recreation, and tourism purposes.

Aside from anthropogenic impact, climate change has become another important threat for forest ecosystem degradation during the recent decades. According to the second and third national statements on the RA climate change, the lower border of the forest will be transferred to a 250-300 m height because of the climate change thus causing serious changes in the forest ecosystem structure.

Another reason for forest degradation is pasturing cattle in forest areas which are subject to restoration, especially in the areas surrounding the communities.

2.5.3.2. Assessment methodology of anthropogenic impact on forest ecosystem

No methodological assessment guidelines of impact on ecological changes and environment exist in the Republic of Armenia, with the help of which it would be possible to achieve *measurable* results. For that reason, assessment of impact on environment is conducted by means of ecology matrix method through a *method of scaling*, with similarity to other *semi-quantity scaling method* applied for the assessment of impact on environment. The imact assessment (positive and negative) has been conducted in a four-scale system: insignificant (1 point), low (2 points), moderate (3 points), and high (4 points). *Impact assessment* reflects the *level, special and time* factor measurement of the impact on all components of the environment (soil and lithosphere, surficial, including lakes and seas, subterranean and underground water, underwater floor sediment, atmospheric air, physical effect, biodiversity flora and fauna, landscape and panorama) which is expressed in the following mathematical equation:

$$AAi = AUi \times GAi \times SAi \ /1/$$

Where: AAi is the *impact assessment/point/* on i environmental component/ значимость воздействия/

AUi is the level assessment/point/ on i environmental component;

GAi is the time assessment on i environmental component.;

SAi is the spatial assessment on i environmental component.

Table 2-10: *The Qualitative change description of the environmental components*

N	Impact level	Qualitative change description
1	Insignificant (1 point)	Changes in the main characteristics of the components of the environment are almost not found.
2	Low (2 points)	Some changes in the main characteristics of the components of the environment have been identified, which are temporary in nature and do not exceed 20% of the initial conditions.
3	Moderate (3 points)	Significant changes in environmental components have been detected. The rate of change is such that a change in initial conditions of at least 50% can be clearly recorded.
4	High (4 points)	Significant changes in the components of the environment have been found, changes compared with initial conditions are irreversible and/or can be restored only by special measures.

The criteria of *spatial impact* assessment for the components of the environment are listed in the Table 211 below:

Table 2-11: *The criteria of spatial impact assessment for the components of the environment*

Spatial impact	Spatial Impact Criterion /km2 or km/*		Point
Local impact	Impact surface is up to 1 km^2	Impact dimension for object line is no more than 100m	1
Restricted impact	Impact surface is 10 km^2	Impact dimension for object line is no more than 1000m	2
Local impact	Impact surface is from 10 to 100 km^2	Impact dimension for object line is from 1km to 10km	3
Regional impact	Impact surface is more than 100 km^2	Impact dimension for object line is more than 10km	4

***Usually the surface is applicable for object lines, however, in the case of difficulties occurring in relation to the measuring of the surface, the length of the object is considered as a criterion.*

The critera of *time impact* assessment for the components of the environment are listed in the table Table 212 below:

Table 2-12: *critera of time impact assessment for the components of the environment*

Time impact	Time Impact Criterion*	Point
Short-term impact	Impact duration is up to 6 months	1
Medium-term impact	Impact duration is from 6 months to 1 year	2
Long-term impact	Impact duration is from 1 year to 3 years	3
Perennial or permanent impact	Impact duration is 3 years and more	4

Impact assessment is considered *low* when the result calculated with /1/ formula for the given component of the environment has 1-8 value, *medium* when the result calculated with /1/ formula for the given component of the environment has 9-27 value, and *high* when the result calculated with /1/ formula for the given component of the environment has 28-64 value.

The assessment results are presented in the format of ecological matrics in a table.

2.5.3.3.Anthropogenic impact assessment on forest ecosystem in the investigated area; special characteristics of the community

The rural areas included in the program have special characteristic features. The three villages of the region Tavush (Voskevan, Berkaver, and Azatamut) are located in a relatively lowland territory. The forests in their surroundings are mostly lush and sparse mixed (open), and the possibilities for the production of their natural wood are low, hence the population of these communities have to respond to their needs for natural wood by getting it from distant (10-20 km) lush forests. The pastures and hays of these villages are also far, as a result of which cattle farming is not considered as an effective branch of farming activity here. Due to a lowland location the climate in these communities is comparatively mild, the duration of frosts is short, and so the need for wood fire used for heating purposes is relatively low. On the other hand, the majority of the administrative areas of these communities, most often the most fruitful lands are located near the border, at the zone where military fire happens. They are not cultivated, as a result of which the communities are deprived of the income and try to get additional income from neighboring forests. Among the villages investigated in the region of Tavush, Azatamut has specific characteristic features since its nearly entire housing facilities are apartment buildings, with smaller residential area than an average house in the village. This circumstance deprives the population of Azatamut of the opportunity of running agriculture, just like "normal" villagers do.

The villages of Chkalov and Vahagni of the region of Lori are located in more upland areas, closer to lush (closed) forests. The climate is relatively humid in those villages, with more precipitation, as a result of which the forest cover is thicker and the grass cover is abundant, however, the period of frost and accordingly also the heating period is longer-term. This provides an opportunity to develop *pasture-based cattle farming* without the threat of *overgrazing* of pastures.

The situation is quite different in the village of Shirakamut of the region of Lori. The location of Shirakamut community is on the altitude 1665 m above the sea level/, as compared to other investigated villages, the climate is more severe; winter is longer. Mountainous steppe areas prevail in the surroundings of the village, which spread with mild contour on the hills. The forests here are artificial (plantation) and occupy the northern hillsides and canyons. There are also river-valley river-bed forests in that area. The effectiveness of this type of forests is low; their main function is health, tourism, and recreation organizing. The residents of Shirakamut get firewood from forests located tens of kilometers away from their village with higher prices. Cattle farming (pastures are located on higher locations on the mountains), sheep-breeding and field-crop cultivation are quite developed in Shirakamut.

The factor of anthropogenic impact on forests mainly depends on the gasification of the community. Although the level of gas consumption for heating purposes is not high

aside from heating, the gas is also consumed for other household purposes, reducing the cost of wood fire.

Taking into consideration the above mentioned specifics we considered appropriate to assess the community impacts on the neighboring forestry ecosystems separately.

2.5.3.4. Existing mechanisms for purveying of natural wood (firewood)

Unregulated logging is the main reason for forest degradation. *The level of logging, which is happening as a result of existing socio-economic issues and the high demand for wood is higher than the level of forest natural restoration.*

The procedure of woodfire purveying is prescribed by the RA Government decision N1535-N, dated 27.10.2011 "On issuing license for natural utilization fee for the purveying of waste woodfire by families residing in forest neighboring settlements in the RA for non-production/non industrial purposes" and the respective decrees of the Ministers of Environment and Economics (previously, Agriculture). According to Point 4 of the above mentioned decree, it is allowed to "to purvey at his/her own cost and obtain up to 8 cubic meters of waste wood fire from the regional forestry organizations with no cost, as prescribed by the set procedure…"

However, not all the families of neighbouring forest communities can independenly obtain firewood at no cost, and that volume of wood is not sufficient for all families (see related information in the sociological study report). In fact, firewood is mainly purveyed and removed from the forest by the residents with respective capacities and skills, with some remuneration. That amount is 12000-15000 AMD/m3 in the villages of Voskevan and Berkaber, it is 12000-15000 AMD/m3 in Azatamut, up to 5000 AMD/m3 in Chkalov, up to 10000 AMD/m3 in Vahagni, and up to 20000 AMD/m3 in Shirakamut. This fact is important given that limited number of people make *direct impact* on forest ecosystem in relation to purveying of woodfire, who, in practice, do not have appropriate state registration.

2.5.4. Impact Assessment of Forest Neighboring Communities of Forest Ecosystems

2.5.4.1. Impact of the community of Voskevan on forests located in the surrounding areas of the village

Voskevan is a village situateted in the region of Tavush in Armenia, which is located 33 km to the north-west of the center of the region, on the southern hillside of the Voskepar mountain range. Before 1978, the village was called Ghoshghotan. Since 1978, it has been known as Voskevan. The altitude of the village is 940 m above the sea level. The climate is mild, the precipitation level is approximately 540 mm. Average temperature in January is -1 C0, and +17 C0 in July. The community has been expanded. The city of Noyemberyan is the center of the community.

Voskevan is located within 16 km from the former regional center of Noyemberyan, 45 km from the present regional center of Ijevvan, and 180 km from Yerevan.

The occupations of the population include animal husbandry, fruit farming, tobacco cultivation, and grain and fodder farming.

The village is gasified; it has 283 inhabited houses. 155 families consume gas. The number of the population is 1405 (2008). The heating is mainly carried out by means of firewood through traditional wood heaters. Firewood is obtained from the forests of "Hayantar" SNCO's "Noyemberyan Forestry" branch, located in 6-10 km. Household needs are addressed with the help of firewood. No industrial exploitation of forest resources is practiced in the community. The population collects forest resources for their family needs, and sells a small part of it.

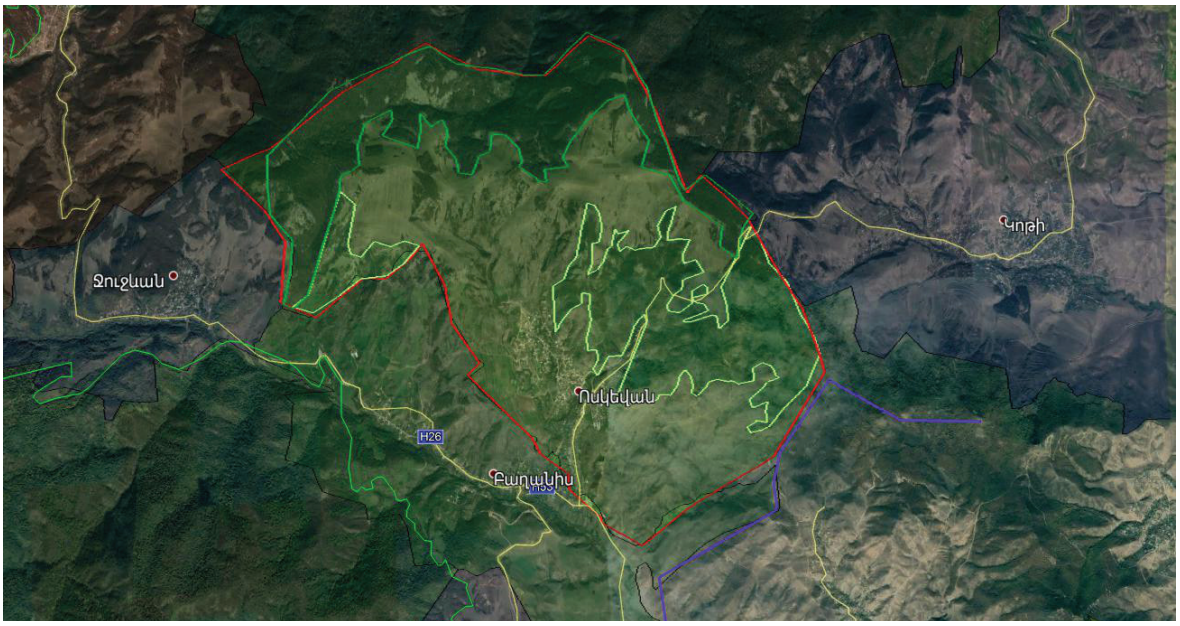


Figure 2-14: *Sattelite picture of the village of Voskevan taken with Google Earth program. The purple line indicates the state border, the red line indicates the community border – 20 km2, the deciduous mixed sparse forest (4,3 km2) is indicated in light green, and the lash (closed) forest (5,0 km2) is indicated in dark green*

Figure 2-15: *Voskevan, degraded forest*

Figure 2-16: *Gathered firewood in the forest near Voskevan*

Table 2-13: *Impact assessment matrix on the forests located in the surrounding areas of the community of Voskevan*

N	Natural environment component imposed to impact	The factor or technological process considered as the source of impact	Impact description direct/indirect	Spatial impact	Time impact	Intensity of impact	Impact assessment
1.	Timber (firewood and lumber) procurement						
1.1	Lush (closed) forests	Purveying of firewood, cutting of healthy trees	direct	limited (2 points)	perennial (4 points)	moderate (3 points)	medium /9<24<27/
1.2	Deciduous mixed (open) sparse	Purveying of firewood, cutting of healthy trees	direct	limited (2 points)	perennial (4 points)	moderate (3 points)	medium /9<24<27/

N	Natural environment component imposed to impact	The factor or technological process considered as the source of impact	Impact description direct/indirect	Spatial impact	Time impact	Intensity of impact	Impact assessment
1.3	Fauna	habitat degradation	direct	limited (2 points)	perennial (4 points)	moderate (3 points)	medium /9<24<27/
1.4	Surface and subterranean waters	evaporation increase	indirect	limited (2 points)	perennial (4 points)	low (2 points)	medium /9<16<27/
1.5	Ground cover	construction of forest roads, soil infringement	direct	limited (2 points)	perennial (4 points)	low (2 points)	medium /9<16<27/

2.5.4.2. Impact of the community of Berkaber on forests located in the surrounding areas of the village

The village of Berkaber is situated in the region of Tavush, in Armenia, located 22 km to the north of the center of the region, on the left bank estuary of the river Aghstev, in the valley of the river of Voskepar, on the left side of the Joghaz reservoir – in the valley of the river, in front of mount Gavazan, 3 km to the north of Sarigyugh. The altitude is 700 m above sea level and 670 m above the sea level.

Some of the former names of the village include Pipis, Papis, and Joghaz. It has been named Berkaber since 1978. It is an old Armenian-populated village; it has also been mentioned as a town.

The population engages in animal husbandry, field cropping, gardening, vegetable farming, and tobacco cultivation. The climate in Berkaber is temperate. Average temperature is +30 ^{0}C in summer and -2 ^{0}C in winter.

The population of the village is 527 people.

The village is not gasified. Heating is mostly carried out by means of firewood with traditional heaters. Normally one room is heated and all the household needs are taken care of in that one room. Bedrooms are heated partially by electricity. Public buildings are partially heated by solar photovoltaic panels. Firewood is obtained from the forests of the "Noyemberyan forestry" branch of "Hayantar" SNCO, which is located in 20-30 km from the village. Household needs are taken care of by firewood. The price of firewood ranges between 12000 to 15000 AMD/m3 in the village. There are no forest resource-related industrial activities operating in the community. The population collects forest resources for family needs and sells a small part of it.

The total soil balance of the community of Berkaber does not include land types of practical forest significance. Nevertheless, as investigation showed, some land types can be characterized as *deciduous mixed* (open) sparse forests. Those forests are separated by 3 forest-islands with a total area of 0,63 km^2 and are located on the south-eastern and southern parts of the village. These forests supply the minimal demand for firewood for the local community. The main demand of the community for firewood is supplied from remote *lush (closed) forests*. Hence, the community of Berkaber impacts the lush (closed) trees located beyond its administrative borders. This impact can be measured together with that of Voskevan which is nearly in the same condition as Berkaber, taking into consideration that the population of Voskevan is three times bigger than that of Berkaber, accordingly, the community of Berkaber consumes three times less firewood and its impact is three times less than the impact imposed by the community of Voskevan on the forest ecosystem. The lush (closed) tree ecosystem of Voskevan is measured with 24 points, as indicated in Table 213: Accordingly, the same indicator for Berkaber will be 8 points. Or else, if a forest with total area of 5 km^2 is necessary for meeting the firewood needs of Voskevan, then that indicator will be three times less for Berkavan, which is less than 1 km^2. According to the data provided in Table 211 the spatial impact is measured as local (1 point).

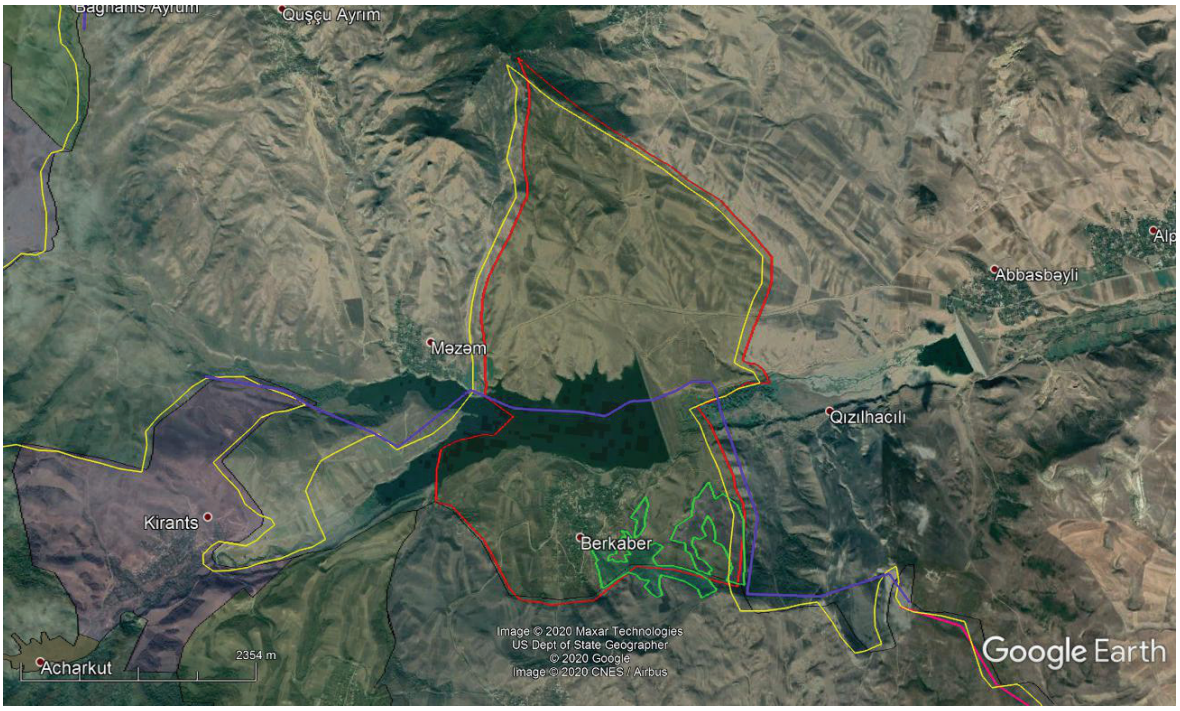


Figure 2-17: *Satellite picture of the village of Berkaber taken by Google Earth. The real state border is indicated in a purple, the RA-Azerbaijani border is indicated in yellow, the community border, which is 11,9 km2, is indicated in red, and deciduous (open) sparse forest (total area of 0,63 km2) is indicated in light green.*

Figure 2-18: *Gathered firewood in Berkaber*

Figure 2-19: *Berkaber, degraded forest*

Figure 2-20: *Berkaber, rural forest*

Figure 2-21: *Berkaber, early erosion of forest soil*

Table 2-14: Impact assessment matrix on the forests located in the surrounding areas of the community of Berkaber

N	Natural environment component imposed to impact	The factor or technological process considered as the source of impact	Impact description direct/indirect	Spatial impact	Time impact	Intensity of impact	Impact assessment
1.	Timber (firewood and lumber) procurement						
1.1	Lush (closed) forests	Purveying of firewood, cutting of healthy trees	direct	local (1 point)	perennial (4 points)	moderate (3 points)	medium (9<12<27)
1.2	Deciduous mixed (open) sparse forests	Purveying of firewood, cutting of healthy trees	direct	local (1 point)	perennial (4 points)	moderate (3 points)	medium (9<12<27)
1.3	Fauna	habitat degradation	direct	local (1 point)	perennial (4 points)	moderate (3 points)	medium (9<12<27)
1.4	Surface and subterranean waters	evaporation increase	indirect	local (1 point)	perennial (4 points)	low (2 points)	low (1<8=8)
1.5	Ground cover	construction of forest roads, soil infringement	direct	local (1 point)	perennial (4 points)	low (2 points)	low (1<8=8)

2.5.4.3. Impact of the community of Azatamut on forests located in the surrounding areas of the village

The village of **Azatamut** is situated in the region of Tavush in Armenia, located 16 km to the north-east of the center of the region, and 149 km from Yerevan. It is located on the right bank of the river of Aghstev. The total area of the village is 0,5 square km. It is 580 m above sea level. The village is located in a temperate climate zone and is not rich with forests. The average temperature in summer is +32 C^0, and +3 C^0 in winter. Annual precipitation level is 400-450 mm.

Azatamut was established in 1970. Before January 25th, 1978, it was called a town adjacent to the Bentonite clay factory.

The population of Azatamut is 2644 (2008). There are 2500 permanent residents, approximately 600 urban farms (according to the data provided by the community municipality). The administrative area of the community is 0,5 km^2:

The majority of the population was employed by the bentonite factory which presently is operating at 5 percent of its overall projected capacity. The residents of the community are also engaged in trade and cigarette waste recycling. The level of unemployment is high in the community which results in a high level of emigration.

The village is gasified. The heating of the apartment buildings is mostly carried out by gas (wall-mounted heaters or gas heaters). Public buildings are heated by gas, in some cases also by electricity. Some of the public buildings are also partially heated by solar photovoltaic panels.

Nevertheless, the residents use firewood for heating and other household purposes, which they bring from the "Ijevan" Branch of "Hayantar" SNCO. The average annual cost of firewood is 8 m^3 per family. The price of firewood in the village is 12000-15000 AMD/m3.

There are no forest-related industrial activities operating in the village. There were sole proprietors (registered in neighboring community of Ditavan) who were engaged in coal production and were producing coal from local firewood. They have stopped their activities now and are engaged in the packaging of imported coal, in order not to lose consumers (the data was provided by the head of the community).

The population collects forest resources for their family needs, from which they sell a small part.

The community of Azatamut impacts the lush (closed) forests located outside their administrative boundaries, from where the firewood consumed in the territory is imported. The volume of the impact can be assessed by

counting the approximate cost of firewood of the community which is 4800 m3 and which, as noted by the head of the community, tends to decrease year by year, especially within the previous year.

Figure 2-22: *Satelite picture of the village of Azatamut taken with Google Earth. The red line indicates the present state border, and the yellow line indicates the border between RA and Azerbaijan.*

Figure 2-23: *Satelite picture of the village of Azatamut taken by Google Earth. The red line indicates the administrative border of the community, the red line indicates the boundary (0,53 km^2) of deciduous (open) sparse forests impacted by the community of Azatamut.*

Figure 2-24: *Firewood gathering near Azatamut*

Figure 2-25: *Azatamut, a forested mountain slope near the village*

Table 2-15: *Impact assessment matrix on the forests located in the surrounding areas of the community of Azatamut*

N	Natural environment component imposed to impact	The factor or technological process considered as the source of impact	Impact description direct/indirect	Spatial impact	Time impact	Intensity of impact	Impact assessment
1.	Timber (firewood and lumber) procurement						
1.1	Lush (closed) forests	Purveying of firewood, cutting of healthy trees	direct	limited (2 points)	perennial (4 points)	moderate (3 points)	medium (9<24<27)
1.2	Deciduous mixed (open) sparse forests	Purveying of firewood, cutting of healthy trees	direct	local (1 point)	perennial (4 points)	moderate (3 points)	medium (9<12<27)
1.3	Fauna	habitat degradation	direct	limited (2 points)	perennial (4 points)	moderate (3 points)	medium (9<12<27)
1.4	Surface and subterranean waters	evaporation increase	indirect	limited (2 points)	perennial (4 points)	low (2 points)	medium (9<16<27)
1.5	Ground cover	construction of forest roads, soil infringement	direct	limited (2 points)	perennial (4 points)	low (2 points)	medium (9<16<27)

2.5.4.4. Impact of the community of Chkalov on forests located in the surrounding areas of the village

The village of **Chkalov** is situated in the region of Lori, on the upper right shore of the Debed river, in the neighboring communities of Dsegh, Debed, and Dzoragyugh. The altitude is 1350 m above sea level. It is located 23 km to the north-east from the center of the community. The residents engage in animal husbandry, agriculture and bee keeping.

The climate is temperate, typical of foothills. It is hot and humid in summer. Average temperature ranges from 16 C^0 to 20 C^0, relative humidity (at 15:00) is 45-60%, the winds are favorable with average speed of 2.0-3.0 m/s. The climate in the winter is temperately cold, with mild winds and optimal humidity. Average temperature ranges from 0 C^0 to minus 5 C^0 in January, relative humidity (at 15:00) is 50-70%. The average wind speed is 3.0-5.0 m/s. Average precipitation level (according to Gyulagarak) is approximately 800 mm.

The population is approximately 240 people. Sixty-six families are registered in the village, from which 62 live in the village. From those 62 families, 48 are permanent residents of the village. Other residents which mostly include elderly people move to their children's houses in the winter to avoid heating costs.

The village is located near a forest area and is not gasified. The gasification works are about to be completed. Heating is carried out mostly by means of firewood, many of the villagers benefit from their right to purvey the 8 u^3 firewood provided to villagers located near forests by the government with no cost. Many households purvey firewood independently or by helping each other. As a result of that, the cost of firewood purveying is 2000-5000 AMD/m3.

The main agricultural branch of the village is cattle farming which has a tendency to grow. There are no forest-related industrial activities operating in the village. The population of the community collects forest resources for their household needs from which they sell a small part (3 families engage in it during the summer season). The investigation showed that the population of the communities of Chkalov utilize the meadow lands, pastures, and forests of the administrative community of Dsegh.

The meadow lands and pastures neighboring the community of Chkalov are separated by spotted forests and forest layers. Individual trees are quite common, especially Pyrus groves, which indicates that the area used to be completely covered by lush (closed) forests and those spots and forest layers are the remnants of former widespread forest cover. Young, ripe and seed trees can often be found in these spots. Although trees are sparse in those spots the average canopy closure cover does not exceed 0,6, however, the altitude of the location and the composition of forest species make grounds for assumptions that those spots are remnants from lush forests. Apparently, forests located in higher locations than Chkalov were intensively logged 15-20 years ago and now young trees of Carpinues, Quercus, to some extent also Fagus now grow in the place of the logged forest. Ripe (seed) trees, mostly species of Carpinus and Quercus can be found in relatively inaccessible locations. It is noteworthy that the impact on the forests situated in the surroundings of the village of Chkalov is not only the result of the activities of the community but also that of the neighboring villages, possibly also other people and organizations that purvey natural wood. For that reason, our assessment of the impact imposed on Lush (closed) forests will be conducted only for the forest ecosystems situated in the administrative community of Chkalov. As a result of the temperate warm and humid climate, the vegetation cover (grass cover) in the surroundings of the community is restored quickly, which reduces the cases of soil erosion.

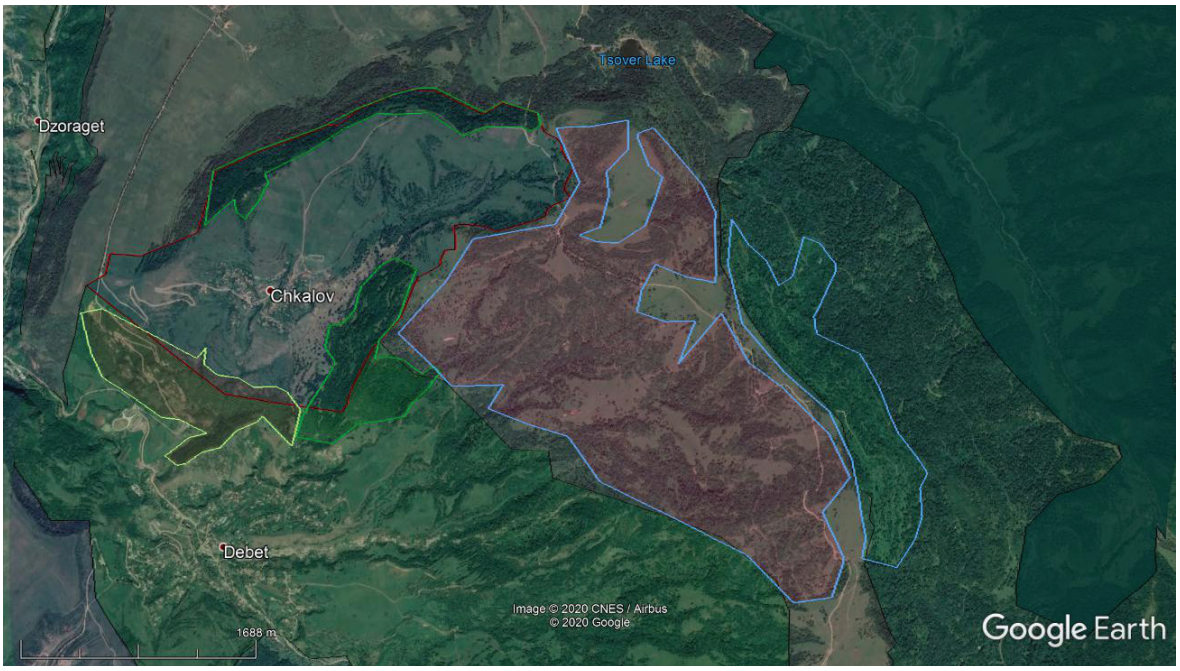


Figure 2-26: *Satellite picture of the village of Chkalov taken by Google Earth. Red lines indicate the community border (4,13 km2), light green lines indicate deciduous mixed sparse forests (0,83 km2). Lush (closed) forests are indicated in dark green, the lush (closed) trees logged in the past which have partially restored (total of 5,5 km2) are indicated in blue.*

Figure 227: *Chkalov, roadside forest*

Figure 228: *Chkalov, closed deciduous forest*

Table 2-16: *Impact assessment matrix on the forests located in the surrounding areas of the community of Chkalov*

N	Natural environment component imposed to impact	The factor or technological process considered as the source of impact	Impact description direct/indirect	Spatial impact	Time impact	Intensity of impact	Impact assessment
1.	Timber (firewood and lumber) procurement						
1.1	Lush (closed) forests	Purveying of firewood, cutting of healthy trees	direct	limited (2 points)	perennial (4 points)	low (2 points)	medium (9<16<27)
1.2	Deciduous mixed (open) sparse	Purveying of firewood, cutting of healthy trees	direct	local (1 point)	perennial (4 points)	low (2 points)	low (1<8=8)
1.3	Fauna	habitat degradation	direct	limited (2 points)	perennial (4 points)	insignificant (1 point)	low (1<8=8)
1.4	Surface and subterranean waters	evaporation increase	indirect	limited (2 points)	perennial (4 points)	insignificant (1 point)	low (1<8=8)
1.5	Ground cover	construction of forest roads, soil infringement	direct	limited (2 points)	perennial (4 points)	insignificant (1 point)	low (1<8=8)

2.5.4.5. Impact of the community of Vahagni on forests located in the surrounding areas of the village

The village of **Vahagni** is situated in the region of Lori, which is 21km north-east from the regional center of Vanadzor. The village is located on the lower valley of the river Pambak, on the left side of the Vanadzor-Alavedi highway. The administrative area of the community borders with the administrative areas of the communities of Dzoragyugh, Antaramut, Yeghegnut, and Vahagnadzor. The village was established in 1805. The total administrative area of the village is 21,1 km2, with a population of 975 people. The altitude is 1030 m above sea level. The community was greatly damaged as a result of the earthquake in 1988.

The climate is hot in the summer, with an average temperature of 19 C^0 in July, relative humidity (at 15:00) is 70%, the average wind speed is 2,0-3,0 m/s. Average yearly precipitation level is 600 mm (Odzun).

The population engages in animal husbandry, fruit farming, vegetable farming, and cereal and cattle feed cultivation.

The village is gasified. The heating is mostly carried out by means of firewood.

The majority of the administrative area of the village is forested. Lush (closed) forests are situated on the highest (1800-1350 m above the sea level) point and occupy a total area of 1,46 km2. The majority of the lush forests – 2,48 km2, was massively logged 15-20 years ago; particularly trees of value were cut. Now the forest is recovering and Carpinus tree groves are mostly growing in the locations where valuable eastern Fagus and Quercus trees used to grow. It will take more than 50 years to restore the former forest ecosystem, taking into consideration the climate conditions, and if no new impacts are imposed.

Deciduous (open) sparse forests mostly grow in the southern hillsides to the west of the village in scattered groups, occupying a total area of 2,76 km2. The total area of sparse forests of the northern hillsides is 1,44 km2. Traces of erosion can be seen on the southern hillsides, especially on the lower locations. The uncultivated garden occupies a separate landscape (0,34 km2).

It is noteworthy that the impact on the forests surrounding the village of Vahagni is not only a result of the population of the community but also the neighboring villages, possibly also other people and organizations engaged in natural wood purveying. Our assessment of the impact imposed on Lush (closed) forests will be conducted only for the forest ecosystems situated in the administrative community of Vahagni. As a result of the temperate warm and humid climate, the vegetation (grass cover) in the surroundings of the community is restored quickly, however, low value forests of Carpinus, along with a few other similar tree species intensively grow there instead of valuable trees. Traces of soil erosion can be seen on the southern hillsides of the administrative area, particularly in the surroundings of the village.

Being located in a restricted recreation area the forest is quite littered. No traces of wildfire were found. We could hear a chainsaw working throughout the entire period of the investigation.

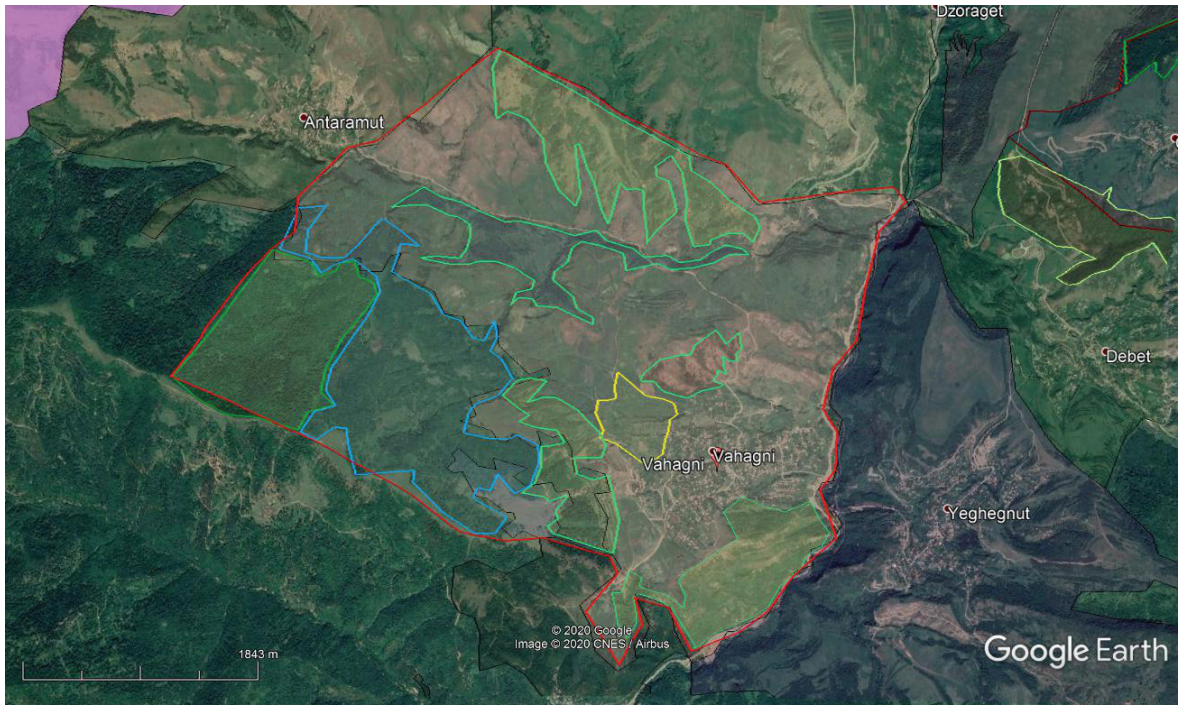


Figure 2-29: *Satellite picture of the village of Vahagni taken by Google Earth. The red line indicates the community impact border (19,4 km2), the dark green indicates lush (closed) forests (1,46 km2). The deciduous restorable forests are indicated in blue (2,84 km2), the area of the uncultivated garden (0,33 km2) is indicated in yellow, and deciduous (mixed) sparse forest (total of 4,2 km2 from which 1,44 km2 is located on the northern hillside and 2,76 km2 on the southern hillside) is indicated in light green.*

Figure 2-30: Vahagn, degraded forest near the village

Figure 2-31: Vahagn, re-harvested forest

Table 2-17: Impact assessment matrix on the forests located in the surrounding areas of the community of Vahagni

N	Natural environment component imposed to impact	The factor or technological process considered as the source of impact	Impact description direct/indirect	Spatial impact	Time impact	Intensity of impact	Impact assessment
1.	Timber (firewood and lumber) procurement						
1.1	Lush (closed) forests	Purveying of firewood, cutting of healthy trees	direct	limited (2 points)	perennial (4 points)	low (2 points)	medium (9<16<27)
1.2	Deciduous mixed (open) sparse forests	Purveying of firewood, cutting of healthy trees	direct	limited (2 points)	perennial (4 points)	low (2 points)	medim (9<16<27)
1.3	Fauna	habitat degradation	direct	limited (2 points)	perennial (4 points)	insignificant (1 point)	low (1<8=8)
1.4	Surface and subterranean waters	evaporation increase	indirect	limited (2 points)	perennial (4 points)	insignificant (1 point)	low (1<8=8)
1.5	Ground cover	construction of forest roads, soil infringement	direct	limited (2 points)	perennial (4 points)	insignificant (1 point)	low (1<8=8)

2.5.4.6. Impact of the community of Shirakamut on forests located in the surrounding areas of the village

The village of **Shirakamut** (previously Nalband; it was renamed *Shirakamut* in 1978) is situated in the region of Lori in Armenia, which is 26 km noth-east to the regional center of Vanadzor. The village is located on the left bank of the river Pambak, at the tributary of the Chichkan river, with altitude of 1650 meters above sea level. It borders with the villages of Geghasar, Katnajur, Mets Parni, and Gogaran. The Vanadzor-Gyumri highway and railway (Nalband train station) cut through this area. The village was established in 1829. It is 1670 m above sea level, the administrative area is 26,68 km^2 from which 140 hectares are occupied by the village population.

The climate is cold, with an average temperature of minus 4-5 C^0 in January, and an average temperature of 17 C^0 in July. The average temperature per year is 7,0 C^0. The average humidity per year is 70 percent, and average yearly precipitation is 455 mm. The wind blows mostly from the east-western direction; average wind speed is 4-5 m/s (Spitak).

The population of the village is 2550 people. The population is mostly engaged in animal

husbandry and field cropping. Individual households are engaged in bee keeping.

The village is gasified, however, firewood is mostly utilized for heating purposes. The community of Shirakamut is not situated near a forest and it does not take advantage of the government's decision of receiving 8 m3 free firewood waste. Firewood is sold for 18000-20000 AMD/m3 in the village.

There are no forest resource-related industrial activities operating in the village. The population of Shirakamut uses natural resources for their household needs. They mostly collect wild edible greens and herbs.

The administrative area of Shirakamut is situated at a height of 1650 m above the sea level to 2439 m above the sea level (Akloraver peak) and it occupies the mountainous steppe zone. The forests which are artificial (plantation), were planted on the northern canyons of the Chichkan river and its left tributary as separate groves. The total area of such forests is 0,91 km2. (Often separate types of forests do not fit the size requirements of the term "forest" defined by the RA "Forest Code".) The age of the artificial (plantation) forests located in the surroundings of the community of Shirakamut is 35-40 years. The diameter of the tree trunks is 15-25 cm. The quality of firewood purveyed from artificial forests is lower than that of lush forests; it is not utilized by the population of the village. That is the reason the artificial forests of the administrative area of the community are untouched.

River-bed forests are situated on the valley of the Chichkan river which mostly consist of Populus and Salix tree species, the natural wood of which has less quality and caloricity than that of the lush forest. River-bed forests are good for recreational purposes and they, too, are mostly untouched.

A sparse forest, most probably a remnant, occupies the northern hillsides above the upper stream of the Chichkan river, which mostly consists of low growing trees and shrubs of Quercus (0,84 km2). These sparse forests are not of particular interest, however, they protect sloping hillsides from erosion.

In conclusion, the investigation did not show any major impact imposed by the residents of the community of Shirakamut on the forests located in the surrounding of the village. Nevertheless, by using firewood for heating purposes the residents of the community of Shirakamut impact the remote forests and it is not possible to assess that impact. The quantity of the utilized firewood can be considered a rough criterion for measuring that impact, which is approximately 5000 m3:

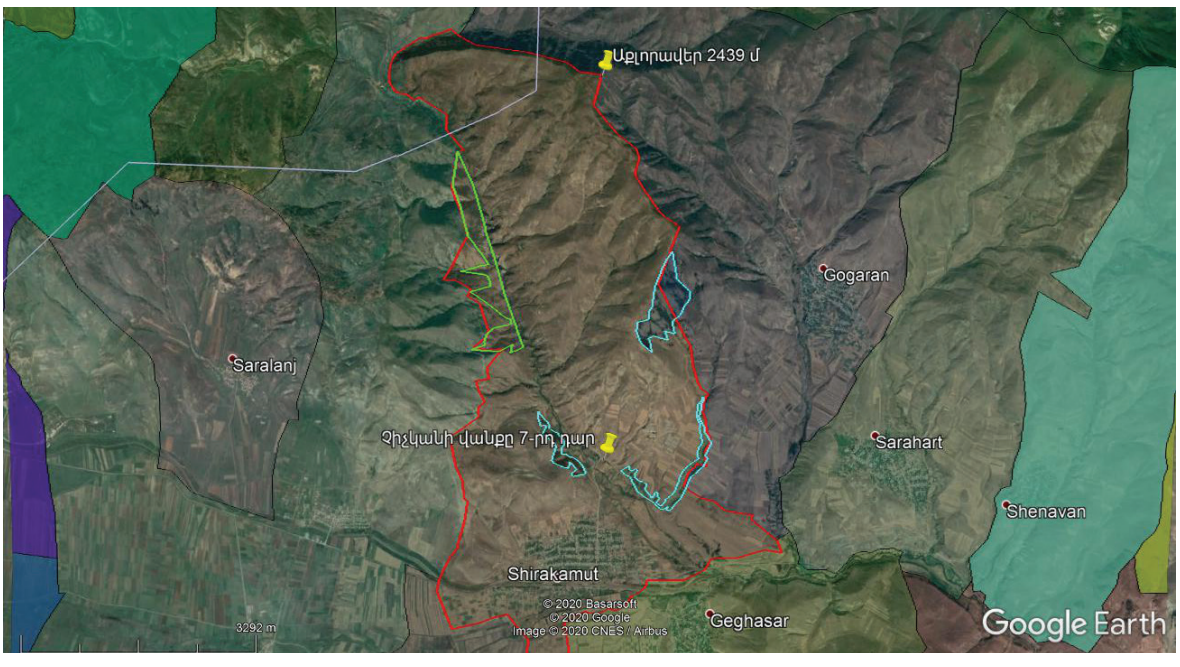


Figure 2-32: *Satellite picture of the village of Shirakamut taken by Google Earth. The administrative area border (27,1 km2) is indicated in red, the artificial/plantation forests (0,91 km2) are indicated in light blue, and the deciduous (mixed) sparse forest (0,84 km2) is indicated in light green.*

Figure 2-33: *Shirakamut, river valley forest*

Figure 2-34: *Shirakamut village, panorama*

Figure 2-35: *Shirakamut, pine forest on the hillside*

Figure 2-36:Shirakamut, *planted forest*

ROAD MAP

WITH RECOMMENDATIONS

TO DEAL WITH

ALTERNATIVE ENERGY

3. ROAD MAP WITH RECOMMENDATIONS TO DEAL WITH ALTERNATIVE ENERGY NEEDS OF LOCAL COMMUNITIES, INCLUDING OPTIONS FOR IMPROVED MANAGEMENT OF FUEL WOOD HARVEST AND COLLECTION, EFFICIENT ISOLATION OF HOUSES, ALTERNATIVE SOURCES OF ENERGY AND MECHANISMS FOR THEIR IMPLEMENTATION

3.1. EXECUTIVE SUMMARY

The primary goal of the current road map is to provide recommendations on reduction of firewood use and mitigations of subsequent environmental and social impacts by effective application of the alternative energy sources and thermal insulation of rural households.

The roadmap focuses on:

- Improved management of firewood harvest and collection
- Recommendations (technical, institutional, legal and financial) on application of alternative energy by local communities, reduction of thermal losses by effective insulation of the households, and relevant mechanisms for their implementation

The roadmap outlines the applicable policies, institutional arrangements, technologies, management practices and list of recommendations to address the management of firewood collection and distribution from the forest and to promote energy efficient technologies and renewable energy.

The recommended actions are compiled as a coordinated measure to be implemented in a short and long term perspective. The social, economic and environmental benefits are one of the key components for consideration of the relevant recommendations.

Given the various multi sectoral aspects of firewood management issues, a coordinated activities and responsible bodies are needed for promoting efficient and sustainable use of resources and implementation of proposed recommendations and measures. All proposed recommendations could be integrated into sectoral and relevant state development programs and strategies.

3.2. IMPROVED MANAGEMENT OF FIREWOOD HARVEST AND COLLECTION

3.2.1. Summary

There is a considerable difference in the share of fuel costs in the total expenditure of households in rural and urban areas. Urban HHs spend more on utility services including fuel and heating costs. This is linked to the fact that fuelwood remains the cheapest and most easily accessible energy source in rural areas.

In general, the use of firewood is predominant in communities with no gas supply and peri-forest communities. The prevalence of the use of gas and electricity as the main sources of heating in Tavush marz, particularly in the non peri-forest communities, point towards the impact of privileges granted to the border communities in terms of reimbursed energy costs (in terms of 50 percent of gas and electricity consumption up).

In terms of other alternatives, solar heating and fuelwood alternatives from biomass such as briquettes or pellets are gaining popularity fuelled by growing energy prices, and the availability of loan financing from green lending programmes. Yet solutions such as briquette efficient stoves and solar water heaters are the only identified types of renewable energy alternatives that were actually applied in the target communities. This is primarily due to the efforts of development organisations such as UNDP in the target regions that promoted the application of such measures. The awareness and application of such measures nevertheless remains to be very low.

Households tend to use one main source of heating system/devise (primarily traditional wood stoves) and to a very limited degree supplement the main heating system with additional heating

means. The use of traditional wood stoves results in uneven heating of the living space. The use of Efficient wood stoves is very limited and involves those households that benefited from third party (donor funded) projects such as UNDP implemented energy efficiency projects.

A majority of the households (58 percent) uses more than 8 m^3 of firewood per heating season. This means that for those living in peri-forest areas the 8m^3 threshold set by the government for free collection of firewood from the forest is not enough to meet their needs and additional firewood is acquired.

Efficient hot water systems and double glazed windows are the most applied EE efficiency means yet such measures are applied by less than half of the questioned households. Application of other less known energy efficiency means such as thermal insulation of walls is very rare. Solar panels and water boilers are the most preferred RE substitutes to current heating and hot water supply systems.

The potential application of these technologies is rated low by the HHs also. Awareness on alternative energy solutions besides photovoltaic panels and solar water heaters is very low particularly among more elderly population. Even in case of solar panels and solar water heaters the possible application of these measures is not high and is even lower in peri-forest communities. These is often related to technical issues with application of such means. Nevertheless, the probability of installing such equipment raises when people have stable income.

3.2.2. Conclusions

Forest resources in Armenia are overexploited. Firewood consumption far exceeds the sustainable level of supply, degrading forest resources. Although the official numbers of fuelwood consumption remained stable during the previous years, the energy tariff increases had a direct impact on curtailing consumption through among others suppressed demand and gave a rise to a new wave of deteriorating utility affordability. There is a large gap between reported fuelwood consumption and official fuelwood supply which again contributed to escalating pressure on forests for firewood.

Moreover, no one from the surveyed local population inhabiting the forest neighboring settlements in the investigated area was informed about the privilege to obtain up to 8 cubic meters of debris-firewood free of charge from regional forestry organizations. As an example the survey revealed that only several families in the village of Chkalov had the possibility to purvey 8 m^3 of free firewood at their own cost. No cases of stamping of purveyed (in the inhabitant's house) firewood (collected in the forest) were identified during the survey. The current scheme of firewood purveyance is as follows: there are certain groups in villages which have the means for firewood purveyance, such as SUVs (as a rule, they are used without state plate numbers), chainsaws, and tractors, etc. These groups make arrangements with forest managers and the locals, they purvey the necessary firewood and sell it to the inhabitants of forest neighboring settlements as per their family needs, which is more than 8 m^3 annually in average. Hence, the institutional order of firewood purveyance set forth by state governing bodies is not being enforced effectively and it needs radical revisions. It can surely be stated that the decisions of the State Forest Cadaster (07.02.2008, N 133-N) and the State Forest Monitoring Center (28.07.2005, N 152-N and 25.01.2007, N 98-N) are not being effectively enforced either. The survey also showed that forest roads are not equipped with the technical means necessary for ensuring forest conservation (forester's lodges, toll bars, signboards, etc.).

The high energy expenditures vis-à-vis income levels and reliance on firewood raises the risk of fuel poverty in rural areas. Households with more liquidity constraints are less likely to use alternative options to fuelwood and the other way around. As it is in other countries worldwide, indoor air pollution in Armenia is assumed to lead to serious health problems and many premature deaths every year.

The survey showed that the issue related to the utilization of forest lands for agricultural purposes (sheep and cattle farming, bee keeping) persists in all forest neighboring settlements: despite the ban set by the "Forest Code", all the communities utilize forest lands for agricultural purposes - sheep farming in settlement neighboring areas and cattle farming in distant highland areas. (Article 38 of the "Forest Code" prescribes: "... pasturing large and small cattle in forests is forbidden.") Moreover, as the survey showed, no rural communities and/or other state authorities regulate animal pasturing; no effective schedule of use of pastures is in place.

Gas is often preferred as an alternative to firewood, Yet its relative cost and, in rarer cases, availability discourage households particularly those who live in proximity of forests from using it. Next to the low affordability of alternative

heating options, other issues are the very low efficiency of used heating devices and resulting major energy losses. Inefficient use of energy, high energy prices and ecosystem degradation continue to perpetually impoverish rural communities.

Awareness on the possibility to collect free firewood in the framework of the RA government's policy is high yet the use of this opportunity is limited and as it is very much linked to the ability of households to collect fire wood. Majority of the questioned households (58%) however use more than the set threshold of 8 m^3 per heating season. This means that for these households, those living in peri-forest areas the set threshold is not enough to meet their needs and (additional) firewood is purchased. Non-gasified periforest communities rely the most on firewood for heating.

Next to the approximately of communities to forests and coverage of national energy subsidy programs also existence of fuel alternatives affects energy consumption patterns. In this regard the economic profile of communities plays a role as communities where animal husbandry is common also use manure for heating purposes.

Application of innovations in terms of Energy Efficiency and Renewable Energy are very limited both in terms of energy efficient heating technologies and energy saving technologies. The intention to adopt more energy efficient technologies in the future was also found to be limited. Awareness of such technologies and conviction of their effectiveness are some of the underlying factors. Potential application of such means is also correlated with the economic stance of HHs.

The Government of Armenia committed itself to reducing the burden on the forests, while at the same time improve energy security of the country. This included further development of legal and institutional framework and strategies to implement its commitments towards meeting climate, renewable energy and energy efficiency commitments. Results of the assessment show that some of these actions have had direct beneficial impact on reduction of firewood use in rural areas. In this regard the government support with regard to energy subsidies to border line communities seems to directly contribute to reduction of fuelwood consumption and lighten the burden on forests in those respective areas.

Nevertheless, there has been a downward trend of the forest coverage in Armenia. The created legislative environment does not create enough incentives for rural households to comply with forest protection legislation[1] and the policy to provide each household with 8 (eight) cubic meters of firewood has further placed heavy burden on the forestry sector to find solutions to meet this need without causing forest degradation.

The government therefore recently initiated steps to further improve the legislative and administrative environment. An important step towards that involves the draft law on making amendments and supplements (addenda) to RA Forest Code which has been put into circulation. The draft law aims at provision of legal basis for preservation and use of forests and forest lands, clarification of forest restoration processes in terms of time frames, provision of legal basis for wood processing on economic purposes as a separate procedure during the forest maintenance, without harming the forest areas, review of forests significance as per their operational significance, as well as provision of the legal basis for development of a new national forest program, definition of some key concepts, strengthening of the competences of the employees involved in the conservation of forests, creation of opportunities for forest lands (with no forest cover) to be provided for construction purposes, as well as implementation of institutional reforms, as a result of which a single structural unit will be responsible for the maintenance of forestry.

Ensuring sustainable forestry management will involve adoption and effective implementation of Armenia's updated Forest Code. Further steps need to be taken to harness the potential of sustainable forestry residues and complement the code. This includes application of sound forestry management principles, ending social cutting and transition away from fuelwood in the long term.

3.2.3. Recommendations

Address the supply gap, facilitate improved timber production and secure supply of timber to ensure sustainability of entire timber value chain;

Improve policy formation and implementation with regard to forest management, specifically targeting reduction of firewood consumption for heating purposes in communities

1 See Deliverable 1, Chapter 2, Table 1: Matrix of Assessment Criteria for Legal Instrument

Enhance alternative economic activities including forest related goods and services to promote economic development in rural areas

Implement innovative ways to enhance and streamline the regulatory and institutional environment for promotion of sustainable development.

Facilitate awareness raising and information sharing with a view to enhance application of energy efficiency means and renewable energy sources

Create enabling environment and financial arrangements for application of energy efficiency and renewable energy mechanism in rural areas.

3.2.4. Road Map

Below Table 31presents key actions for Ensuring sustainable forest management.

Table 3-1: *Key actions for Ensuring sustainable forest management*

N	Action	Measures	Responsibility (Optional)
1.	**Address the supply gap, facilitate improved timber production and secure supply of timber to ensure sustainability of entire timber value chain;**	Facilitate and support afforestation initiatives	"Hayantar" SNPO Ministry of Environment Forest Committee The Police of the Republic of Armenia
		Develop and implement a system for effective access to and management of off-take from woodlands and natural forests	
		Improve the existing sub-regulatory framework for firewood supply	
		Bring to the legal field the groups involved in the supply of firewood in accordance with the relevant regulations.	
		Strengthen forest protection through technical measures and new organizational measures, including prevention of forest fires, forest pollution and poaching	
2.	**Improve policy formation and implementation with regard to forest management, specifically targeting reduction of firewood consumption for heating purposes in communities**	Approve and actively implement new Forest Code nationwide	Government of RoA Ministry of Environment Forest Committee
		Develop dedicated and state policies and strategies aimed to reduce firewood consumption for heating purposes in communities such as a national bioenergy strategy, biomass fuel strategy	
		Develop a clear framework guiding introduction of the new technologies and their benefits	
3.	**Enhance alternative economic activities including forest related goods and services to promote economic development in rural areas**	Implement business support interventions for local economic development focusing on the forest sector	RA Government Ministry of Economy Ministry of Environment Regional Administrations
		Launch focused initiatives to establish upgraded-fuel production businesses	
		Introduce support measures for upgraded-biomass and waste fuel supply businesses	
		Establish a public-private partnership for more efficient use of forest lands	

3.3. RECOMMENDATIONS (TECHNICAL, INSTITUTIONAL, LEGAL AND FINANCIAL) ON APPLICATION OF ALTERNATIVE ENERGY BY LOCAL COMMUNITIES, REDUCTION OF THERMAL LOSSES BY EFFECTIVE INSULATION OF THE HOUSEHOLDS, AND RELEVANT MECHANISMS FOR THEIR IMPLEMENTATION

3.3.1. Background

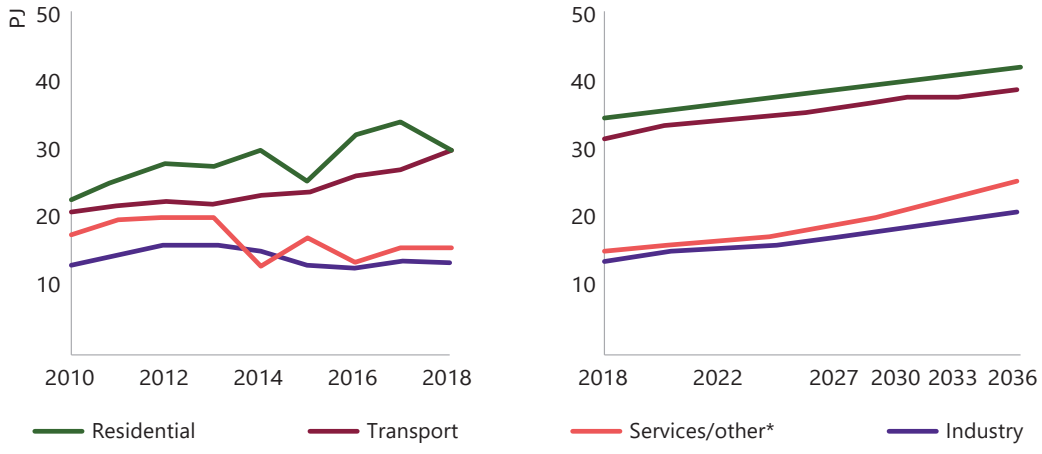
Based on conducted surveys and studies in rural communities of RoA, current trends in energy supply and use for heating and provision of the hot water are apparently technically, environmentally and socially unsustainable. In order to reduce dependence from the forest and consequent use of firewood there is a need for widespread deployment of the energy efficient and renewable energy technologies.

For this purpose, the current roadmap is developed focusing on thermal insulation and renewable technologies.

Considering that one of the goals of this roadmap is to support the relevant government agencies, local administrations and other stakeholders in wider use of the energy efficient technologies and overcoming technical, institutional and other barriers, thermal insulation of households and solar water heaters are considered in this report. It is worth to mention that the feasibility study was conducted in the frames of the program "Management of natural resources and safeguarding of ecosystem services for sustainable rural development in the South Caucasus" (ECOserve). The study covered the main RE and EE measures applicable for rural HHs in Armenia. Cost benefit analysis (CBA) was done to define the financial/economic feasibility and sustainability of the approaches/products and their potential for scaling up. The results of CBA showed that the replacement of existing inefficient heating devices (stoves and boilers) with efficient devices and use of alternative fuels are economically most feasible measures which ensures the highest monetary savings. Thus to avoid overlapping and not to duplicate the results of the given program, this report considers the possibilities of promoting other measures such as thermal insulation of households and other renewable energy technologies.

By identifying the steps needed to accelerate the implementation of energy efficient measures, this roadmap will enable government, local authorities, NGO`s and other stakeholders to make the right decisions.

Figure 3-1: *Total Finaly Energy Consumption in Armenia by sector, 2010-36 (projected)*



** Includes non-specified consumption of electricity and natural gas.*
Notes: PJ = petajoule. numbers for 2018-36 are based on business-as-usual projections by USAID based on TIMES model.

Sources: *IEA (2020d), World Energy Balances (database), www.iea.org/statistics/; USAID (2019)*

Reduction of the thermal losses and Improving building energy efficiency is one of the key measures of sustainable development of the rural communities of the Republic of Armenia. As Armenia's largest energy-consuming sector, buildings account for nearly 40% of the country's total electricity demand and more than 25% of its gas demand. The residential sector consistently accounts for the highest share of TFC in Armenia – higher than the industry sector and exceeding commerce and public services. Furthermore, solid residential energy demand growth is expected over the next 15 years (Figure 31).

Estimated energy-saving potential ranges from 40% to 60% across residential, public and commercial buildings, depending on type of interventions. This level of savings could lead into significantly reduction of energy consumption, improved thermal comfort in homes, offices and schools, other communal buildings, as well as reduce dependence from firewood. In addition, it will have a positive impact on wellbeing and health conditions of the affected people.

Homes in rural areas are typically less energy efficient and more dependent on fuels for heating and hot water preparation purposes. Application of energy efficient (EE) technologies and utilization of available RE resources can increasingly help communities overcome barriers to harnessing local sources and to benefit from the energy which is cheaper, more efficient, secure and reliable.

3.3.2. Barriers and Gaps

There are number of barriers which needs to be addressed, in order to create conditions in the regions and rural communities for deployment of the EE projects.

Below Table 31 is a list of the main barriers and gaps Identified during surveys across the communities:

Table 3-2: *List of the main barriers and gaps Identified during surveys across the communities*

Institutional gaps	Unclear institutional arrangements for implementation of EE projects in communities Poor coordination of various state agencies implementing EE projects in communities
Socio Economic barriers	High Poverty in the regions High Unemployment rates Low income and affordability of new technologies
Policy/legal gaps	Absence of dedicated state policies and strategies to reduce firewood consumption for heating purposes in communities No clear framework guiding introduction of the new EE technologies and benefits
Regulatory gaps	Inadequate expertise of the design documents on new buildings absence of supervision of the application of mandatory and voluntary standards Absence of certification (accreditation) mechanisms for ESCO companies, energy auditors etc.
Investment and financing gaps	Limited offers from banks and other financial institutions for financing of EE projects Difficulties for rural population for obtaining Green loans, EE credits No financial mechanisms for households to encourage investment in EE or green technologies
Information, knowledge and awareness gaps	Lack of data on saving potentials in communities to guide investments in EE technologies. Lack of awareness of the technical and economic benefits of EE technologies Insufficient awareness on potential improvement of indoor air quality, health conditions, environmental and social benefits

3.3.3. Thermal insulation and RE technologies

One of primary measures to reduce dependence on firewood for heating is the thermal insulation of houses, as insulated houses require less energy for heating. For instance, insulation of walls and roof of the building significantly reduces heating and cooling expenses. Consequently, thermal insulation of rural houses is a constructive method for reducing expenses on heating and reduce dependence on firewood. According to the implemented study in the scope of current project in rural communities of Armenia, vast majority of rural houses do not have proper insulation. Moreover, the energy performance of building envelopes has been significantly neglected.

Thermal insulation is not widely used due to the high investment costs and a general lack of awareness regarding energy efficiency. While there has been general knowledge on energy efficiency of new appliances, lighting and heating equipment, many buildings which are being constructed or renovated have no proper insulation of walls and roofs. Overcoming these barriers and providing thermal insulation for housing will reduce energy consumption and subsequently dependence from forests. Additionally, as a result of improvement of thermal characteristics of the buildings numerous environmental and social benefits have been realized. Due to less consumption of firewood and sustainable forest management it will trigger to reduced pressure on national forestry resources and prevents deforestation. Positive social benefits are also occurring as thermal insulation provides thermal comfort and reduces indoor air pollution and improving general health conditions.

So far, a number of technical assistance programs have been implemented for the widespread use of thermal insulation. Particularly The Database of Construction Insulation Materials (2016) was developed in the framework of UNDP Improving Energy Efficiency in Buildings project. It presents companies locally producing construction insulation materials and importing them to Armenia and blueprints technical features of their goods. The technical data on the heat insulation materials were collected directly from the listed companies. The estimated values of required thickness and other technical parameters for installation of thermal insulation are presented in the Advisory Handbook on Technical Solutions for Thermal Insulation of Envelopes of Residential, Public and Industrial Buildings in Construction and Reconstruction in the Republic of Armenia. It was developed and published in the frames of UNDP Improving Energy Efficiency Project. The Handbook was endorsed by the RA Minister of Urban Development (order #343 of November 6, 2013). Thermal conductivity and technical applicability are important parameters for selection of insulation material along with the price of the materials. The required thickness of thermal insulation depends on the type of insulation material and required thermal protection level of households.

From a technology perspective, the deployment of typical thermal insulation measures has been developed. However, specific recommendations and solutions are needed on a community level to address needs of the rural households and to promote wide application of thermal insulation materials.

There are several international initiatives aimed at reduction of the thermal losses through building envelope. Many of these approaches can be implemented in Armenia during renovation or construction of the buildings. Many advanced building design concepts are already cost effective if Life-cycle costs are taken into account, especially in locations where the climate is severe. lowering energy costs and investing in thermal retrofit of building envelope can reduce the capital costs of heating systems, as the need for heating according to various technical studies can be reduced by up to 60%.

3.3.4. Policies and legal framework

The following legislative acts related to energy efficiency and renewable energy use are relevant to the project objectives and can be mentioned:

Energy Sector Development Strategy

Law on Energy Saving and Renewable Energy

National Program on Renewable Energy and Energy Efficiency

2nd NEEAP (targeting 2017-2018-2020)

2012-2025 Long-Term Strategic Development Program

National Energy Security Concept

Least Cost Generation Plan

RE Roadmap & SREP Investment Plan 2014

3.3.4.1. Secondary Legislation & Regulatory Framework

Adopted Building Construction Norm on Building Thermal Protection

Resolution 1504 on Mandatory EE In State Investment Programs

Technical Regulation on "Buildings and structures/premises, construction materials and products. Safety"

Technical Regulation on "Building Energy Efficiency"

3.3.4.2. Normative-technical documentation and International Treaties

Energy Charter Treaty

United Nations Framework Convention on Climate Change

EU Covenant of Mayors

Eurasian Economic Union documentation

3.3.4.3. Norms & Standards in Building EE

RACN II-7.01-96 Construction climatology

RACN 24-01-2016: Thermal Protection of Buildings

3.3.4.4. Adopted standards

ISO 16818 Building Environment Design. Energy Efficiency. Terminology

ISO 23045 Building Environment Design. Energy Efficiency Assessment Guide for New Buildings

EN 15316-1 Heating Systems in Buildings. A Method for Calculation of System Energy Demand and System Efficiency

EN 15217 Energy Performance of a Building. Methods for Expression of Energy Performance and Energy Efficiency Certification of a Building

The presented list is not comprehensive, however it provides general understanding on applicable policies and legal acts.

3.3.4.5. Roadmap

Homes in rural areas are typically less energy efficient and more dependent on heating fuels. Application of energy efficient (EE) technologies and utilization of available RE resources can increasingly help communities overcome barriers to harnessing local sources and to benefit from the energy which is cheaper, more efficient, secure and reliable.

As a first step it was recommended to Analyze the structure of energy consumption in communities. In order to obtain this data, relevant statistical and field survey data such as: the type of houses, public buildings; heating technologies and approaches, the level of energy efficiency; heating sources etc. This data is necessary for the elaboration of a targeted policies and strategies. In addition, this data will facilitate making effective decisions with respect to planning, implementing and promoting energy efficiency measures in specific communities and households depending from their income level.

This roadmap lays out (Table 32) the key actions required to wider use of Energy efficient technologies such as thermal insulation of HH and RE.

Table 3-3: *Key actions required to wider use of Energy efficient technologies such as thermal insulation of HH and RE*

N	Action	Measures	Respon-sibility
1.	Address the policy, strategy, institutional and legal gaps	Cooperation and coordination in terms of design and implementation of the state policies, strategies, community development programs are required. Exchange and dialogue between the key state authorities such as Ministry of territorial administration and infrastructures (MoTAI), Urban development committee (UDC), local authorities, Energy efficiency and Renewable Energy fund and other players such as NGOs, private companies, donor and financing institutions Key stakeholders will need to consider the integrated use of different resources and support in inclusion of energy efficient measures (thermal insulation of buildings, solar water heaters etc.) in relevant policies and other documents. Revision/establishment of the advanced building codes, performance standards of the new or renovated private and public buildings. Development of policies and strategies supporting thermal retrofit and use of EE and RE technologies in existing buildings. Development of projects addressing energy demand reduction issues for low-income areas or non-gasified communities Establishing mechanisms for proper supervision of the application of relevant technical standards and regulations Establishing mechanisms for certification or accreditation of energy auditors, ESCO companies, etc.	MoTAI UDC
2.	Create enabling environment and financial arrangements for application of energy efficiency and renewable energy mechanism in rural areas	Promote various financial mechanisms (subisidies, state subvention programs, community revolving funds, etc.) and their combinations for financing of application of thermal insulation and other EE/RE measures. Promotion of Green loans, EE credits in rural areas Tax/fiscal incentives for application of EE/RE technologies Subsidies, grants, or other financial aid mechanisms for low-income households intended to encourage use of EE/RE technologies Encourage project financing through ESCO`s or community based revolving funds Introduction and promotion of the innovative financing mechanisms such as on bill financing etc.	Ministry of Finance Ministy of economy MoTAI
3.	Facilitate awareness raising and information sharing with a view to enhance application of energy efficiency means and renewable energy sources	Establish a strategy to enhance public awareness of the benefits of EE technologies and thermal retrofit of households, and economic and health impacts	MoTAI UDC

N	Action	Measures	Respon-sibility
		Using donor or state support programs funding, create rural household insulation pilot projects to highlight best technology practices and stimulate adaptation rate. The high capital costs of the most insulation technologies mean that such projects are challenging to replicate. Rather than conducting one demo project, development funding mechanisms for both private and public buildings in communities for pilots would be more effective and self-sustaining models. The efficiency and other technical parameters of the insulation should be standardized to permit performance and energy efficiency verification. As several pilot projects of this nature have already been undertaken by various donor funded projects (External insulation of residential building in Avan district of Yerevan, UNDP) , drawing on their experiences and lessons learned is a good starting point for relevant projects development. Training and capacity building activities for the construction sector. Develop and disseminate technical guidelines and instruction manuals for application of thermal insulation and other EE/RE technologies. Intoduction of environmental, health, social,and financial benefits of EE/RE technologies.	

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